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WB4bis-REG-ENE-01:

Feasibility Study and ESIA for Elbasan (AL) - Bitola (MK) 400 kV Transmission Line

Macedonian Environmental and Social Impact Assessment Report (ESIA): Section from Bitola (MK) to MK/AL Border

31.01.2013

This project is funded by the European Union

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*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.

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LIST OF ABBREVIATIONS

a.s.l.	above sea level
AL/ALB	Albania
CORINE	Coordination of Information on the Environment (programme of the European Commission)
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
FS	Feasibility Study
GDP	Gross Domestic Product
HD 92/43 EEC	EU Habitat Directive 92/43
IBA	Important Bird Area
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IFI	International Financial Institutions
IPA	Important Plant Area
IPF	Infrastructure Project Facility
KfW	KfW Bankengruppe, Frankfurt am Main, Germany
MEPP	Ministry of Environment and Physical Planning
MEPSO	Transmission System Operator of the Republic of Macedonia
MK/MKD	Macedonia
NGO	Non-governmental organisation
NP	National Park
OGK	Basic Geological Map
OHL	Over-head (Transmission) Line(s)
OPGW	optical ground wire
OHS	Occupational Health and Safety
OST	Transmission System Operator of Albania
PA	Protected Area(s)
PR	Performance Requirement(s) (of the EBRD Policy 2008 document)
PBA	Priority Butterfly Area
Ref.	Reference
SEA	Strategic Environmental Assessment
SECI	Southeast Europe Cooperative Initiative
SEETEC	Southeastern Europe Electrical System Technical Support project
SEP	Stakeholder Engagement Plan
SS	Substation
SWOT (analysis)	Strengths, Weaknesses, Opportunities, and Threats (analysis)
TPP	Thermal Power Plant
TSO	Transmission System Operator
UCTE	Union for the Coordination of the Transmission of Electricity
UNESCO	United Nations Educational, Scientific and Cultural Organization
WBIF	West Balkans Investment Framework
WHS	(UNESCO) World Heritage Site

1 Synopsis

Project Title:	Feasibility Study and ESIA for Elbasan (AL) - Bitola (MK) 400 kV Transmission Line
Project Number:	WB4bis-REG-ENE-01
Contractor:	COWI-IPF Consortium
Beneficiaries:	OST (AL) and MEPSO (MK)
Lenders:	EBRD, KfW
Location:	Tirana and Skopje
Project start date:	26/01/2012
Project Duration:	12 months
Anticipated completion:	January 2013

2 Operational Framework

2.1 Purpose of the Environmental and Social Impact Assessment

The project intention is to construct and operate 400 kV overhead transmission line from Bitola to Macedonian / Albanian border (further on to Elbasan, Albania) and to construct and operate new 400/110 kV substation in Ohrid area. It also includes activities to upgrade existing substation Bitola 2 to accommodate the proposed 400 kV transmission line.

Project developer is the Macedonian Transmission System Operator (MEPSO).

This Environmental and Social Impact Assessment (ESIA) describes the potential environmental and social impacts that construction and operation will have, and describes actions that will be taken to reduce those impacts.

This ESIA Report is to serve as the main input to the environmental appraisal by the Macedonian competent authority on environment matters – the Ministry of Environment and Physical Planning, as well as to the environmental and social appraisal by the the European Bank for Reconstruction and Development (EBRD) for funding decisions.

This ESIA Report and its level of details are based on the best available information in the time of its preparation. This information includes geographical disposition of a preliminary OHL route within the corridor, which is determined with proposed locations of the OHL angle towers, used where route changes direction, while locations of the OHL suspension towers, used for straight OHL sections, are yet to be determined.

2.2 Project Status and Level of Details

The project has been developed to a feasibility level, i.e. to a detail considered sufficient to establish that the proposed line is technically feasible and to allow environmental effects to be assessed. Final design, including precise location of towers and access roads would be undertaken once the main technical design is developed and prior to construction commencing.

This refinement of the current design would be within the limits of deviation defined for the 500 meters wide transmission line corridor.

Committed mitigation measures defined in this ESIA will be included in construction procedures which the contractors will be required to follow for construction. This will need to include commitments to further consultation with competent authorities.

2.3 Legal Framework

2.3.1 Overview of Relevant National Legislation

2.3.1.1 Key National Legislation

Law on the Environment

This law (OG of RM no. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10 and 51/11) represents a horizontal legal framework and regulates, inter alia: the principles for environment protection and sustainable development, planning aspects and documents for environment protection, subjects and instruments for environment protection, environment monitoring and information system, public involvement in environment matters, environment labeling, financing issues and supervision aspects.

The main instruments for environment protection identified in the law include: (i) environmental monitoring and information system and access to environmental data; (ii) strategic environment assessment (SEA); (iii) environment impact assessment (EIA); (iv) integrated pollution prevention and control (IPPC); (v) environmental auditing; (vi) prevention and control of major accidents involving hazardous substances, and (vii) liabilities for environmental damages.

This law regulates the administrative procedure for environment impact assessment for projects that will likely cause significant effects on the environment. It also defines the content of the EIA study (EIA Report) and stakeholder engagement and public involvement process.

The general EIA procedure includes three main steps:

(i) **Screening process** - a process during which the competent authority determines whether an EIA is required for a certain project when a notification on the project implementation intention is made.

(ii) **Scoping process** - a process during which the competent authority determines the content and extent of the matters which should be covered by the EIA study.

(iii) **Review process** - a process of checking the adequacy of the EIA study as one of the main 'safeguards' built into the EIA process.

The administrative competent authority for the EIA process is the Directorate for Environment Protection within the Ministry of Environment and Physical Planning (MEPP).

The "Decree on determining of projects and criteria upon which the need for an environmental impact assessment is established" (OG of RM no.74/2005) – the EIA Decree determines the projects that may require environmental impact assessment.

Other relevant legal instruments in the area of EIA are following:

- Rulebook on the information to be included in the notification on the intention to carry out a project and the procedure determining the requirement for environmental impact assesment of the project (OG of RM no. 33/06).
- Rulebook on the content of the requirements to be fulfilled by the environmental impact assesment study (OG of RM no. 33/06).

- Rulebook on the content of the announcement of the notification on the intention to carry out a project, on the decision for environmental impact assesment, of the environmental impact assesment study on the project, of the report on the adequacy of environmental impact assesment study and the decision by which consent to the project implementation is issued or rejected, as well as the manner of public consultation (OG of RM no. 33/06).
- Rulebook on the form, content, procedure and manner of development of the report on the adequacy of the project environmental impact assesment study, as well as the procedure on the authorization of persons on the List of environmental impact assesment experts to prepare the report (OG of RM no. 33/06).

Relevant Sectorial Environment related Legislation

Other environment related legislation in Macedonia includes:

- **Law on Nature Protection** (OG of RM no. 67/04, 14/06, 84/07, 35/10, 47/11 and 148/11). This law regulates the nature conservation and promotion via protection of the biological and landscape diversity as well as the natural heritage. It identifies principles for nature protection, inter alia: principle for sustainability, precautionary principle, prevention principle and user-pays principle and sets the legal bases for protection of habitats, ecosystems and species. In addition, the law regulates the legal bases for establishment of a coherent ecological network, including the European Natura 2000 Network. The law also determines the planning documents for nature protection and the legal bases for protected areas (establishment, categorization, management).
- **Law on Ambient Air Quality** (OG of RM no. 67/04, 92/07, 35/10 and 47/11). This law sets the air quality standards and regulates air quality monitoring, air protection measures, air quality assessment, planning documents for air quality management, inspection and supervision, etc.
- **Law on Waters** (OG of RM no. 87/08, 6/09, 161/09, 83/10 and 51/11). This law introduces watershed management approach and regulates the legal status and manner for integrated water management, water infrastructure, conditions and manner for water economy, conditions for issuing water use and water discharge permits, etc.
- **Law on Waste Management** (OG of RM no. 68/04, 71/04, 107/07, 102/08, 143/08, 124/10, 09/11and 51/11). This law sets the legal bases for the integrated waste management system in compliance with waste management hierarchy. It regulates the types and classification of waste, waste management planning, rights, obligations and responsibilities of legal bodies and physical persons, conditions for issuing waste licenses, inspection and supervision, etc.
- **Law on Noise Protection in the Environment** (OG of RM no. 79/07, 124/10 and 47/11). This law regulates protection against noise in the environment and determines measures for mitigation of harmful effects of the noise on human health, including normative, urban planning and technical measures. The law excludes noise in working and living environment.

- **Law on Forests** (OG of RM no. 64/09). This law regulates protection, conservation and promotion of forests and forest land, planning aspects, manner and conditions for use of forests, construction and maintenance of forest roads, forest land and forestry issues.
- **Law on Management of the World Natural and Cultural Heritage in the Ohrid Region** (OG of RM no. 75/10). This law regulates the management of the UNESCO's world heritage site – the Ohrid Region by setting the rights and obligations of legal entities and individuals as well as various institutions, including the national authorities and the municipalities Ohrid, Struga and Debrca.

Relevant Spatial Planning and Construction Legislation and Strategic Documents

- Law on Spatial and Urban Planning (OG of RM no. 51/05)
- Spatial Plan of Macedonia 2002 – 2020 (OG of RM no. 39/04)
- Law on Implementation of the Spatial Plan of Macedonia (OG of RM no. 39/04)
- Law on Construction (OG of RM no.130/09)

Other Relevant Legislation

- Law on Energy (OG of RM no. 63/06 and 36/07)
- Law on Protection of Cultural Heritage (OG of RM no. 20/04 and 115/07)
- Law on Expropriation (OG of RM no. 33/95, 20/98, 40/99, 31/03, 46/05 and 10/08).

2.3.1.2 Other National Sectorial Regulations

Water Quality Regulations

Based on the purpose of the water use and the degree of the water purity, the Decree on classification of the waters (OG of RM no. 18/1999), divides the surface waters including watercourses, lakes and accumulations into five classes (Table 1-1).

Class	Purpose / Use of Water
I	This is very clean, oligotrophic water, which in its natural state, with possible disinfecting, can be used for drinking and production and processing of food product and is suitable for mating and cultivation of noble types of fish – salmonids. The buffering capacity of the water is very good. It is constantly saturated with oxygen, with low content of nutrients and bacteria, contains very slight, occasional anthropogenic pollution with organic matters / but not with inorganic matters.
II	This is a very clean, mesotrophic water, which in its natural state can be used for bathing and recreation, water sports, production of other types of fish / ciprinids /, or which can be used – after usual methods of purification / coagulation, filtration, disinfection etc./ –for drinking and production and processing of food products. The buffering capacity and oxygen saturation, present throughout the year, are good. The loadings may lead to slightly increased primary productivity.
III	That is moderately eutrophic water, which in its natural state can be used for irrigation, and after usual purification methods (conditioning) for industries which do not need drinking water quality. Buffering capacity of the water is low, but it maintains the pH value / acidity at a level still suitable for most fish. Occasionally oxygen deficit occurs in the hypolimnon. The level of primary production is considerable, and some changes in community structure, including fish species can be observed. The load of harmful substances is evident as well as microbial pollution. The concentration of the harmful substances varies from natural levels to levels of chronic toxicity for aquatic life.
IV	This is strongly eutrophic, polluted water, which in its natural state can be used for other purposes only after certain processing. The buffering capacity is exceeded, which leads to higher levels of acidity that affects the development of the offspring. In the epilimnion there is oxygen saturation, and in hypolimnion there is oxygen deficit. Algal blooms are common. Increased decomposition of organic matter at the same time with the stratification of the water can cause anaerobic conditions and fish death. Mass occurrences of more tolerant species, fish population and benthic organisms can be affected. Microbiologic pollution does not allow the water to be used for recreation. Harmful substances emitted or released from the sediment / deposits can affect the quality of the aquatic life. The concentration of harmful substances can vary from level of chronic to acute toxicity to aquatic life.
V	This is strongly polluted, hypertrophic water, which in its natural state can be used for other purposes. The water has no buffer capacity and its acidity / pH value is harmful for many fish species. Large problems occur with the oxygen regime, namely saturation in hypolimnon absence of oxygen, leading to anaerobic conditions in hypolimnon. Decomposers dominate over producers. Fish and benthic species are constantly not present. Concentration of harmful substances exceeds acute toxicity levels for aquatic life.

Table 2-1 – Classes of water quality according to the Macedonian regulations

In accordance to the Decree on categorization of the watercourses, lakes, accumulations and ground water (Off. Gazette of the RM No. 18/99 и 71/99), these water features are grouped in five categories. Each category from I to V corresponds with the classes of the water quality, from I to V.

Air Quality Regulations

Limit values for air pollutants in Macedonia are established by the Decree on limit values and types of polluting substance in the ambient air (OG of RM no. 50/2005) based on the EU legislation and recommendations made by the World Health Organization (WHO). Legally binding limit values for Macedonia to achieve have already been set for SO_2, NO_2, PM10, CO, lead, benzene (C_6H_6).

For some pollutants, (e.g. NO), there is a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-

hour averaging period, whereas for PM10 it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road). Limit values of polluting substances for protection of human health are given in the following tables.

Pollutant	Protection	Average Period	Limit Value
SO_2	Ecosystems	Year – winter period	20 µg/m³
$NO + NO_2$	Vegetation	Year	30 µg/m³

Table 2-2 – Air quality limit values for protection of eco-systems and vegetation

Pollutant	Averaging period	Limit value	Permissible number of annual exceeding events
SO_2	1 hour	350 µg/m³	24
	24 hours	125 µg/m³	3
NO_2	1 hour	200 µg/m³	18
	1 year	40 µg/m³	0
PM10	24 hours	50 µg/m³	35
	1 year	40 µg/m³	0
CO	Maximum daily 8-hour average value	10 mg/m³	0
Lead	1 year	0,5 µg/m³	0
C_6H_6	1 year	5 µg/m³	0

Table 2-3 – Air quality limit values for protection of human health

Source: Decree on limit values and types of polluting substances in the ambient air (OG of RM no. 50/2005)

Noise Management Regulations

The law on the Protection against Environmental Noise (OG of RM no. 79/2007) defines the polluting noise in the environment as noise caused by undesired or harmful outdoor sound generated by human activities, posed by the close vicinity and causing nuisance and annoyance, including the noise emitted by transportation means on the road, railway and air traffic and coming from sites of industrial activities. A source of noise is a construction, plant, piece of equipment, installation, device, means or apparatus, the operation/activity or use of which causes permanent or temporary noise, noisy activity carried out by humans and animals, as well as other activities spreading and/or generating sound in the surroundings.

Nuisance is the annoyance caused by sound emission which is frequent and/or durable generated at given time and place and which prevents or makes impact on normal human activity and work, concentration, rest and sleeping. The annoyance by noise is the degree of nuisance of the population by the noise determined by means of field surveys or inspections.

A noise indicator is a physical scale for describing environmental noise, which is related to harmful effect. Indicators are defined in the Ordinance for use of noise indicators, additional noise indicators, manner for noise measurement and methods for assessment of the environmental noise indicators (OG of RM no. 107/2008). There are four basic noise indicators:

- L_D – noise indicator during the day (period from 07,00 h to 19,00 h)
- L_E – noise indicator during the evening (period from 19,00 h to 23,00 h)
- L_N – noise indicator during the night (period from 23,00 h to 07,00 h)
- L_{DEN} – noise through day-evening-night as an average noise level

This ordinance also defines the methods for calculation of industrial noise (various ISO methods), as well as methods for calculation of noise from different types of traffic.

Limit values for the basic environmental noise indicators are determined in the Ordinance on environmental noise level limit values (OG of RM no. 147/2008). In accordance to the level of protection against noise, the limit values for the basic noise indicators should not be higher than shown in the next table.

Area, defined in relation to the degree of protection from noise	Noise level [dBA]		
	L_D	L_E	L_N
Area with first degree	50	50	40
Area with second degree	55	55	45
Area with third degree	60	60	55
Area with fourth degree	70	70	60

Table 2-4 – Ambient noise limit values

The areas in regard to their degree of protection against noise are determined in the Ordinance for locations of the measuring stations and measuring spots (OG of RM no. 120/2008):

i. Area with first degree of protection from noise is touristic and recreational area, an area in immediate vicinity to health-care institutions and areas in natural protected areas.

ii. Area with second degree of protection from noise is an area which primary purpose is accommodation - residential area, area around educational buildings and buildings for social care and health care, area around playgrounds and public parks and public green areas.

iii. Area with third degree of protection from noise is business - trade area, area with public buildings for administrative, trade, service and similar purposes and an agricultural area.

iv. Area with fourth degree of protection from noise is an area without residential buildings, an area for industrial and other production activities, transport activities, storage and other service activities and communal activities which produce significant noise.

Cases as well as the conditions when it is considered that the peace of the citizens is disturbed by noise are defined in the Governmental decision no. 19-6920/1 (OG of RM no. 01/2009).

2.3.2 Overview of Relevant International Legislation

The EU Environmental Impact Assessment Directive

The EU Directive on Environmental Impact Assessment (EIA Directive 85/337/EEC, as amended by 97/11/EEC, 2003/35/EC and 2009/31/EC) defines the requirements for assessment of potential effects on the environment by some public and private pojects that are expected to have significant impact on the environment EIA is conducted prior the issuance of construction permit and approval for project implementation. The envrionmental impact may be the impact on human beings and biological diversity, soil, water, air and other natural resources and climate, hystorical and cultural heritage, as well as the interaction among these elements. This EU Directive has been transposed into legislation in the Republic of Macedonia. Thus, prior to issuing construction permit or approval for implementation of certain types of projects, it is mandatory to conduct the EIA.The EIA process is intended to anticipate the potential risks and avoid or mitigate eventual damage, while at the same time to balance the social and economic goals with the goals for environmental protection.

The public and other parties are to be consulted on the EIA as the consultation with the public is a key feature of environmental assessment procedures. These requirements have been incorporated into Macedonian legislation.

Under the EIA Directive projects are classified in two groups: projects listed in Annex I are all subject to compulsory EIA while for projects in Annex II, the assessment contains and element of discretion, noting that an EIA procedure will, in any event, be required for projects with potentially significant environmental impacts. These Annexes are transposed into legislation of Macedonia via the Macedonian EIA Decree.

Other Most Relevant EU Directives

- Directive on conservation of wild birds (79/409/EEC as amended by 2009/147/EC)
- Directive on habitats (92/43/EEC)
- Directive on the assessment of the effects of certain plans and programmes on the environment (2001/42/EC)
- Directive on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (2004/40/EC).

Relevant International Multilateral Agreements:

- UN Framework Convention on Climate Change – UNFCCC (New York, 1992)
  - Kyoto Protocol to the UN Framework Convention on Climate Change
- UN Convention on Biological Diversity – CBD (Rio de Janeiro, 1992)

- UN Convention on Wetlands of International Importance – Ramsar Convention, (Ramsar, Iran, 1971)
- UN Convention on the Conservation of Migratory Species of Wild Animals – CMS (Bonn, 1979)
  - Agreement on the Conservation of Populations of European Bats – EUROBATS (London, 1991)
  - African-Eurasian Waterbird Agreement – AEWA (Hague, 1995)
- Convention Concerning the Protection of the World Cultural and Natural Heritage – UNESCO World Heritage Convention (Paris, 1972)
- Convention of the Conservation of European Wild Life and Natural Habitats – Bern Convention (Bern, 1982)
- UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters – Aarhus Convention (Aarhus, Denmark, 1998)
- UNECE Convention on Environmental Impact Assessment in a Transboundary Context – Espoo Convention (Espoo, Finland, 1991)
- European Convention on Landscape (Florence, 2000)
- Bilateral Agreement between Albanian and Macedonian Governments: "On the protection and sustainable development of the Ohrid Lake" (OG of RM no. 46/05).

Relevant International Guidelines:

- ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz), 1998
- ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (from 1 to 100 KHz), 2010

2.4 Relevant Strategic Framework

The most important strategic document in Macedonian energy sector is the National Strategy for Energy Development until 2030 [Ref. 3] from 2010 – the Strategy. Number of strategic goals and priorities identified in the Strategy is related to the Macedonian transmission system and, therefore, relevant for the proposed transmission line Bitola – Elbasan:

- Maintenance, revitalization and modernization of the existing, and development of new modern energy infrastructure.
- Improvement of the energy efficiency in production, transmission and utilization of the energy.
- Integration of the Macedonian energy sector with the regional and the European electricity and natural gas market by development of new interconnections.

In that respect, the SWOT analysis performed in the Strategy framework identifies the need for "further interconnection with neighboring countries with 400kV transmission lines" as one of main strategic recommendations. In addition, the Strategy concludes that "Macedonia has improved its connectivity with the regional electricity system by construction of the 400kV lines to Greece and Bulgaria, but there is a need for connections with Serbia and Alba-

nia, as well as additional connection with Kosovo". The Strategy's action plan for development investments clearly identifies the proposed transmission line Bitola-Elbasan as a medium-term priority action. The Figure 1-1 represents the current and future transmission infrastructure in Macedonia.

Figure 2-1 – Exisiting and planned transmission infrastructure in Macedonia

Source: Macedonian Strategy for Energy Development until 2030 (2010)

2.5 EBRD Context

Through its environmental and social appraisal and monitoring processes the EBRD seeks to ensure that the projects it finances:

- are socially and environmentally sustainable
- respect the rights of affected workers and communities, and
- are designed and operated in compliance with applicable regulatory requirements and good international practice.

In order to translate this objective into successful practical outcomes, the EBRD has adopted a comprehensive set of specific Performance Requirements (PRs) that clients are expected to meet, covering key areas of environmental and social impacts and issues.

EBRD's document "Environment and Social Policy" (the Policy) and related PRs detail the commitments of the Bank to promote in the full range of its activities, environmentally sound and sustainable development.

EBRD categorises proposed projects as A / B / C based on environmental and social criteria to: (i) reflect the level of potential environmental and social im-

pacts and issues associated with the proposed project; and (ii) determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required for each project, taking into account the nature, location, sensitivity and scale of the project, and the nature and magnitude of its possible environmental and social impacts and issues.

Projects categorised by EBRD as "A" require special formalised and participatory assessment processes. An indicative list of such projects is provided in Appendix 1 of the Policy. The categorisation of each project depends on the nature and extent of any actual or potential adverse environmental or social impacts, as determined by the specifics of its design, operation, and location.

Projects are categorized by EBRD as "B" when the potential adverse environmental and/or social impacts that it may give rise to are typically site-specific, and/or readily identified and addressed through mitigation measures. These impacts could be from past, current or future activities. Due diligence requirements may vary depending on the project and will be agreed with the EBRD on a case-by-case basis.

Projects categorised by EBRD as "C", as having minimal or no adverse impacts, are not subject to further environmental or social appraisal beyond their identification as such.

The project proposal falls under category "A" of the EBRD screening categorization as it is listed in Appendix 1, item 21 – "Construction of high-voltage overhead electrical power lines" of the EBRD's 2008 Policy document. As such, the project for development of the proposed 400 kV overhead transmission line and associated substation requires special formalized and participatory assessment process in compliance to the EBRD's requirements and following PRs:

- PR 1: Environmental and Social Appraisal and Management
- PR 2: Labour and Working Conditions
- PR 3: Pollution Prevention and Abatement
- PR 4: Community Health, Safety and Security
- PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement
- PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- PR 8: Cultural Heritage
- PR 10: Information Disclosure and Stakeholder Engagement

2.6 Overview and Methodology of the Environmental and Social Impact Assessment Process

This project proposal for construction of the 400 kV transmission line Bitola – Macedonian-Albanian border (to Elbasan, Albania) is included in the Macedonian EIA Decree in the Annex 1 – Projects which are subject to compulsory EIA, item 17 – "Overhead transmission lines of 110 kV voltage or higher, and

longer than 15 km". As such, the project requires full environmental assessment process in compliance to the national EIA legislation and, therefore, preparation of an EIA study.

Therefore, MEPSO submitted to the MEPP a *Notification on the intention to carry out the project*, as well as document for EIA scoping – a *Scoping List: Questions on project characteristics.*

The scoping exercise is an early stage in the ESIA process and is designed to ensure that the environmental studies provide all the relevant information on:

- the environmental and social impacts of the project, in particular focusing on the most important impacts
- the alternatives to the project
- any other matters to be included.

In principle, the scoping exrecise should identify the content and extent of the information to be included in the ESIA report. In particular, the scoping needs to identify the types of environmental and social impacts to be investigated and reported in the ESIA.

As a result of the project's screening exercise, the MEPP has informed MEPSO for the need for an environmental impact assessment and, based on the scoping document, has determined its scope. The Decision on the aforesaid is given in the Appendix 6.

Consequently, ESIA has been carried out in accordance with the requirements of the Macedonian and EU legislation, as well as requirements of the international financial institutions in order to meet several main objectives:

- the requirements of the environmental policies and procedures of the International Financing Institutions who are expected to provide the finance for the project.
- to obtain environmental permits, pursuant to the Macedonian requirements.
- to ensure public input into the proposed project.
- to inventory features of environmental, social, cultural and economic significance within the study area and identify appropriate mitigation measures to be incorporated into the design and construction process to minimize those impacts.
- to establish procedures in the contract package to ensure construction is conducted in an environmentally acceptable manner.
- to establish procedures for monitoring environmental conditions following completion of construction.
- to incorporate all mitigation measures, construction procedures and monitoring procedures into an environmental management plan to facilitate implementation.

The ESIA approach for this project is based on three main groups of activities as described below.

Activity 1: Data collection

Data collection exercise was conducted via desk and field surveys which provided a sufficient fund of relevant information and clear baseline of the state of the environment and social surrounding in the project affected area, as basic prerequisite for identification of likely impacts and, consequently, for proposal of mitigation strategy.

Activity 2: ESIA study

The ESIA study is based on the following requirements:

- Detailed knowledge of the baseline situation.
- Overview of considered alternatives.
- Identification and evaluation of probable direct and indirect impacts during the main phases of the project life cycle:
  - Construction and installation of the required infrastructure and equipment, and
  - Project operation (operational stage).
- Review of cumulative effects.
- Protection of environment and other natural resources.
- Definition of applicable measures to mitigate probable impacts, with advantage being given to measures for avoidance and prevention and use of compensation measures as ultimate alternative.
- Development of an environment management and monitoring plan.

a) Identification of environmental impacts and their significance

Methodology for identification and assessment of potential environmental impacts included:

- Review of published literature.
- Acquisition and review of unpublished documents and reports by various organizations and other projects of this type.
- Interviews and discussions with representatives of relevant organizations / stakeholder groups.
- Review of relevant statistical and cartographic databases and data from censuses.
- Field works and investigations.

Impacts will be probably significant if:

- They are intensive in space or time.

- They are intensive with regard to absorption capacity of the environment.
- They exceed environmental standards and thresholds.
- They are not in compliance with environmental and land use policies.
- They have negative impacts on ecologically sensitive and important areas or natural heritage resources.
- They have negative impacts on the lifestyle of the community or traditional land use.

Cumulative impacts

Cumulative effects can result from multiple environmental impacts on a single receptor. They may also occur as a result of the accumulation of impacts from different developments.

b) Measures for impacts mitigation

Measures to mitigate impacts on the environment are necessary if there is probability for significant damages and irreversible effects on environment. Measures proposed in this ESIA are consistent with the requirements of the relevant legislation and policies, as well as the best international practices.

Principles of mitigation, including their hierarchical setup, are as follows:

- Preference to measures for avoidance and prevention
- Review of feasible project alternatives
- Identification of minimization measures for each significant impact
- Measures should be appropriate and cost-effective
- Application of compensation measures as last resource

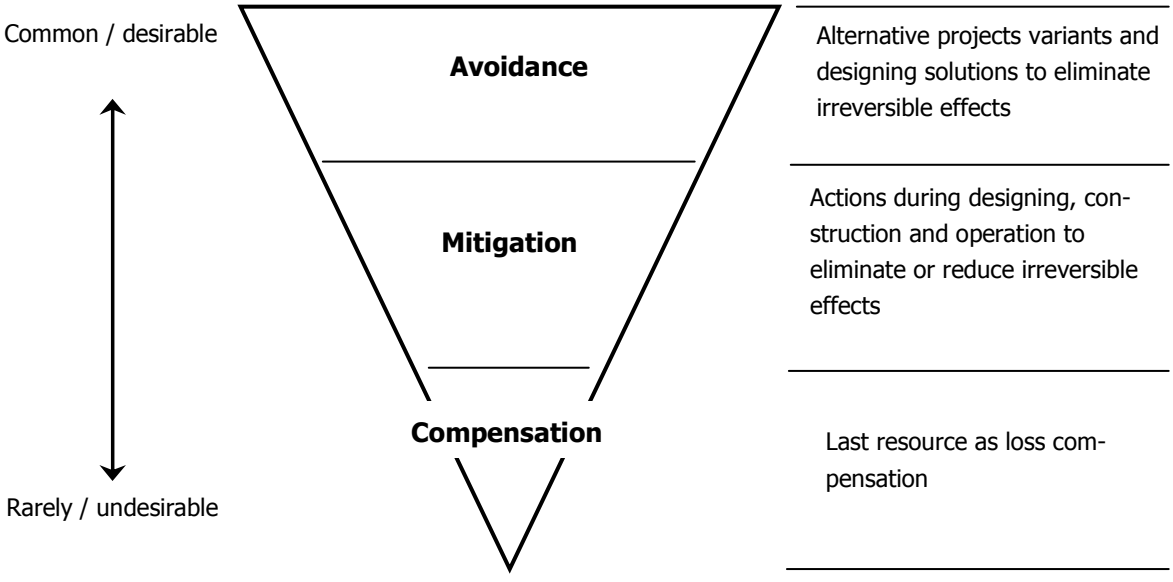


Figure 2-2 – Hierarchy of mitigation

Activity 3: Stakeholder consultation

Macedonian legislation concerning EIA specifies the rules and the detailed procedures for stakeholder engagement and public involvement in the decision making process.

Practical involvement of the public is accomplished through: a) dissemination of information for the public, b) public participation, to enable its active participation in public discussions possibility to submit written opinions in different phases of the EIA process, and c) through the access to justice mechanism, where the public can influence the process of decision making through filing appeals to court or the Second Instance Commission of the Government of the Republic of Macedonia.

Under the Macedonian national legislation, public is involved in the early phase of the EIA procedure. Any decision taken during the process should be published in appropriate medium. Public has a possibility to follow the process and take part in different phases of the procedure itself. This concerns the following documents:

- Notification on the intention to implement the project
- Decision determining the requirement for EIA implementation
- Decision determining the scope of the EIA
- Dissemination of EIA Study availability
- Non-technical summary of the EIA Study
- Report on the adequacy of EIA Study
- Decision approving or rejecting the application for project implementation

Public has the possibility to express their opinion on EIA study during public discussions, organized by MEPP and by way of submitting written opinions to MEPP.

These obligations will be followed by MEPSO. All relevant documents produced in the course of preparation of this ESIA are publicly accessible, timely submitted and at locations easily accessible for the local population.

Overview of the process of public consultation in Macedonia is shown on the following figure.

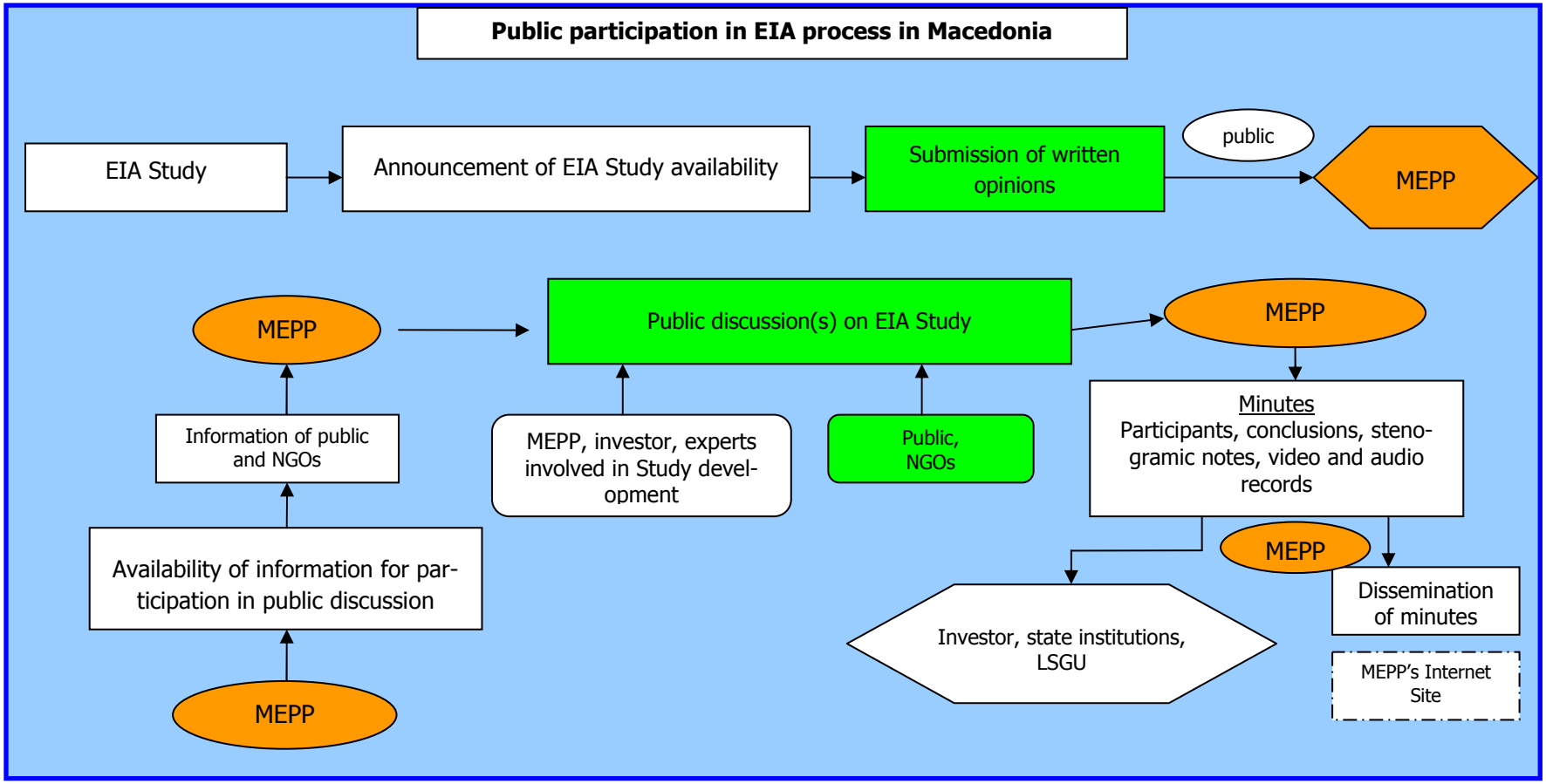


Figure 2-3 – Public participation process during environmental impact assessment process

2.7 Information Disclosure and Stakeholder Engagement

MEPSO has undertaken stakeholder engagement during the ESIA process, including many consultative meetings with various institutions and the public. An overview of the stakeholder consultation process throughout the ESIA process is given in the Appendix 3. MEPSO will actively engage stakeholders during the next project stages. Future stakeholder engagement will be guided by a Stakeholder Engagement Plan (SEP) that was prepared to meet EBRD requirements. This plan summarizes engagement to date and calls for regular communications with key stakeholders throughout the planning, construction works and operation stage of the project.

MEPSO intends to implement the project as an example of good practice in the development of transmission lines and substation infrastructures with the aim to involve stakeholders and maintain good communication practices throughout the life of the project. According to this approach, the target of the information disclosure / communication will be:

- To provide all stakeholders (including those who are directly and/or indirectly affected) with a schedule of, and information about, project related activities.
- To provide an opportunity for all stakeholder to articulate their concerns about the project or related activities.
- To make public the commitment to ensure the best practices in terms of environment protection and health and safety for workers and contractors.
- To make available to the public a grievance procedure, so that people can bring their concerns and complaints to the attention of MEPSO and thereby provide an opportunity for them to be addressed.

General information comprising the most important information related to the various stages of the development of the project (planning, construction and operations) will be available:

- on information board in offices of the concerned municipalities
- in daily newspapers

Electronic version in Macedonian language of this Environmental and Social Impact Assessment (ESIA) report as well as associated Non-Technical Summary (NTS), Stakeholder Engagement Plan (SEP) and Environmental & Social Action Plan (ESAP) will be available to the public on the MEPSO's website (www.mepso.com.mk). Hard copies of these documents will be available in the central premises of MEPSO in Skopje. The ESIA will be available in Macedonian, and the other documents in both English and Macedonian.

Project summary information (NTS, SEP and ESAP) will be also available in offices of the concerned municipalities.

The full ESIA package will also be made available by EBRD in its resident office in Skopje and in London for public review and a notification will be put on the EBRD's website (www.ebrd.com) in compliance with the EBRD's Public Information Policy. For this project, a public disclosure of 120 days of the documents is required, during which time comments from all stakeholders will be accepted and considered before the project is considered by the EBRD Board of Directors.

3 Description of the Project

3.1 Project Purpose and Life Cycle

The project intention is to construct and operate 400 kV overhead transmission line from Bitola to Macedonian / Albanian border (further on to Elbasan, Albania) and to construct and operate new 400/110 kV substation in Ohrid area. It also includes activities to upgrade existing substation Bitola 2 to accommodate the proposed 400 kV transmission line.

This project has been studied previously, in the context of establishing a major East - West power transmission corridor between Bulgaria, Macedonia, Albania and Italy (via a planned submarine cable). Since that time, the section between Bulgaria and Macedonia has been completed, and the submarine cable has been planned between Italy and Montenegro. In addition, the 400 kV connection between Albania and Montenegro is in operation, while the construction of Albania and Kosovo connection is being tendered.

In terms of electrical energy, connecting Albania and Macedonia and allowing transfers to Italy (the interconnection between the Macedonia and Bulgaria was implemented in January 2009) will provide the possibility for enhanced connection within the countries of Italy and Southeast Europe through better connecting the Albanian power system with the region.

Figure 3-1 –- Planned 400 kV Connection (dotted line) Elbasan (AL) - Bitola (MK)

The main national and regional benefits from the proposed 400 kV OHL development are summarized below:

1. Significantly better, more powerful transmission network in South – West Macedonia.
2. More reliable power supply and reducing electrical supply constraints for further economic developments in the wider project region.
3. Improved network capacity to facilitate anticipated load and transit growth, new generation connections, in the context of improving transmission capacity in Albania and in Macedonia, and in the Balkans Region.
4. Improvement of the reliability of the regional network, the overall security of supply, and system operational issues such as stability.
5. A decrease of the technical losses in the transmission system,
6. Improving the quality of electricity supply (normalise the voltage levels, stabilize the load flow and the frequency fluctuations, etc).
7. Supporting the potential to develop the regional energy market in South East Europe and creating trading opportunities with Bulgaria and Italy.
8. Mutual support between Macedonia and Albania to complement power generation types (Albania - hydro, Macedonia - thermal).
9. Reducing the cost of providing reserve capacity, and providing mutual emergency support.

The entire life cycle of the project includes the following phases:

- Selection of adequate corridor for the route of the transmission line. This phase has been realised through (i) identifying the potential alternative corridors, (ii) assessment of the feasibility thereof and (iii) selection of the most feasible alternative.
- Planning and design phase. This phase is underway and includes preparation of relevant planning documentation, including technical and design documentation and analysis of the environment aspects.
- Construction phase. Activities of this phase will include construction activities and installation of the necessary infrastructure and equipment.
- Operational phase. This project phase will include operational activities of the substations and transmission line, including maintenance and control.
- Decommissioning and closure of the installation. This phase will include measures for remediation and future use of the area, as well as measures for managing the impact on the environment during the post-project period.

3.2 Technical Description of the Proposed Transmission Line

All components of the planned transmission line (towers, foundations, conductors, earth wires and insulators) and substations and all their elements will be designed, produced, tested and installed according to the relevant IEC standards and the conditions of the 400 kV grid in Macedonia. The entire equipment must be designed and constructed in the manner that will ensure safe operation in the ambient conditions that dominate in the area where the transmission line is to be built, and under various energy burdens and voltages that might occur during the operation of the transmission grid.

Technical Characteristics of the Overhead Transmission Line

The proposed transmission line will be designed and constructed in compliance with the current international and national regulation, i.e. the Regulation on the Technical Rules for Construction of Overhead Power Lines with Nominal Voltage of 1kV to 400 kV.

The proposed OHL is approx. 100 km long and is situated in south-western region of Macedonia. It passes various geographical features from its starting point, existing substation Bitola 2, in flat area of the Pelagonija Field via hilly and mountainous northern slopes of Baba Mountain through Prespa valley to Struga Field at the northern side of the Ohrid Lake and eastern bottom edge of the Jablanica Mountain toward the crossing point on the Macedonian-Albanian border (locality Kafasan). In general, the proposed OHL corridor follows, as much as practicable, the corridor of the existing 110kV OHL Bitola-Resen-Ohrid-Struga.

An overview of the basic technical parameters of the transmission line is presented in the following table.

Parameter	Characteristic
Nominal voltage	400 kV
Type of towers	Steel-lattice hot zinc-coated, single circuit self-supporting towers with horizontal configuration of conductors, two per phase and with two earth wires.
Foundation	• Typical separate reinforced footings, depending on the engineering and geo-mechanical parameters of the ground. • Reinforced concrete: brand of concrete according to the valid regulations. • Protection against corrosion of anchor segment.
Conductor	• Number per phase: 2 • Material: ACSR type with nominal cross-section of 490/65 mm^2 • Maximum work stress: According to valid regulations and design practice
Protective wire	Two earth wires in horizontal configuration: • First: Alumo-weld wire with diameter of 126.1 mm^2, labeled AWG 19 N^O 9 • Second: Earth wire with optical fibers, OPGW with 48+48 fibers
Insulators	• Type of cap and pin insulators: - On the line: Toughened glass insulator units U 160 BS - On the portal: Toughened glass insulator units U 160 BS

	• Number of insulator sets: According to the regulations
Tower earthing	• Specific soil resistivity: According to the terrain measurements of specific places and use of typical earthing • Material: Round zinc-coated steel wire • Dimensions: Minimum diameter: Ø10 mm
Insulator set fittings	• Material: Steel hot zinc-coated.
Climate parameters	• Wind pressure: 75/90 daN/m^2 • Additional loading due to ice and snow: 1,6/2.5/4.0 x 0,18√d daN/m • External temperature: Maximum: + 40 °C / Minimum: - 20 °C

Table 3-1 – Overview of technical parameters of the proposed transmission line

Towers

The design of the towers must ensure safe operation in all working climatic conditions, in relation to the used phase conductors, earth wires and insulator sets and for the designed wind and weight spans.

Depending on their position in the transmission line, the types of towers could be:

- Suspension towers, used for straight section of the line, and
- Angle (tension) towers, used where the line changes direction.

In terms to their design, there will be one main type of towers used for construction of the proposed transmission line:

- Towers for the single circuit 400 kV OHL ("Y" – tower type) – see Figure 2.2 below. They will vary in size depending on exact ground conditions and landscape at each tower type. The tower height range would be between 20 and 40 meters.

The towers will be steel lattice design (see Figure 2.2 below). Each tower will have four legs and single foundation per leg, i.e. four foundations for each tower. Number of conductors and their disposition on each tower type is 3 lines in horizontal direction, each with 2 phase conductors and 2 lines in horizontal direction with 2 earth wire conductors (one with OPGW).

The total number of towers per type and per OHL section as well the average length spans for each OHL section are given in the following table.

Tower type (position in the OHL)	Sub-total per tower type (position in the OHL)
Suspension	217
Tension	33
Total:	250

Table 3-2 – Number of towers per type

Typical footprint area for the different tower types is given in the following table. This land area would need to be permanently acquired in order ensure safe operations and maintenance of the proposed transmission line.

Tower type (design)	Tower type (position in the OHL)	
	Suspension	Angle-tension
	footprint area [m^2]	footprint area [m^2]
Single circuit 400 kV ("Y" – type)	80 m^2	115 m^2

Table 3-3 – Footprint area for towers

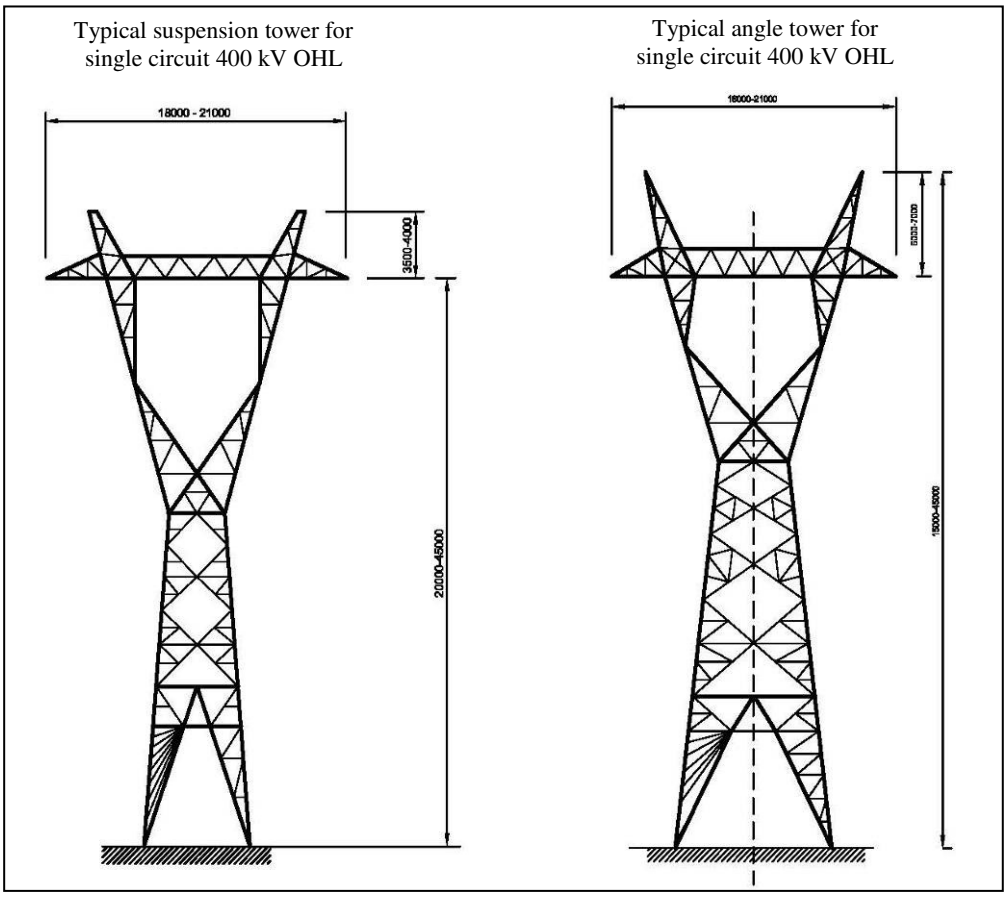


Figure 3-2 –- Typical single circuit 400 kV OHL tower types and their basic characteristics

Foundations

The foundations of transmission line will be constructed of reinforced concrete blocks. The type of concrete should provide conditions for placing normal foundations and should be suitable to the specific carrying capacity of the terrain. In case of weak carrying capacity of the terrain at certain micro-locations and based on geo-technical investigations, relevant specific technical solutions will be designed and conctructed.

The final solutions in relation to the type of foundation for each single tower location, depend on the geo-technical investigation.

Earthing

In the context of safety and protection at work (reducing the effects from electric shock, etc.) special emphasis will be given to the tower earthing. This procedure should be conducted in compliance with the requirements of the technical regulations.

Earthing of OHL towers will done with two rings around each tower foundation, made from FeZn wire Ǿ 10mm. These rings are connected between them and to the tower steel structure. In cases when earthing needs to be reinforced (e.g. for types of soil with lower conductivity), reinforcement is done by adding two legs (extensions) from FeZn wire or FeZn tapes to existing rings on each tower foundation. Finally, for sites with special earthing requirements (in principal case – near buildings or houses), additional FeZn wire ring is laid around entire tower structure, roughly 1 meter away from existing rings and at depth of 0.8 to 1.0 meter.

Phase Conductors

For the phase conductors for the planned transmission line, pursuant to the current concept for this type of power lines in Macedonia, conductors ACSR will be used with normal cross section of 490/65 mm^2. Two conductors per phase are planned at a mutual distance of more than 400 mm.

Insulators

The proposed transmission line will belong to the grid with a directly grounded neutral point and a degree of insulation for which the nominated lightening impulse withstand voltage is 1,425 kV.

The insulator that is to be used will be of a type approved for such power lines and appropriate assembling procedures will be carried out for the various types of insulator chains.

3.3 Construction Works for the Transmission Line

Transportation means used to transport towers to the construction sites mainly depend on the terrain conditions. In general, trucks or heavy tractors will be used. No use of helicopters for construction purposed is planned.

Use of existing access roads to tower location will be preferred. Thus, a combination of access options will be used, using existing roads and tracks to allow access to construction sites wherever possible and making new tracks where necessary. Roads for construction access will be prepared using standard road construction heavy machinery, mainly – bulldozers, by upgrading existing roads in order to accommodate construction needs and buildings new access roads. Once construction is completed it is intended to maintain access roads to enable maintenance activities. Any other access road disturbed by construction activities will be improved to better condition in comparison to its original stage.

Tower sub-structures (segments of the steel lattice) will be pre-assembled in suitable project bases and transported in pieces to the lay-down areas. These segments will be then assembled on site to construct final tower structure. For locations with difficult access, pre-assembled pieces will be smaller and accordingly number of pieces will be bigger. The tower assembly and lay-down areas will be organised for each 3-5 km long subsection (11-12 towers on average), which results in around 20-25 temporary lay-down areas in total. Area for each OHL lay-down area is around 100 x 50 m. They will be guarded, but not fenced. Assembly process is such that materials for few towers are brought on site, tower sub-structure are assembled and transported to construction site. Average use of a single lay-down area is around two weeks.

For preparatory works (mainly construction of access roads) there will be maximum 3 teams working in parallel, consisting of roughly 10 staff each.

The typical area of land that would be permanently acquired for each of the towers is given in the Table 2.4 in the Section 2.2 above. For construction purposes, the working area at each OHL tower will be around 1,000 m^2, up to 2,500 m^2 for angle towers and approximately 6,000 m^2 for winch sites which will be used for pulling the conductors into place between towers. After completion of the construction works, the remainder of the working area would be restored and put back to its original condition. Any previous forms of agricultural activities or other land use type can continue after construction of the proposed transmission line and during its operational stage.

Construction of towers along the OHL route differs mainly due to terrain profiles and accessibility patterns. Average duration of a tower construction, calculated at single crew basis, consists of:

- time for preparation of foundations (excavation and concrete works),
- time for construction of tower (assembly and erection), and
- time for mounting electrical equipment.

Average time for construction of foundations for a single tower, i.e. for four foundations, is one tower per day for excavation and one tower per day for concrete works. The time for concrete works include half a day for preparation of reinforcement and half a day for concrete works. Reinforcement steel will be transported by tracks or heavy tractors, while the concrete by trucks for ready mix concrete (mixers). Single crew staff number is 15 workers. Typically the total number of crews that would work in parallel along the OHL is three.

Average time for erection of a single tower is 1.5 towers per day. Erection of the tower segments will be done by the mobile construction crane. Single crew staff number is 12, while the total number of crews working in parallel along the route is three.

Average time for mounting electrical equipment is 4 – 5 km per month, which is roughly equal, as an average, to 1.7 towers per day. Single crew staff number is 30, while total number of crews working in parallel along the route is three.

As a result of all above, the average total construction time per tower could be estimated on 7.2 days, and consists of:

- 2 days for preparatory works
- 2 days for construction of foundations (one day for excavation and one day for concrete works)
- 1.5 days for erection of towers
- 1.7 days for electromechanical works

Single crew staff number would be 67 and maximum staff number working in parallel along the OHL route would be 201.

Above calculation is made for the estimated construction period of maximum three years (36 months). Estimated average number of working days per year is 180.

The number of days for each type of construction activity over the estimated construction period of three years is as follows:

(i) Preparatory works: 396 days over 3 years

(ii) Foundation works: 414 days over 3 years

(iii) Erection/construction works: 306 days over 3 years

(iv) Electrical works: 342 days over 3 years

Average number of truckloads per tower is 12, i.e.:

- 3 truckloads for ready mix concrete (mixers)
- 5 truckloads for tower structure
- 2 truckloads for equipment, tools, materials, etc.
- 2 truckloads for electrical equipment (except for the conductor which is transported in large drums with special heavy vehicles).

Daily number of truckloads per tower is estimated to be 3 - 4. However, all materials will be brought in cycles, not continuously, so there may be the case when at the same time tower structures, tools and electrical equipment is delivered, and in such a case maximum number of truckloads per lay-down area will be between 8 and 10 per day. Since there are usually two construction sites within the same section operating in parallel, maximum number of truckloads per base camp is between 12 and 15 (possibility to have maximum truckloads at both sites simultaneously is very small).

Conductors will be strung using special pulling machine and adjacent, also special, breaking machine.

In case the power line crosses certain facilities or entities in nature, i.e. in case when the power line approaches facilities or entities in nature, the requirements incorporated in the above stated regulation will be followed. This refers to the prescribed safety heights and distances as presented in the following table. These are minimum distances from a facility or entity in nature to the nearest energized conductor (wire) of the OHL that will allow its safe operations.

Entity / terrain condition	Safety height [m]	Safety distance [m]
unaccesible places (canyons, rocks, unnavigable rivers, marshes, etc.)	6	5
places accessible for vehicles	8	7
forests and trees	5	5
inhabited places	9	NA
buildings (inaccessible parts – roof, chimney, etc)	5	5
buildings (accessible parts – balcony, terrace, etc)	7	6
roads (local / regional / highways)	9	12 / 12 / 42
bridge constructions	7	7
gas and oil pipelines	10	10
electrified railways	14	17
high-voltage line	4.5	3.0
low-voltage line	4.5	4.0

Table 3-4 – Safety heights and distances for 400 kV power lines

Source: Regulation on the Technical Rules for Construction of Overhead Power Lines with Nominal Voltage of 1kV to 400 kV

For construction of the proposed transmission line, there are no plans for opening new installations for exploitation of mineral raw materials. Due to the nature of materials and the need for precise construction works, the concrete for the foundations of the steel towers will be ordered from licensed producers. At each individual tower location, prior to the placement of concrete, there is a very sensitive phase of defining the center of the anchor elements of the tower where the connection of steel elements of the tower and its proper vertical position depend on the precision of these anchor elements.

Figure 3-3 –- Construction and installation of a single circuit 400 kV transmission line infrastructure

3.4 Access to Construction Sites of the Transmission Line

Access to the works would be gained wherever feasible from the existing main road network. The use of certain unclassified roads would also be required. Those unclassified roads which may be used would be identified in subsequent project stages and during preparation of the project's main technical design. Information about estimated vehicle transport requirements for construction of the transmission line is given in the below table.

Transport activity	Estimated vehicle transport requirements for construc-tion
Ready mix concrete	750
OHL tower elements	1,250
Construction equipment and materials	500
OHL electrical equipment	500
OHL conductors and winching equipment	33*)

Table 3-5 – Estimated vehicle transport requirements for construction

*) Based on the "a per angle tower" number, where winching works will be performed. More vehicle requirements may be needed depending on specific conditions along the route.

Temporary or permanent tracks capable of taking a heavy crane and other heavy machinery and vehicles are required for the construction of each tower. Stone roads to all angle towers sites are preferred, i.e. where winching equipment would be used. Matting can be used in some sensitive areas but it is not suitable for use on steep slopes (mountainous and hilly areas, etc) or during wet weather.

A combination of access options would need to be considered including making best use of existing roads and tracks as well as new temporary and permanent tracks to allow access to construction sites with the least environmental impact. In general terms, the following principles would be used to define the route of new temporary and permanent access tracks:

- Best use would be made of existing road network - bridges, roads and tracks.
- Although use of existing accesses is preferred, use of private accesses to residential properties would be avoided wherever possible for safety and intrusion reasons. Where this is unavoidable access arrangements would be agreed with the landowner.
- Permanent stone tracks to angle towers are preferred because these would assist future operational and maintenance activities.
- Longer length of temporary routes would be used where use of public roads could cause major nuisance to the public and local population within settlements along the transport routes.

The following principles would be used to define access routes in agricultural areas:

- In agricultural areas it would usually be possible to make best use of the existing road network and access the construction areas with temporary tracks that branches from an existing road.
- In agricultural land temporary tracks would be used and the ground restored at the end of construction, unless it has been agreed with the landowner that a permanent track is required for general land access.
- Accesses through farms would be agreed with landowners and if necessary longer tracks would be used to avoid intrusion into agricultural land.

The following principles would be used to define access routes in sensitive areas:

- Permanent roads would be avoided wherever possible.
- All tracks within forest areas would be designed to minimise the loss of trees.
- Existing tracks would be used in forest areas where possible.
- Tracks can be permanent in forest areas, if required, where there are no ecological, hydrological or forestry sensitivities. This would be agreed with competent authority.
- Crossing of watercourses with vehicles would be forbidden.
- There would be no unnecessary tracking by construction vehicles near rivers and watercourses.

3.5 Commencement with Operation

The commencement of operation will include assessment of parameters and performance of installed equipment and the degree of its conformity with the technical specifications with an aim of ensuring safe and secure operation of the transmission line, including its conformity with requirements for environment protection, testing will be performed of the operability of the different components.

3.6 Operation and Maintenance

The project will be designed for continued operability (24 hours per day, 7 days per week) depending on the regime and parameters of the national and regional power transmission grid. From the beginning of operations, the transmission line will work without continuous presence of personnel.

Maintenance of the proposed transmission line will be carried out by MEPSO and will be implemented in compliance to the national legislative requirements stipulated in by-laws on technical standards for operation and maintenance of electro-energy systems. Detailed maintenance activities would be set out in the MEPSO maintenance plans for the proposed transmission line. These activities could include line inspection, tower painting, future upgrading, etc.

OHL towers often require maintenance painting 10-15 years following erection, depending upon their environment. Painting a lattice-type structure is a team effort. A crew of 3 or 4 painters will paint a standard 35 meters high OHL tower in 3–4 hours, or two towers per day. For the most part, application is ac-

complished using a pound or oval brush, or a paint mitt. No lead based paints will be used to paint the towers of the proposed transmission line.

In general, maintenance works include regular maintenance (visual inspections and routine annual maintenance works) and overhauls (detailed examination and elimination of eventual faults).

Visual inspection would be conducted twice a year and may be followed by certain actions in individual sections and/or on towers, such as replacement of insulators, bridges, strengthening of tension ropes, repair/replacement of tower lattices, etc. Four wheel drive vehicles and small trucks would be used for that purpose. Overhauls are to be done once in three to five years. These may require use of tracks and heavy tractors. Overhauls include physical inspection of each tower and removal of all registered faults on the OHL towers and electrical equipment (short circuits, ground faults, ground wire damages, etc.).

Maintenance access requirements could include:

- Access for maintenance – using suitable off road vehicles and trucks.
- Storm damage - using suitable off road vehicles and trucks.
- Conductor damage – access requirements for conductor stringing equipment.

Thus, maintenance of the 400 kV transmission line would require access by a range of vehicles of varying size. These vehicles would use the public road system and those access tracks which are retained for permanent use following completion of construction. Operational traffic would be very light and no significant traffic related effects are predicted on any part of the public road system.

According to MEPSO practise, all high voltage overhead lines (and especially extra high voltage OHL - 400 kV lines) have to be accessible for maintenance and/or repair works 365 days/year, if possible.

3.7 Decommissioning and Closure

The overall operational life of the proposed transmission line is approximately 70 years. The eventual final termination of operations will involve activities for dismantling the infrastructure and equipment and their dislocation from the area of the corridor of the transmission line. The location will be subject of restoration and returning the environment in the initial condition, to the greatest possible extent. The biggest part of the transmission line equipment can be recycled or reused and it may be offered to other interested licensed companies.

3.8 Substations

The project includes activities for construction of a new substation in Ohrid region and upgrading of the existing substation Bitola 2 to allow it to be able to accommodate the proposed 400 kV transmission line.

3.8.1 New substation in Ohrid Area

Location of the new substation

The new 400/110 kV substation in Ohrid area is located at north-west from village Livoista at relative distance of more than 1 km, on the locality Staro Selo on altitude of 800 m. On its southern side, the wider area is characterized with open and flat landscape and occasional agricultural land uses, mainly vineyards. The substation location itself is not under agricultural land-use. The slope is gently dipping towards south. Western, northern and eastern sides of the location are sheltered with hilly topography.

The location is distant from any residential property (Figure 2-4).

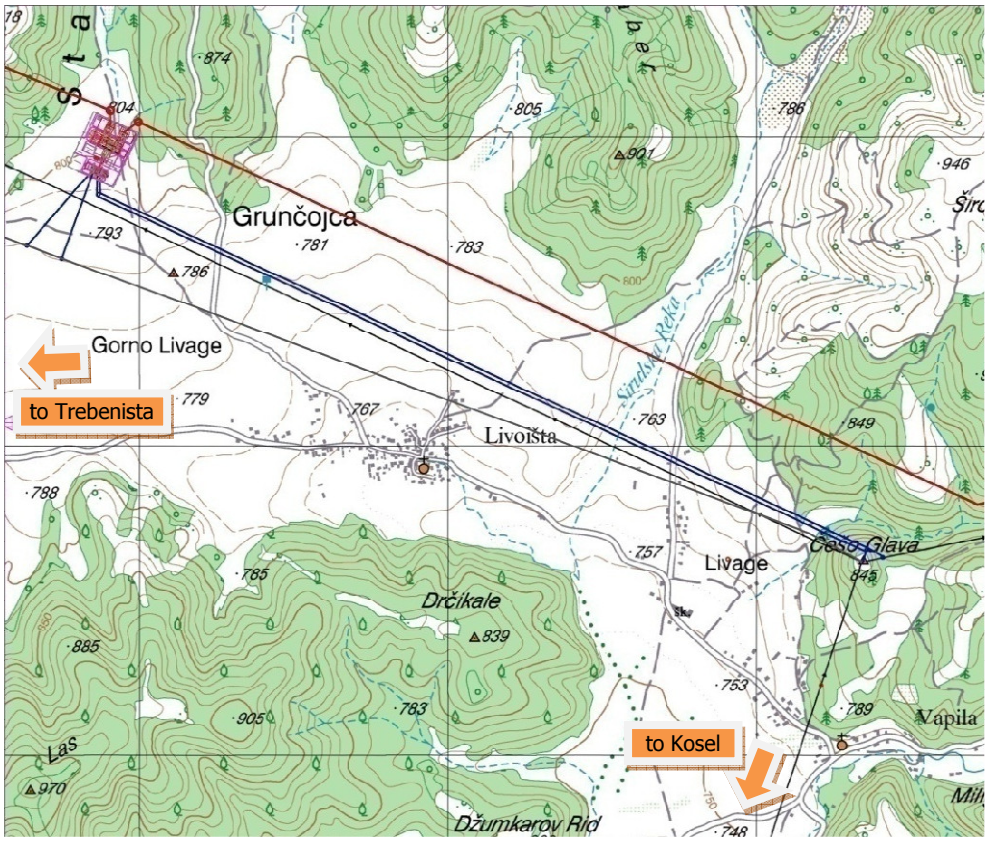


Figure 3-4 –- Location of the new substation in Ohrid region

Access to construction sites of the new substation

In general, the location is accessible via the existing local network from two main directions:

1. Existing asphalt road Kosel – Vapila – Livoista that branches from regional road Bitola-Ohrid and is main road connection for residents of villages Vapila, Livoista and Sirula. It is passing through residential zones.

2. Existing unclassified unpaved road Trebenista – Livoista that branches from regional road Skopje-Ohrid and is very rarely used by local residents, mainly to access agricultural plots in the area. This road (Figure 2-5) is approximately 5 km long and is considered as preferable access option for the construction purposes as well as during operational stage. Improvement of this road would be needed to allow use of transport and construction vehicles for construction purposes. Existing exit point from the regional road Skopje-Ohrid at the village Trebenista is not suitable to support transport needs during construction of the substation and transport of the new substation transformer and, therefore, construction of new exit point is required.

Technical description of the new substation

The new substation will occupy an area of 175x195 meters. The SS building will be 10 meters high, while the highest SS structures (busbar portals) will be 27 meters high. It will be constructed as 400/110 kV substation.

There will be one 400/110 kV power transformer in the substation. Groundwater protection measures against transformer oil spill will be installed and will include oil / storm water tank, placed nearby energy transformer on a concrete foundation and with same capacity as the transformer unit. There will be 400 kV switchgear with a total of 4 equipped bays and one spare bay: 1,400 kV transformer bay, 2 OHL bays and bus-coupler bay. Also, there will be 110 kV switchgear with total of six equipped bays and one spare bay: 1 transformer bay 110 kV, 4 OHL bays and bus-coupler bay. All switchgears will be for outdoor use, designed with respect to local weather conditions. Necessary civil works will be undertaken in order to prepare concrete portals for mounting of the switchgear equipment and busbars.

Existing 110 kV OHL Bitola-Resen-Ohrid-Struga will be cut in order to allow its diversion to the new substation. The 110 kV OHL section Resen-Ohrid will be cut at the hill Ceso Glava above village Vapila (a point where at the moment the OHL branch to Ohrid is created), while the OHL section Ohrid-Struga will be cut in vicinity of the new substation. No dismantling activities on the existing OHL towers will be performed.

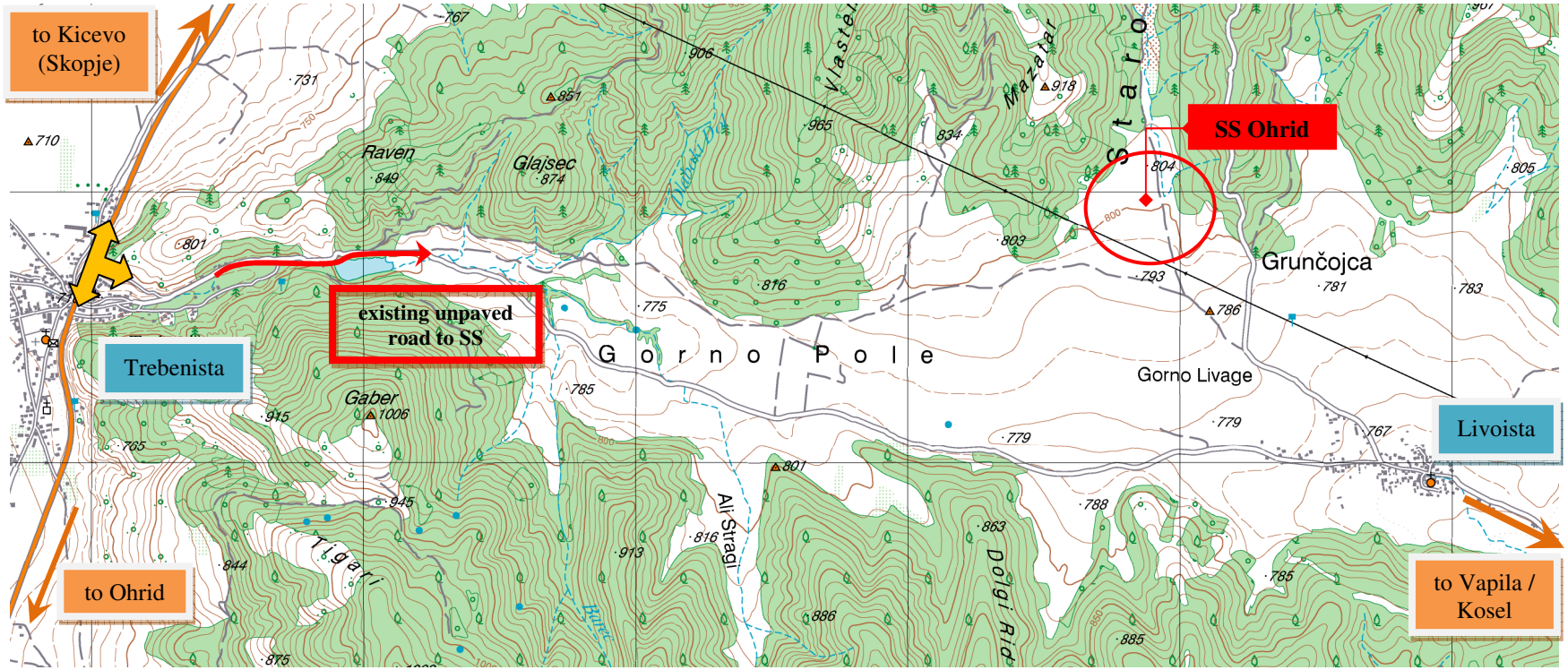


Figure 3-5 –- Access to the site of the new substation in Ohrid region

Fire protection measures will be designed and executed during construction of the substation. These measures would include (i) passive fire safety measures in terms of appropriate selection of equipment and materials, compliance with fire standards for safety distances of buildings, appropriate organization of the location in terms to fire protection sectors, etc. and (ii) active fire safety measures such as hydrant network, fire alarm system, fire extinguishers etc.

The perimeter of the location of the substation will be protected against unauthorized access by fence.

Construction works for the substation

The construction of a 400/110 kV substation is an intensive and complex operation. It requires the coordination of numerous different supplies, works and activities, and accordingly the coordination of numerous different suppliers and various contractor teams. Normally, the construction works for a substation of the size of the 400/110 kV SS Ohrid last around two years. The first 6-months period is usually dedicated to making preparations for the construction, necessary administrative procedures and setting up site offices, etc. The following site construction works could be split into two main groups: civil works and electro-mechanical works.

Civil construction works will include:

- construction work on access roads
- earth works (excavation, grading, levelling and drainage), and
- construction works for foundations, buildings (including all building services such as electrical installations, plumbing, heating, air-conditioning, ventilation), fire protection systems and fencing.

Electro-mechanical works will include:

- earthing arrangements
- mounting, installation, testing and commissioning of the main/primary equipment (busbars, transformers and switchgear)
- mounting, installation, testing and commissioning of the secondary equipment (protection, signalling, telecommunication systems), and
- mounting, installation, testing and commissioning of the auxiliary equipment (LV AC supply, DC supply, mobile generators, monitoring equipment, etc).

The sequence of works for the new 400/110 kV substation is briefly described below.

The first action will be improvement of the existing access road from Trebenista to the substation location nearby Livoista. This will also include design and construction of new exit point from the regional road Skopje-Ohrid near to village Trebenista. The necessary excavation and removal of surplus soil at the substation location will follow, with two purposes: 1) to level the ground and 2) to remove surface soil layer in order to install the earthing system for the entire

substation and to install the drainage system. The next phase is the fencing and concrete works for the foundations of buildings, equipment portal foundations and transformer gantries. At this point, the supply of the equipment (primary equipment, secondary equipment, busbars, etc.) and outdoor electro-mechanical works would commence, while the civil works continue with the construction of buildings and the associated installation works inside those buildings. The indoor electrical equipment is supplied in the final stage, followed by installation, testing and final commissioning of all electro-mechanical equipment (including control and protection systems, telecommunication facilities, auxiliary supplies, etc.).

The construction workforce is approximately distributed as 55% for civil workers and 45% for electro-mechanical workers. The average total number of workers on site (for all profiles of the work force, i.e. engineers, craftsmen and workers) is 45, out of which 25 workers are for civil works and 20 workers are for electro-mechanical works. The maximum number of workers present on site simultaneously occurs during the first half of the second construction year, when a total of 70 workers will be present. The minimum number of workers present on site simultaneously occurs during the second half of the second construction year, when 15 workers will be present.

The heavy machinery which will be used for construction on site will consist of bulldozers, excavators, graders, cranes, road rollers, etc. This machinery will remain on the construction site during overall construction works.

For transportation purposes, mainly normal (standard) trucks will be used, and only in exceptional case trailer trucks will be employed – one truck load for the 400/110 kV transformer. For the standard truck deliveries, the total usage is estimated at nearly 700 truckloads for the electro-mechanical works. The number of truckloads for civil works would be determined during the preparation of the main technical design, but it is currently estimated to be in the range between 2,000 and 3,000 truckloads for the entire construction period.






Figure 3-6 –- Construction and installation of a substation infrastructure

3.8.2 Extension of the Existing Substation Bitola 2

Existing SS Bitola 2 is located in immediate vicinity to, and west from, the thermal power plant (TPP) REK Bitola in the Bitola Field at the southern edge of the Pelagonija Valley. It is accessible via local road Bitola-Novaci-Staravina (Mariovo region). In terms of its morphology, the surrounding area represents a flat open field landscape which includes a number of land uses and human-caused intrusions: settlements, roads, agricultural fields, various energy and industrial infrastructure (TPP REK Bitola, coal mine and overhead transmission lines).

The extension - equipping spare bay - will require no construction outside the current area of the substation. The extension will not include new transformer unit. One of the existing two spare 400 kV bays in the substation will be equipped to accommodate the proposed 400 kV transmission line. Currently, a spare bay B10 (Figure 2-6) is available in the substation and will be used for that purpose. This is feeder switchgear which will consist of standard device configuration (two busbar disconnectors, circuit breaker, line disconnector and earthing switch) mounted on concrete portals, and necessary extensions in protection, control, telecommunication and auxiliary supply. All civil and electrical works are going to be executed inside the existing substation fence.

The proposed project does not include any change or intervention on the existing electrical equipment in the SS Bitola 2.

Figure 3-7 –- Spare bay in the existing substation Bitola 2 which will accommodate the proposed transmission line

4 Considered Alternatives

4.1 'Do nothing' option

The 'Do nothing' option is an alternative involving no development of the proposed project.

One of the main strategic goals identified in the Macedonian Strategy for Energy Development until 2030 [Ref. 3] – the Strategy is "maintenance, revitalization and modernization of the existing, and development of new modern energy infrastructure".

In addition, the basic Macedonian long-term development and regionally strategic priority identified in the Strategy is construction of new electricity production and transmission infrastructure. The foreseen development of the transmission network until 2030 should achieve full integration of the Macedonian energy sector with the regional and the European electricity market by development of new interconnections. In that context, the Strategy calls on "further interconnection with neighboring countries with 400kV transmission lines" and clearly identifies the need for interconnection with Albania.

In terms of fulfillment of the above Macedonian strategic goals, the 'Do nothing' option has no positive argument in its favour, because if the proposed 400 kV transmission line is not build, then it would cause a serious problem in the planned state energy sector development and the regional integration of the Macedonian electricity system.

'Do nothing' alternative does not involve capital investment costs. However, maintenance costs are higher than for lines within the expected life span because the equipment would become obsolete with an expired useful life. Consequently, the 'Do nothing' option will directly contribute to higher operational costs of the existing out-of-date transmission infrastructure, as well as to higher technical losses. It will also decrease security and reliability of the power supply in the project region.

In a wider context, the 'Do nothing' option would limit overall economic development and possibilities for the improvement in the social welfare of the citizens in the region.

4.2 New 400/110kV Substation in Ohrid Area

A number of alternative locations for the 400/110 kV substation in the area of the villages Vapila and Livoista (Ohrid area) were considered:

- **Alternative location 1.** It is located at north from village Vapila, on a locality on altitude of 800 m a.s.l. in immediate vicinity of the hill Ceso Glava (845 m a.s.l.), on its south-east side. Ceso Glava is a point where the OHL branch to Ohrid from the existing 110 kV OHL Bitola-Resen-Ohrid-Struga is created. Main access road to the location passes through villages Kosel and Vapila. The location itself is accessible via existing steep dirt road that branches from the local road Kosel - Vapila - Livoista. Due to its steepness, it may cause difficulties related to the transport of the substation elements and transformer(s). The wider area is hilly and distant from the closest settlement (approx. 800 m from northern edge of the village Vapila) and completely sheltered from any viewpoint in the surroundings. Occasional agricultural plots exist in the area. Existing 35 kV OHL passes through the site.

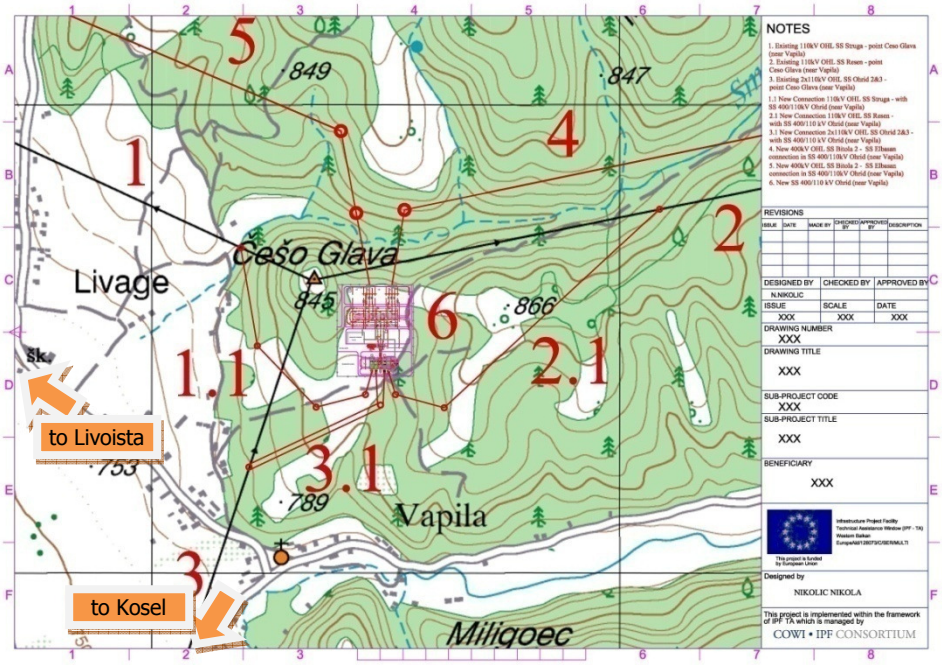


Figure 4-1 –- New substation alternative location 1

- **Alternative location 2.** It is located on the locality Livage on altitude of 760 m a.s.l. on western bottom area of the hill Ceso Glava. It is easily accessible via network of existing roads that branch from the local road Kosel - Vapila - Livoista. The wider area is characterized with open landscape and different agricultural land uses. The substation would be exposed to the existing landscape and visual impacts to the surrounding residential properties and local road network are likely. This location is close to several houses.

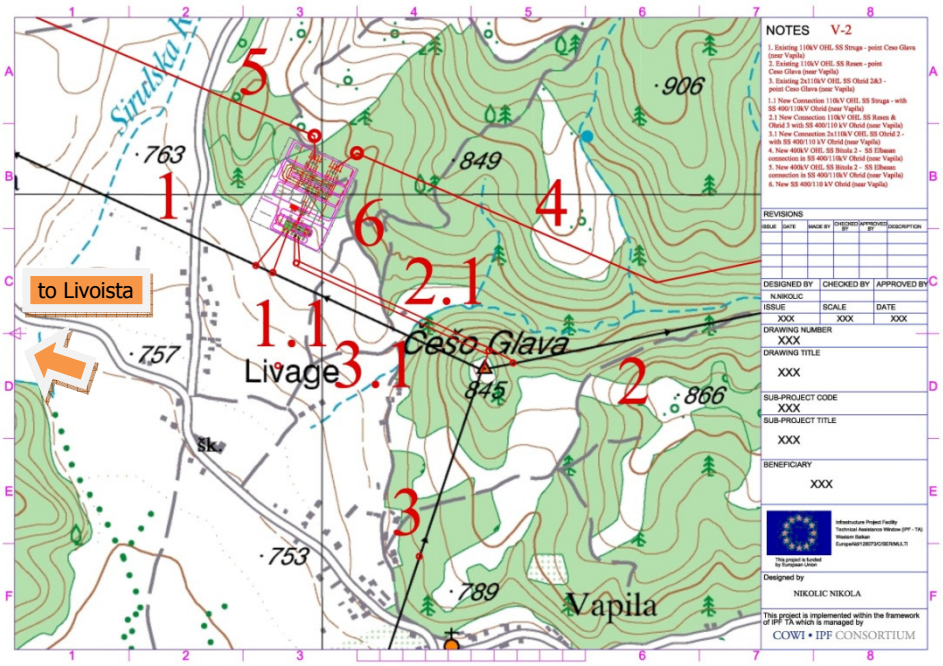


Figure 4-2 –- New substation alternative location 2

- **Alternative location 3.** It is located at north-west from village Livoista at relative distance of more than 1 km, on the locality Staro Selo on altitude of 800 m. Main access road to the location is existing unpaved road Trebenista – Livoista that branches from regional road Skopje-Ohrid and is very rarely used by local residents. The wider area is characterized with open landscape and occasional agricultural land uses. The substation location itself is not under agricultural land use. This location is distant from any residential property.

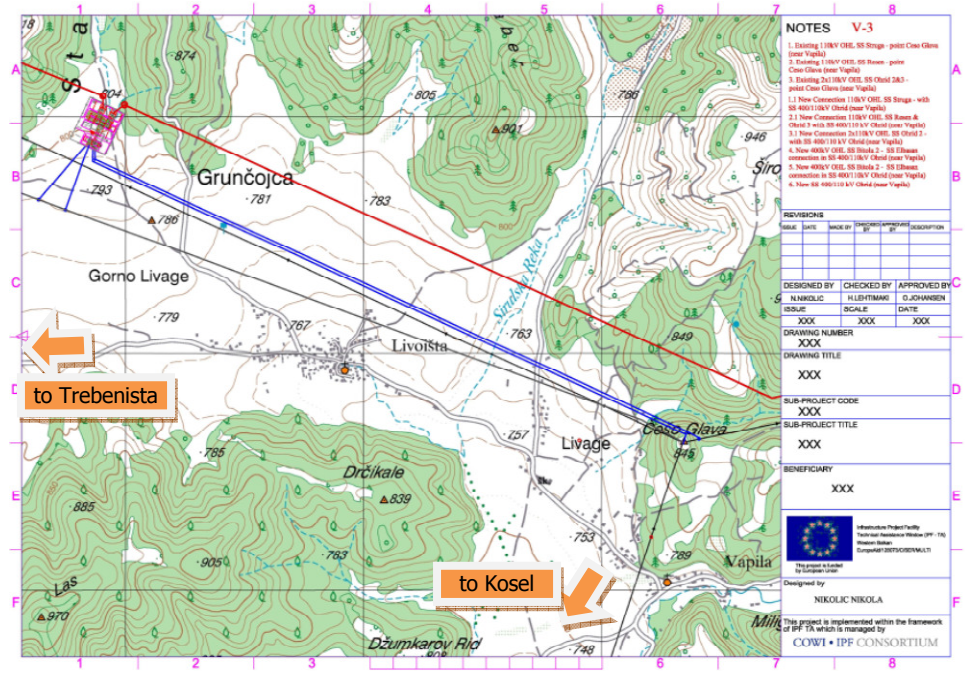


Figure 4-3 –- New substation alternative location 3

Comparative analysis of the proposed alternative sites is given in the following table.

Alternative SS site	Environmental Aspects		Social Aspects*)	
	Construction	Operation	Construction	Operation
Alternative 1	• Existing dirt steep access road (significant improvement required or new road required) • Natural vegetation clearance required	/	• Very limited loss of agricultural land may occur • Transport difficulties expected due to access road steepness • Nuisance due to construction traffic and noise (Kosel, Vapila) • Transport nuisance on local road Kosel-Vapila-Livoista	• No visual impact
Alternative 2	• Existing good access road (limited improvement may be required) • No natural vegetation exists on the site	/	• Close residential properties • Loss of agricultural land is likely • Nuisance due to construction traffic and noise (Kosel, Vapila) • Nuisance to residents due to dust emission • Transport nuisance on local road Kosel-Vapila-Livoista	• EMF exposure (close residential properties) • Operational noise • Visual impact
Alternative 3	• Existing access road (improvement required) • No natural vegetation exists on the site	/	• Loss of agricultural land is possible • No transport or construction nuisance	• Limited visual impact

Table 4-1 – Comparison of the alternative sites for the new substation

*) Additional information in relation to the land ownership is required and would be acquired throughout the land acquisition process.

The above evaluation of the proposed sites has concluded that the Alternative 3 is an optimal choice for a location of the planned new SS and, therefore, has been selected by MEPSO as the future development site.

4.3 Overhead Transmission Line

In 2007, Albania, Italy and Macedonia have studied the feasibility of a 400 kV overhead transmission interconnection between Albania and Macedonia as a constituent part of the future submarine cable interconnection between Albania and Italy along the European Corridor 8. An overview of such analysis is given in the Summary Report of the Feasibility Study of the 400kV Interconnections Macedonia-Albania-Italy [Ref. 4].

Fundamentally different alternative OHL corridors for interconnection between Macedonia and Albania (further on to Italy) have been evaluated at a strategic and spatial planning level, which resulted in proposal for a general OHL corridor that should accommodate the OHL route.

Two main strategic alternatives for the OHL corridor from Bitola to Albanian coast (further on to Italy) have been considered:

i. Alternative corridor 1: Bitola 2 (Macedonia) – Elbasan 2 – Vlore (Albania) – Brindisi (Italy)

ii. Alternative corridor 2: Bitola 2 (Macedonia) – Elbasan 2 - Tirana 2 - Durres (Albania) – Foggia (Italy).

Two main corridor alternatives of the section between Bitola and Elbasan as a part of the overall OHL corridor have been considered. These are:

1. **OHL Corridor 1**. This corridor starts at SS Bitola 2 in flat area of the Pelagonija Field and goes toward the Resen area bypassing city of Bitola and the National Park Pelister. In Resen area the corridor turns to south toward connection point with Albania passing through the National Park Galicica in Macedonia and National Park Prespa in Albania and reaches Zemblak (Albania). Two sub-corridors from Zemblak to the Albanian coast were considered: (i) Zemblak-Librazd-Elbasan-Vlore and (ii) Zemblak-Korce-Erseke-Permet-Vlore.
2. **OHL Corridor 2**. This corridor is situated in wider south-western geographical part of Macedonia in the Pelagonija and Ohrid-Prespa regions. It passes various geographical features from its starting point (SS Bitola 2) in flat area of the Pelagonija Field via hilly and mountainous northern slopes of Baba Mountain through Prespa valley to Struga Field at the northern side of the Ohrid Lake and south and eastern parts of the Jablanica Mountain. In general, the corridor follows, as much as practicable, the corridor of the existing 110kV OHL Bitola-Resen-Ohrid-Struga. This corridor bypasses all various categories of nationally designated protected areas in the project region, including both NPs (Pelister and Galicica) and, consequently, avoids any eventual impact on their natural values or their protection status. It passes through peripheral northern part of the World Heritage Site (WHS) Ohrid Region, distant from the area with main natural values of the site – the Ohrid Lake itself. The affected area mainly consists of cultivated land, pastures and occasional woodlands and the cities of Ohrid and Struga with their fast developing suburbs and with the accompanying infrastructure (airport, roads, commercial developments, transmission

lines, other energy infrastructure, etc.). Two sub-corridors in the area of crossing point with Albania have been evaluated:

i. **OHL Sub-corridor 2A:** OHL corridor with crossing point to Albania at locality Kafasan in vicinity of the existing border crossing, following bottom east slopes of the Jablanica Mountain at altitude up to 1,000 m a.s.l. It passes through the peripheral south-east area of the proposed National Park Jablanica. In general, this sub-corridor follows main existing transport corridor between Macedonia and Albania – the regional road Ohrid – Struga - Kafasan border station.

ii. **OHL Sub-corridor 2B**: OHL corridor with crossing point to Albania over Jablanica Mountain. This sub-corridor passes through the core area of the proposed National Park Jablanica at altitude higher than 1,500 m a.s.l. making access and construction as well as operational control and maintenance very difficult.

A map of the strategic transmission line corridors on Macedonian territory relative to the proposed corridor (red line) is given in Appendix 1.2.

Summary of the main characteristics of each of the considered variants of the OHL corridor vis a vis selected environmental indicators is given in the following table.

Parameter / Indicator	Variants		
	OHL corridor 1 (through NP Galicica)	OHL corridor 2	
		Sub-corridor 2A*) (crossing point to Albania at locality Kafasan, avoiding core area of Jablanica Mountain)	Sub-corridor 2B*) (crossing point to Albania over Jablanica Mountain)
Crossing(s) through internationally designated area (UNESCO)	No.	Yes. Through peripheral northern part of the UNESCO's World Heritage Site (WHS) Ohrid Region, distant from the area with main natural values of the site – the Ohrid Lake itself.	
Crossing(s) through existing protected areas as per national legislation for nature conservation	Yes. Through core area of the NP Galicica in 11 km long section.	No.	
Crossing(s) through identified Emerald site	Yes. Through core area of the NP Galicica, also identified as Emerald site.	No.	
Crossing(s) through planned protected areas as per national strategies for nature conservation	No.	Yes. Through the peripheral south-east area of the proposed NP Jablanica in 2 km long section.	Yes. Through the core area of the proposed NP Jablanica in 5 km long section.

OHL corridor vis a vis settlements	Settlements avoided.	Settlements avoided.	Settlements avoided.
Number of out-standing river crossing(s) (length > 600m)	None.	None.	None.
Access options / Operational maintenance	Difficult in the NP Galicica.	Suitable.	Difficult over Jab-lanica Mountain.

Table 4-2 – Main environmental issues for considered transmission line variants

*) Both sub-corridors, 2A and 2B, from the OHL starting point (SS Bitola 2) to the western area of the Ohrid Lake are equivalent. They differ in the area of Jablanica Mountain (crossing / connection point between Macedonia and Albania).

SUMMARY:

1. Two main OHL strategic alternative corridors have been considered during selection exercise.
2. OHL corridor 1 passes in 11 km long section through the core area of the existing NP Galicica, also identified as an Emerald site (future NATURA 2000). The Emerald Network is based on the same principles as EU's NATURA 2000 ecological network and represents its extension to non-EU countries. Significant impacts on ecological and natural values of the NP as well as forest and landscape fragmentation could be expected. The proposed OHL project is not in compliance with the status of protected area of the NP Galicica. Due to above, this alternative OHL corridor 1 is considered as less preferable option in comparison with the OHL corridor 2.
3. OHL corridor 2 avoids all various categories of nationally designated protected areas in the project region, including both NPs (Pelister and Galicica) and, consequently, avoids any eventual impact on their natural values or their protection status.
4. OHL corridor 2 passes through peripheral northern part of the UNESCO's WHS Ohrid Region, distant from the area with main natural values of the site – the Ohrid Lake itself. However, the affected area mainly consists of cultivated land, pastures and occasional woodlands and the cities of Ohrid and Struga with their fast developing suburbs and with the accompanying infrastructure (airport, roads, commercial developments, transmission lines, other energy infrastructure, etc.).
5. In the area of crossing point with Albania, two variants (sub-corridors) of the OHL corridor 2 have been evaluated:
    i. OHL Sub-corridor 2A: OHL corridor with crossing point to Albania at locality Kafasan in vicinity of the existing border crossing. It passes through the peripheral south-east area of the proposed NP Jablanica in approx. 2 km long section. This particular area is not pristine one, as it includes number of human-caused intrusions: settlements, road lines, residential and commercial developments, etc. Therefore, no significant impacts on the proposed NP are likely.

ii. OHL Sub-corridor 2B: OHL corridor with crossing point to Albania over Jablanica Mountain. This sub-corridor passes through the core area of the proposed NP Jablanica in approx. 5 km long section. Significant impacts on the ecological and scenic values of the proposed NP are likely. This option passes at altitude higher than 1,500 m a.s.l. making access and construction as well as operational control and maintenance very difficult.

6. The variant 2B of the OHL corridor (crossing point to Albania at locality Kafasan, avoiding core area of Jablanica Mountain) is considered as most favourable alternative of the proposed transmission line.

5 Description of the Existing Environmental Conditions

5.1 Physical Environment

5.1.1 Geographical Postion

The proposed OHL is situated in south-western region of Macedonia. It passes various geographical features from its starting point in flat area of the Pelagonija Field via hilly and mountainous northern slopes of Baba Mountain through Prespa valley to Struga Field at the northern side of the Ohrid Lake and eastern bottom edge of the Jablanica Mountain.

In general, the proposed OHL follows, as much as practicable, the corridor of the existing 110kV OHL Bitola-Resen-Ohrid-Struga.

Its starting point is the existing MEPSO's substation Bitola 2 in the locality Tebalica at the immediate vicinity of the thermal power plant (TPP) REK Bitola. From SS Biola 2, the OHL continues toward north-west over the Pelagonija Field, avoiding the settlements in its surroundings (Dobromiri, Trn, Mogila). At the locality Karamanski Pat it turns to south-west, crossing the roads Bitola-Prilep and Bitola-Kicevo to the hilly area above the village Krklino. From the locality Korija (in immediate vicinity to the road Bitola-Ohrid on its north side) the proposed corridor turns toward west up to a point in the area of the village Gjavato, passing north from the road Bitola-Resen in an unpopulated area. At the locality Gradiste on the southern slopes of the Bigla Mountain, the OHL turns to north-west, following the existing 110 kV OHL, avoiding the settlement Sopotsko and bypassing the town Resen in wide ring. Further on to north, it avoids villages Kriveni, Leva Reka as well as Krusje karst area (water supply facilities for Resen). At the area of the village Svinista, the OHL turns to western direction, avoiding the villages Rasino and Livoista and enters the Struga Field by crossing the road Ohrid-Kicevo. Within the Struga Field, at the locality Veljo Pole, the OHL turns to south-west and avoids the villages Volino and Moroista. On the western edge of the Struga Field, at the locality Belicka Krasta the proposed OHL turns to south toward the crossing point on the Macedonian-Albanian border (locality Kafasan) following bottom east slopes of the Jablanica Mountain. It avoids the villages Zagracani, Radolista, Frangovo and Mali Vlaj.

A map of the project area with the proposed OHL corridor is given in Appendix 1.1.

5.1.2 Climate Characteristics

Macedonia with its geographical position and relief structure is characterized by various local climatic characteristics caused by direct climate influence from north by moderate continental climate and from south by the Mediterranean. High mountainous regions are under influence of cyclone and anti-cyclone conditions resulting in mountain climate, featured with short summers and cold and wet winters, where precipitations most commonly occur in a form of snow.

Pelagonija Valley / Bitola Region

This region is situated on southern part of Macedonia at altitude from 575 to 660 m a.s.l. It is relatively close to the Aegean Sea which is situated on south at approximately 150 km. The influence from the Mediterranean is very limited due to barrier of high mountains at the southern perimeter of the Pelagonija valey and its high altitude.

The average annual air temperature in the area of Bitola (Bitola Field) is 11.3^0C. The coldest month is January with average monthly temperature of -0.3°C. The warmest month is July with average monthly temperature of 21.6°C. The average annual temperature oscillation is 21.6°C. Autumn is warmer than spring with average temperature difference of 0.9°C. The local continental characteristic of the Pelagonija Valley is expressed by the absolute temperature minimum (-29.4°C).

The average annual sum of precipitation is 598 mm. In particular years annual sum varies from 359 mm to 818 mm. In the course of the year, precipitations are unevenly distributed. The main maximum is in November with average monthly sum of 72 mm or 12% of the average annual amount. The main minimum is in August, with 34.5 mm at an average or 6% of the average annual amount. By seasons, the rainiest is autumn with average seasonal sum of 171 mm, and the least rain falls in summer with an average of 106 mm.

Precipitations in Pelagonija Valley are mostly of rain, and snow occurs during winter months as well. As an annual average, there are 34 to 36 days with snow cover.

Pelagonija Valley is characterized with high frequency of dry periods. During the year, dry periods are with greater frequency in summer and autumn. Out of the total number of dry periods, 61% occur in these seasons, and 39% in winter and spring. Summer draughts account for 34%, and autumn ones for 27 %, while winter draughts amount 23%, and spring ones 16%.

Average annual duration of solar radiation in Pelagonija Valley amounts 2,321 hours of solar radiation or 6 hours per day at an average. The maximum occurs in July, with monthly average of 336 hours or 10.8 hours per day at an average.

The average annual relative humidity is 70% decreasing gradually in the course of the year from January to August, and then rapidly increasing from September to December. The highest monthly value of relative humidity occurs in

January ranging between 82% and 84%, while the lowest one occurs in August with 57% and 56%.

Pelagonija Valley is characterized with an annual average of 25 days with fog. The highest frequency occurs during winters.

Winds from north and south directions are dominant in the Pelagonija Valley. In Bitola Field, the north wind is dominant with average annual frequency of 189‰, average annual speed of 2.2m/sec and maximum speed of 15.5m/sec.

Prespa Valley / Resen Region

The climate in this region is under influence from the Prespa Lake, which represents particular climate modification parameter due to its thermal accumulation capacity. Such influence is mostly noticeable in a period from October to January.

The average annual air temperature in the region is 9.7^0C. The coldest month is January with average monthly temperature of 0.2°C. The warmest month is July with average monthly temperature of 19.2°C. The average annual temperature oscillation is 19°C. Autumn is warmer than spring. The absolute temperature minimum is -26.5°C.

The average annual sum of precipitation is 730.1 mm. In particular years annual sum varies from 380 mm to 1,170 mm. In the course of the year, precipitations are unevenly distributed. The main maximum is in November with average monthly sum of 103.5 mm. The main minimum is in July, with 25.1 mm at an average. By seasons, the rainiest is winter with average seasonal sum of 237.1 mm, and the least rain falls in summer with an average of 87.2 mm.

Precipitations in Prespa Valley are mostly of rain, and snow occurs during winter months as well. As an annual average, there are 35 days with snow cover.

Prespa Valley is characterized with high frequency of dry periods. During the year, dry periods are with greater frequency in summer and autumn. Out of the total number of dry periods, 61% occur in these seasons, and 39% in winter and spring. Summer draughts account for 34%, and autumn ones for 27 %, while winter draughts amount 23%, and spring ones 16%.

Average annual duration of solar radiation in PrespaValley amounts 2,295 hours of solar radiation.

Prespa Valley is not characterized with fog due to its openness and presence of the Prespa Lake.

Winds from north and east directions are dominant in the Prespa Valley, with average annual frequency of 116‰ and 114‰ and average annual speed of 1.4m/sec and 2.2m/sec, respectively. Maximum wind speed is approx. 18.9m/sec.

Ohrid Valley / Ohrid and Struga Region

The climate in this region is under strong influence from the Ohrid Lake, which represents particular climate modification parameter due to its significant thermal accumulation capacity.

The average annual air temperature in the area of Ohrid (Bitola Field) is 11.2^0C, while in Struga area (Struga Field) is 10.9°C. The coldest month is January with average monthly temperature of 1.7°C (Ohrid Field) and 1.1°C (Struga Field). The warmest month is July with average monthly temperature of 20.8°C and 20.6°C, respectively. The average annual temperature oscillation is 19.1°C (Ohrid Field) and 19.5°C (Struga Field). The local continental climate characteristic of the region is expressed by the absolute temperature minimum (approx. -20. °C).

The average annual sum of precipitation is 708.3 mm (Ohrid Field) and 810.9 mm (Struga Field). In the course of the year, precipitations are unevenly distributed. The main maximum is in November with average monthly sum of 98.4 mm (Ohrid Field) and 108.7 mm (Struga Field). The main minimum is in July, with 23.2 mm (Ohrid Field) and 24 mm (Struga Field).

Precipitations in region are mostly of rain and rarely of snow. As an annual average, there are19 days with snow cover.

Average annual duration of solar radiation in Ohrid Valley amounts 2,233 hours of solar radiation or 6 hours per day at an average. The maximum occurs in July, with monthly average of 308 hours or 10 hours per day at an average.

The average annual relative humidity is 71% decreasing gradually in the course of the year from January to August, and then rapidly increasing from September to December. The highest monthly value of relative humidity occurs in December and January with 79%, while the lowest one occurs in July and August with 60%.

Fog is rarely phenomenon in Ohrid Valley with an annual average of only 5 days.

Ohrid Valley has specific regime of winds, due to influence from the lake. Wind from north is dominant in the region with average annual frequency of 297‰, average annual speed of 2.4m/sec and maximum speed of 12.3m/sec.

5.1.3 Geological Characteristics

Transmission line corridor

In the Bitola and Resen regions, following geological (lithological) units along the proposed transmission line were identified (Appendix 1.3 – Geological Map):

- Sqse - The complex of Paleozoic phylitoide serie: phylite, argiloschist, argilophylite and meta sandstone. They are prevalent within the West-Macedonian geological structure, north of the line Bitola – Resen. Within this complex, breakthroughs of granite (γ), ryolite (χ) and gabbro (ν) have been detected. Generally, by hydro-geological point of view the complex is mostly water-impermeable (transmissivity - T < 15 m^2/day), as a result of developed fracture type of porosity, shallowly beneath the surface and at locally limited space, with registered water sources (range Q_{spring} < 0.05 l/s). By engineering-geological point of view, this complex is is vulnerable to processes of erosion (ravines) and sliding (landslides) of the rock masses. Locations that need particular attention are parts of the OHL route from mountain pass Gjavato to the village Sopotsko and at Zlatari – Kriveni – G. Krusje villages.
- Pl – Pliocene clayey gravel, sand and sandstone, developed in Prespa valley (at Sopotsko village, at Jankovec and Kriveni villages). By hydro-geological point of view these sediments belong to group of medium water-permeable sediments (range Q_{well} = 2-10 l/s). The existing confined type of aquifer is characterized with artesian and sub-artesian groundwater level.
- Quaternary alluvial, proluvial, marsh and fluvioglacial sediments (al, b, pr, fgl) have been recognized in following sections along the OHL route: from Novaci to Kukurecani village; from Bitola to Gjavato village and in Prespa valley. The existing confined type of aquifer, because of active hydraulic connection with the watercources is characterized with free groundwater level which fluctuates shallowly beneath the surface and periodically increases up to the surface (in a period of hidrological maximum). By hydro-geological point of view these sediments belong to group of medium to high water-permeable sediments (range T = 15 - 20 m^2/day and Q_{well} = 2-10 l/s). They can be unfavourable ground for foundation of heavy constructions, especially marsh sediments, registered between Dobromiri and Karamani villages in the Pelagonia valley.

In the Ohrid and Struga regions, following geological (lithological) units along the proposed transmission line were identified (from oldest to youngest):

<u>The complex of Paleozoic rocks</u>

- Sqse - The complex of Paleozoic phylite schist (as a continuation of sheet Bitola).This complex (along the considered OHL route) end between Mesheista and Trebenista villages. Generally, by hydrogeological point of view the complex is mostly water-impermeable (T < 15 m^2/day), as a result of developed fracture type of porosity, shallowly beneath the surface and at locally limited space, with registered water sources (range Q_{spring} < 0,05 l/s). By engineering-geological point of

view, this complex is is vulnerable to processes of erosion (ravines) and sliding (landslides) of the rock masses. Locations that need particular attention are parts of the OHL route at Svinista village, between r. Mokresh - Rasino village – Livagje village, at Radolishta village and north of Radozda village.

- Sq – Metasandstone. They arise in thin layers or in larger masses shifting horizontally or vertically with the previously described phylite schist. They are represented at Klimeshtani and Trebeniste villages.
- M - Marbled limestone; registered south of Kaliste village as a kind of isolated smaller tables. In its lower parts of these limestone tile, while the upper one is massive.

The complex of Mezozoic rocks (presented with Triassic sediments)

- T_2^1 – Conglomerates, occurred in the basal part of the Triassic sediments and rarely like inert-layers into the claystone. There have been registered south of Kalista village and west from Radozda village.
- T_2^1 – Sandstone, alevrolite and claystone; developed on Jablanica mountain, under the big limestone masses. They have heterogeneous and poorly sorted material. These sediments are characterized by rhythmic sedimentation.
- $T_2^{1,2}$ – Plate limestone with chert; developed on Jablanica mountain above villages Kalista and Radozda, and passing on the Albanian side. Built of carbonate material, while cherts are built of amorphous silica materia and radiolarite flakes, they are subject to the following hydrogeological characteristics of the media: >10 karst occurences/km^2, Q_{spring}> 100 l/s. They developed karst-fractured type of aquifer with free groundwater level. The recharge of these aquifers are mainly carried out by rainfall, part through regional fault structures that blocks divided represented rocky masses and a smaller part through lateral recharge from an adjacent aquifer. Discharge of these aquifers is done mainly by the presence of several karst springs, and some through spillover effects in neighboring aquifer. Characteristic of this type of aquifer is a large amplitude (hesitation) of the groundwater level and subsequently significant amplitude in the capacity of the karst springs. Many of these sources, as “Krusje”, "Shum", "Gorna Belica" and "Kalista” have been captured for the water supply of the town of Resen, Struga and several villages. Also there is one non-captured karst spring very near OHL route (water source “Dobra voda” – app. 500 m south of Frangovo).

Tertiary and Quaternary sediments

- Pl_3 – Upper Pliocene sediments transgressivelly developed through the Paleozoic rocks, and through the Triassic sediments throughout the whole Ohrid-Struga valley. These sediments are covered with Quaternary deposits, but also there are discovered masses under Zagracani and Dolna Belica villages. They are presented with gravel, sands and clays. Towards the deeper parts, the material is more clayeyed and better stratified, and towards the upper parts in enters into Quaternary lake sediments. By hydrogeological point of view these sediments belong to group of medium water-permeable sediments (range Q_{well} = 2-10 l/s).

The existing confined type of aquifer is characterized with artesian and sub-artesian groundwater level.

- j – lake and marsh sediments, developed throughout the whole Struga valley, with proved depth between 20-30m. They are presented with gravel, sand, different varieties of clay and peat. By hydrogeological point of view these sediments belong to group of medium to high water-permeable sediments (range T = 15 - 20 m^2/day and Q_{well} = 2-10 l/s).
- pr – Proluvial sediments after peripheral parts of the Ohrid-Struga valley. These sediments are registered in the villages Botun, Klimeshtani and Meseista and on the lowest slopes of Jablanica, the villages Radolista and Kalista. They are presented with roughly-clastic material, unclassified and poorly treated and are composed of sandy clays, gravel, chunks and blocks of quartz, shale, limestone and other rocks.
- al – alluvial sediments, developed in the river valleys of Sateska river. These sediments are presented with roughly-clastic material and are composed of sandy clays, sands, gravel and rounded rock pieces from the surrounding rocks.

New substation location

The following geological units were identified at the wider locality of the new substation in Ohrid area:

- Sq – Paleozoic metasandstone. This unit arises in thin layers or in larger masses shifting horizontally or vertically with the phyllite schist. It is fine to medium granular, gray to dark gray, mainly composed of quartz and less than sericite and pieces of meta-quartzite. In smaller quantities it contains feldspar, calcite, titanite, zircon, garnet and tourmaline. Locally, in quite large quantities occurs graphitic-bituminous matter, which gives the dark color of the rock. By the engineering-geological view of point, this unit belongs to a group of highly coherent rock masses.
- Pl_3 – Upper Pliocene sediments transgressivelly developed through the Paleozoic rocks, in the faces of poorly stratified material, composed of clay, sand and gravel. Towards the deeper parts, it is more clayeyed and better stratified. It is presented with gravel, sands and clays. By the engineering-geological view of point, they belong to a group of non-coherent rock masses.
- pr – Proluvial sediments after peripheral parts of the Ohrid-Struga valley. Presented with roughly-clastic material, unclassified and poorly treated. Composed of sandy clays, gravel, chunks and blocks of quartz, which are built the surrounding slopes. By the engineering-geological view of point, they belong to a group of non-coherent rock masses.

5.1.4 Tectonic and Seismic Characteristics

The territory of Macedonia encompasses several tectonic units (Figure 4-1) as part of the Alpine-Himalaya belt. Based on the applicable principles of tectonic regionalization, the western part of Macedonia, including the Vardar Valley area (in its geographical sense), belongs to the Dinarides-Hellenides. Eastern Macedonian mountainous terrains and valley depressions are segments of the central Serbian-Macedonian massif. A specific zone known as the Kraishtidna zone is distinguished along the border with Bulgaria and belongs to the Carpatho-Balkanides. Within the boundaries of the Dinarides-Hellenides, specific tectonic zones are distinguished on the territory of Macedonia, characterized by their own tectonic elements and geological evolution: (I) Vardar zone; (II) Pelagonian horst-anticlinorium; (III) Western-Macedonian zone; and (IV) Cukali-Krasta zone. In Eastern Macedonia, within the boundaries of the Serbian-Macedonian massif (V), there are several isolated blocks (Belasica, Ograzhden-Maleshevo, Osogovo, German, etc.), separated by secondary neodepressions. The Kraishtidna zone (VI) covers a narrow belt on the territory of the Republic of Macedonia along the border with Bulgaria, extending from Berovo in the South to Delchevo in the North, from where it expands northwards into the territory of Bulgaria.

The project area belongs to two tectonic zones: Pelagonian horst-anticlinorium and Western-Macedonian zone (Figure 4-1).

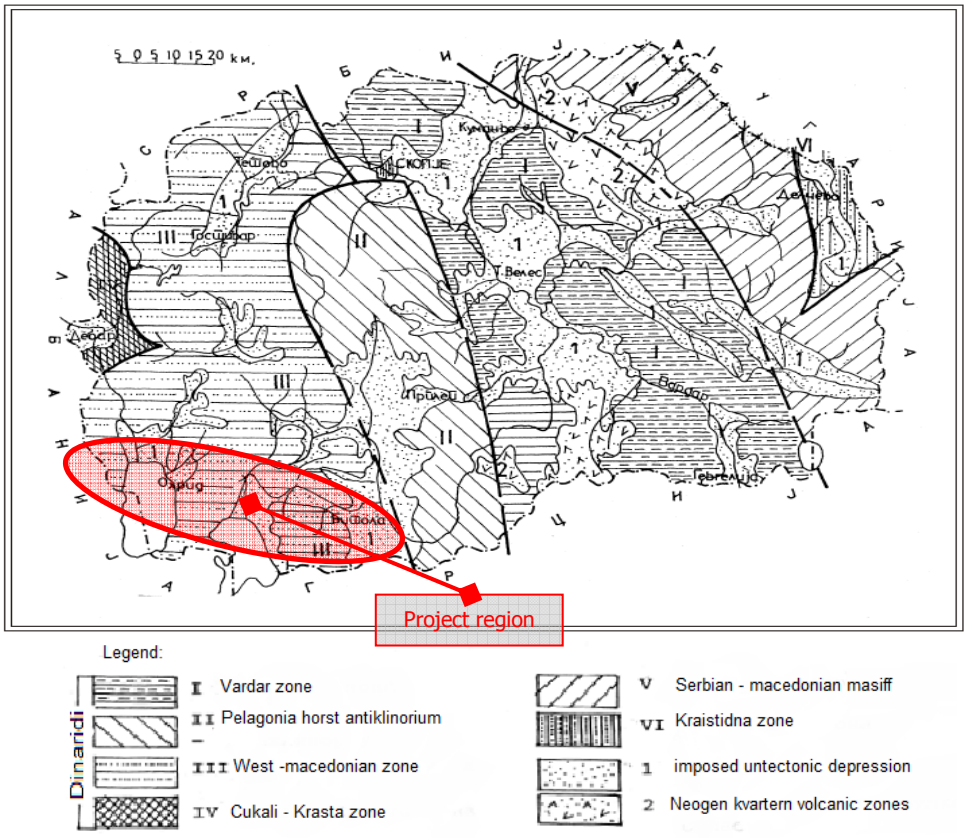


Figure 5-1 –- Tectonic regions in Macedonia

Source: Tectonics of Macedonia, 1997 [Ref. 11]

In tectonic terms, the region encompassing the territory of Macedonia and areas up to 100 km from its borders belongs to the Mediterranean orogenic area of the Alpine-Himalaya belt. Determined by this tectonic association, the seismic activity of this region is among the strongest on the inland part of the Balkan Peninsula. Disastrous earthquakes occur relatively often in this region, reaching epicentral intensities of up to X MSK-64 and magnitudes of up to 7.8 (the highest magnitude observed on the Balkan Peninsula ever). Through the time, earthquake epicentres have concentrated into specific epicentral areas connected in seismogenic zones. Three seismogenic zones determine the seismicity of the broader region:

- √ The first zone stretches along the Vardar River valley, and covers epicentral areas from Serbia, Macedonia and Greece, and it is connected with the tectonic unit of the Vardar zone (part of Dinarides-Hellenides) – therefore, it has been named Vardar seismogenic zone in seismological and seismotectonic literature.
- √ The second seismogenic zone is linked with the Ograzden-Halkidiki zone (major part of Serbian-Macedonian massif and some part of Kraistidna zone on Carpatho-Balkanides). This seismogenic zone includes epicentral areas from Serbia, Macedonia, Bulgaria and Greece. The valley of the Struma River stretches along most of its eastern edge and therefore it has been named the Struma seismogenic zone.
- √ The third seismogenic zone includes epicentral areas from Serbia, Republic of Macedonia, Republic of Albania and Republic of Greece. It stretches along Drim Riever including its two confluents – Bel Drim and Crn Drim. Therefore, this seismogenic zone has been named Drim seismogenic zone.

Based on the above, it may be concluded that the seismicity of the territory of Macedonia and border areas is predetermined by the three main longitudinal seismogene zones (Struma, Vardar and Drim). The project area belongs to the Drim seismogenic zone. It is characterized with a low to medium seismic activity in its eastern and central parts – Bitola and Resen areas (with earthquake intensity up to 7 - 8 degrees by Mercall-Cancani-Sieberg (MCS[1)])) scale and with strong seismic activity in its western part – Ohrid and Struga region (with earthquake intensity up to 9 degrees by MCS) (Figure 4-2).

[1)] MCS scale is a seismic scale used for measuring the intensity of an earthquake. It measures the effects of an earthquake. The scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and man-made structures on a scale from 1 (not felt) to 12 (total destruction).

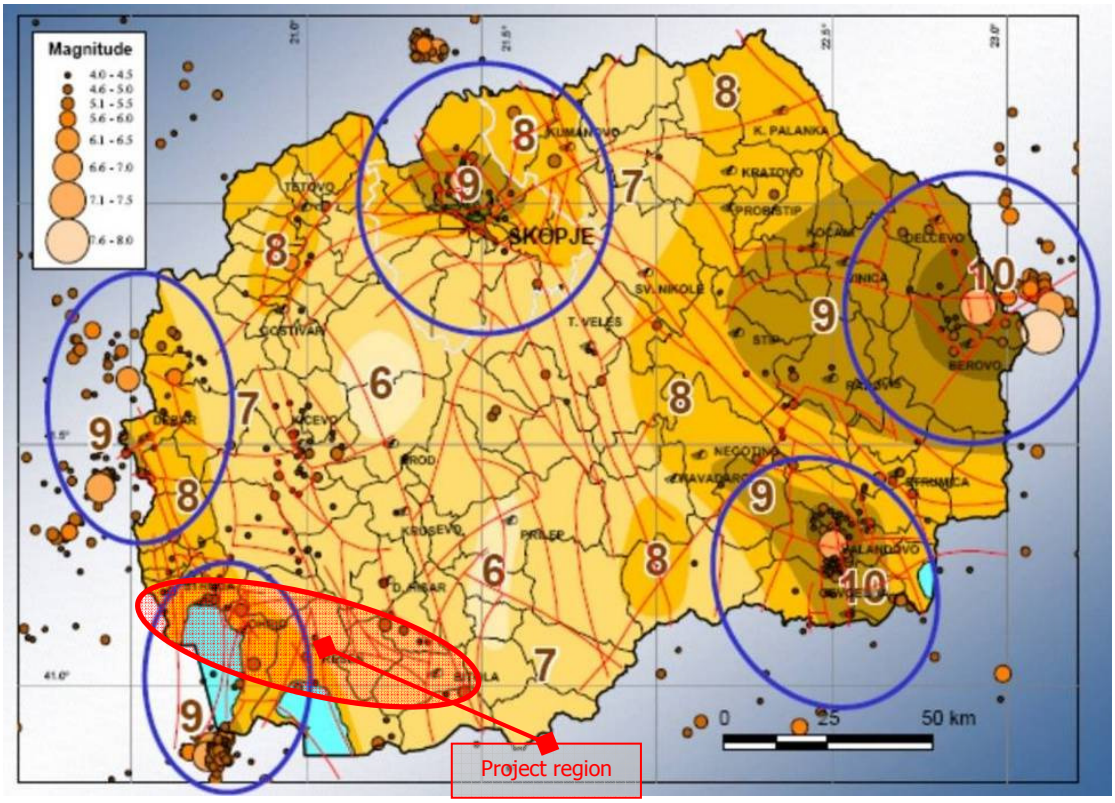


Figure 5-2 – Sesmic map of Macedonia

5.1.5 Soil Characteristics

Based on the vertical climate belts, in general terms, the soils in the project area along the proposed transmission line could be grouped in following categories:

- Warm continental region on altitude belt from 600 m to 900 m a.s.l. which includes Pelagonia and Prespa valley as well Ohrid and Struga fields. This area is characterized with moderate temperatures, increased humidity and low level of aridity which result in increased production of biomass and lower intensity of mineralization processes. Therefore, accumulation of the humus is more intensive, as well as the de-alkalization and the acidification. Non-carbonate sediments which form zonal soils are dominant in these valleys, mainly cinnamon forest soil type (chromic cambisols) under xerophilous and thermophilous oak vegetation. They occupy undulating hilly (fluviodenudational) relief up to 900m and lake terraces in the valleys, on tertiary sediments, particularly neogenic lake sediments and certain more recent ones. They can be found on Mesozoic and Paleogenic (Eocene) sediments and less frequently on compact basic rocks and pyroclastic sediments.
- Cold continental region on altitude belt from 900 m to 1,100 m a.s.l. which includes low mountainous areas along the proposed OHL route (hilly and mountainous terrain from locality Gjavato to Resen and further on to Struga Field, as well as on the lower slopes of Jablanica Mountain). Geological substrate is mainly consisted of compact rocks

on silicate and carbonate bases. Main soil type in this belt is brown forest soil type (calco-cambisols). These soils are the most widespread soil type in Macedonia. They account for approximately 1/3 of the mountain territory of the country and are formed on compact quartz rocks, as well as on a number of compact acid, neutral basic and ultra basic silicate eruptive and metamorphic rocks and, over small areas, on carbonate-free silicate sediments.

Erosion risk along the route of the proposed transmission line

Typically, shallow soils and soils on topography susceptible to erosion, such as soils at prone areas and steep slopes are exposed to erosion risk. Absence of vegetation cover and woodlands increase the soil erosion risk, as well. Some types of forest vegetation are addicted to erosion then other such as sparse Oak forests, particularly at slopes with southern and south-western disposition.

The following zones along the proposed transmission line are identified as susceptible to potential risk for erosion processes during the construction works:

(i) Slopes of the hilly terrain with southern exposition at localities Korija, Mandri, Prisoj and Goli Prisoj, along the northern side of the main road Bitola – Resen. This section is characterized with scarce woodlands.

(ii) Southern and south-western mountain slopes of Bigla Mountain, at localities with altitude of more than 1,000 m a.s.l.

(iii) Steep slopes of Jablanica Mountain

5.1.6 Hydrology and Water Quality

By hydro-graphical point of view, the project region belongs to two large catchment areas:

- Aegean catchment area – the OHL section in the Bitola region, i.e. from its starting point (SS Bitola 2) to the mountain pass "Gjavato". This area is characterized with well developed hydro-graphical network with one main watercourse – Crna River, which is tributary to the country's longest river – Vardar River. In this section, the proposed transmission line crosses number of natural watercourses (Dragor River (tributary to Crna River), Bratindolska River, Rotinska River, Shopnica and Caparska River) as well as man-made drainage and irrigation channels in the Pelagonia Valley.
- Adriatic catchment area – the OHL section in Prespa region and Ohrid-Struga field, i.e. from the mountain pass "Preseka" to the mountain pass "Kafa San" (crossing point to Albania) represented by one main watercourse – river Crn Drim. This area includes two regional basin catchments – Prespa Lake and Ohrid Lake. The proposed OHL crosses number of watercourses in Prespa area: Kriva River (occasional character of flow), occasional stream from Zlatari village to Resen, Cheshinska River, Kriveshnica and Leva Reka, as wella as in Ohrid-Struga region: Mokresh, Starechki Dol, Trebishki Dol, Rasinska River, Sirulska River (ocassional character of flow), Sateska River channel (artificially

changed flow into the Ohrid Lake), Moluzja channel, Crn Drim River, Shum and Vishenska River.

The water quality in the main watercourses in the project area based on the monitoring results and assessed as per Macedonian water quality standards (see Table 1-1) is given in the following table.

Water course	Water quality	Status
Aegean catchment area (Crna River watershed)		
Crna River (in Novaci area)	class III	Moderately eutrophic water
Drainage channels (from v. Novaci to v. Mogila)	class II	Very clean, mesotrophic water
River Dragor (from Bitola until inflow to Crna River)	class III	Moderately eutrophic water
Bratindolska River	No data available	/
Rotinska River	No data available	/
r. Shopnica	No data available	/
Caparska River	No data available	/
Adriatic catchment area – Prespa Lake catchment area		
Golema River	class II	Very clean, mesotrophic water
Kriva River	No data available	/
Cheshinska River	No data available	/
r. Kriveshnica	No data available	/
Leva River	class II	Very clean, mesotrophic water
Adriatic catchment area – Ohrid Lake catchment area		
r. Mokresh (Koselska River)	class II	Very clean, mesotrophic water
r. Starechki Dol	No data available	/
r. Trebishki Dol	No data available	/
Rasinska River	No data available	/
Sirulska River	No data available	/
Sateska River	class II	Very clean, mesotrophic water
Moluzja channel	No data available	/
r. Crni Drim	class II	Very clean, mesotrophic water
r. Shum	class II	Very clean, mesotrophic water
Vishenska River	No data available	/

Table 5-1 – Water quality in the watercourses in the project area

5.1.7 Air Quality

The quality of the air in the wider area of the corridor is dominantly determined by several driving forces – sectors and types of polluters: traffic, industrial installations, organizations / installations possessing boiler stations and individual fire places.

Measurements of the ambient air quality in the project region are regularly performed only in Bitola by two automatic monitoring stations which are part of the national air monitoring system. The air quality in Bitola is given in the following table, represented by the annual average concentrations in 2011, number

of days with concentration above the limit values and maximum daily concentrations for SO_2, NO_2 and PM10.

Measurement location	Average annual concentration (µg/m^3)	Number of days (above limit values)
SO_2 (Limit Value for ecosystems in winter = 20 µg/m^3)		
Bitola 1	6	0
Bitola 2	8	0
NO_2 (Limit Value for 2011 = 60 µg/m^3)		
Bitola 1	13	0
Bitola 2	19	0
PM10 (Limit Value for 2011 = 60 µg/m^3)		
Bitola 1	80	160
Bitola 2	70	140
CO (Limit Value for 2011 = 16 µg/m^3)		
Bitola 1	7	0
Bitola 2	0	0

Table 5-2 – Air quality in Bitola

Source: Ministry of Environment and Physical Planning

Higher concentrations of PM10 and significant number of the days above the limit values of this pollutant is determined during winter season as a result of the specific climate conditions in combination with heating installations and traffic sources.

There are no measurements in other municipalities and consequently there is no available systematized and processed data on the air quality on territory of these municipalities.

In absence of heavy industrial installations in Resen, Debrca, Ohrid and Struga, the greatest contribution to air pollution in these municipalities comes from household fire places. These polluters belong to the group of collective stationary sources of air pollution, from which the emission of pollutants results from the use of certain type of fuel (wood, oil, etc.). As products of combustion, emissions of SO_2, CO_2, NO_X, CO and solid particles (PM) are released in the air. Air pollution of this type is of seasonal nature and exists during the heating season. Additional air pollution source is the traffic sector, which contributes to lower ambient air quality in urban centres as well as along the main road network in the project region. Based on the above, as well as the fact that the areas around the immediate corridor in these municipalities are not densely populated and has rural-agricultural or hilly-mountainous nature, it may be concluded that the ambient air is of un-deteriorated quality and without any significant presence of polluting harmful substances..

The thermal power plant REK Bitola in Novaci is a main air polluter in Novaci and Mogila. The plant combusts cca 6 millions tonnes of low-calorific coal on annual bases. These installations are main source of SO_2, NOx and PM10, as well as of greenhouse gasses CO and CO_2.

5.1.8 Land Use and Landscape

In general, the proposed transmission line passes through areas with various forms of land use and where human intrusion and various developments and infrastructure already exist. Land use map along the proposed corridor is given in Appendix 1.4. There are only few areas along the proposed OHL route where there is no or little human intrusion.

Based on specific geomorphologic characteristics (elevation, slope, etc.), vegetation cover and human impact, several landscape types can be distinguished along the corridor of the transmission line.

The wider area around the OHL's starting point at SS Bitola 2 to the crossing point with the regional road Bitola-Kicevo, belongs to the Pelagonija Field and represents large-scale open and flat landscape on about 580 m a.s.l. The wider landscape includes number of land uses and human developments: settlements (Dobromiri, Trn and Karamani), roads, agricultural fields, various energy and industrial infrastructure (TPP REK Bitola, coal mine, substation and overhead transmission lines).

The OHL section between the roads Bitola-Kicevo and Bitola-Resen and further on parallel to the road to locality Prevalec represents hilly open landscape on altitude between 600 and 1,000 m a.s.l. with shrubberies and scarce vegetation - planted mixed forest with low density and regions of burnt vegetation.

The area from the locality Prevalec up to the locality Djavato, northern from the road Bitola-Resen, is flat open agricultural landscape with occasional vegetation. Number of local roads exists in this area and is crossed by the proposed OHL. Villages Rotino, Capari and Kazani are located in this area, distant from the proposed OHL route, at approx. 2-3 km on the opposite - southern side from the road. The existing 110 kV OHL Bitola-Resen-Ohrid-Struga passes along the road, also on its southern side.

From the locality Gjavato to Livoista (area of the new SS) and further on to the crossing point with the road Ohrid-Kicevo, the proposed OHL passes over hilly and mountainous landscape of the Bigla Mountain on altitude in a range from 800 m to 1,200 m, following the existing 110 kV OHL Bitola-Resen-Ohrid-Struga and the road Bitola-Resen on variable distances. Number of flat areas is settled within this dominantly hilly terrain, including localities Bela Niva and Poroj in Resen region as well as Livage, Gorno Livage and Gorno Polje in Ohrid region.

The new 400/110 kV substation site is located at north-west from village Livoista on 800 m a.s.l. at relative distance of more than 1 km. The wider area is characterized with open landscape toward south and occasional agricultural land use, mainly vineyards. Hilly topography borders the western, northern and eastern sides of the location.

At the crossing point with the road Ohrid-Kicevo, following the corridor of the existing 110 kV OHL Bitola-Resen-Ohrid-Struga, the proposed OHL route enters the Struga Field, large-scale open and flat landscape on about 700 m a.s.l.

The landscape includes number of land uses and human-caused intrusions: (settlements (Mislesevo, Moroista i Vranista), roads, agricultural fields, industries, etc).

From the locality Belicka Krasta, at the western border of the Struga Field until the connection point with Albania, the proposed OHL route passes through lower parts of the Jablanica Mountain through hilly and mountainous landscape at altitude up to 1,100 m a.s.l. with natural vegetation and woodland. Number of settlements exists in this area: Visni, Radolista, Frangovo and Mali Vlaj.

An overview of the various landscape and land-use forms is given in the photo log in Appendix 4.

5.2 Natural Environment

5.2.1 Biomes and Climate Vegetation Zones

The identification of the bio-geographical characteristics of the area is based on the division of biomes by Matvejev (Matvejev 1995: in Lopatin & Matvejev 1995; Matvejev & Puncer 1989) as presented in Table 4-3 and the climate-vegetation-soil zones (regions) by Filipovski at al. (1996) as presented in Table 4-4.

	Types of biomes
1	Biomes of Mediterranean evergreen forests and maquis
2	Biomes of sub-Mediterranean, predominantly deciduous forests and Shrubberies
3	Biomes of South-European, primarily deciduous forests
4	Biomes of European, primarily needle- shape leaved forests of boreal type
5	Biomes of Alpine rock grounds, pastures and snow fields of Alpine-Nordic type
6	Biomes of steppe and forest-steppes
7	Biomes of rocky grounds, pastures and rocky ground forests on (oro) Mediterranean mountains

Table 5-3 – Types of biomes

Zone	Dominant associations / habitats	Altitudal distribution
Sub mediterranean (modified Mediterranean) region	Coccifero carpinetum-orientalis (forests of Oriental hornbeam and Kermes oak)	50-500
Continental - submediterranean region	Querco-Carpinetum orientalis (forests of Oriental hornbeam and W hite oak)	Up to 600
Warm continental region	Quercetum frainetto-cerris (forests of Italian and Turkey oak)	600-900
Cold continental region	Orno-Quercetum petraeae (forests of Sessile oak)	900-1,100
Piedmont-continental-mountain region	Festuco heterophyllae-Fagetum (submontane European beech forests)	1,100-1,300
Mountain-continental region	Calamintho grandiflorae-Fagetum (montane beech forests)	1,300-1,500

Subalpine mountain region	Subalpine beech forests, subalpine Molika pine forests, subalpine spruce forests and Mugo pine forests, subalpine	1,650-2,250
Alpine mountain region	Pastures and rocky sites	Above 2,250

Table 5-4 – The climate-vegetation-soil zones of Macedonia

Most of the area of the proposed transmission line belongs to the *warm continental area.* Much smaller part belongs to the *cold continental area.* Elements of *continental sub-Mediterranean area* occur near Bitola and Struga (forests of Oriental hornbeam and white oak – Querco Carpinetum orientalis) as well as of sub-mountainous region near Svinista (Submontane European beech forests - *Festuco heterophyllae*-Fagetum with mixed beech and alder in river valleys; wet meadows; and forest swamps and streams.

The warm continental area occupies the lower parts of valleys between 600 and 900 m a.s.l. The prevailing climate zonal plant community in this area is the Italian and Turkey oak forest community (*Quercetum frainetto-cerris macedonicum Oberd. emend. H-t*).

In the western part of Macedonia, continental – sub-Mediterranean area spreads over the gorges of the river Crni Drim. Climate zonal community is the forest of the eastern hornbeam and Downy oak (*Querco-Carpinetum orientalis macedonicum Rud. apud H-t*).

These two zones overlap with the biome of *sub-Mediterranean, predominantly deciduous forests and shrubberies*, according to Matvejev. The dominant habitats found within the analyzed corridor are natural habits and semi-natural and anthropogenous habitats. The natural habitats include Italian and Turkey oak forests, forests of Hop hornbeam (*Ostryo-Carpinion orientalis*), forests dominated by Macedonian oak (*Quercus trojana*), as well as alder belts along rivers and river-by belts of willows and poplars (listed in Annex I of the EU Habitat Directive), while the semi-natural and anthropogeneous habitats mostly refer to degraded forests of Hop hornbeam, Acacia plantations, orchards under apricots, peaches, apples and quinces, vineyards, fields with/without boundaries, alleys, gardens, villages, towns. Typical biotopes are forests of Italian and Turkey oak, *Ostria carpinifolia*, *Carpinus orienta*lis, black pine, Common ash (*Fraxinus excelsior*), Maple (*Acer sp.*), Poplar (*Populussp.*), Willow (*Salixsp.*), as well as plain forests in river valleys.

This biome includes also most of the areas adjacent to the route of the planned line. Typical plant species most specific for the *biome of sub-Mediterranean, predominantly deciduous forests and shruberries,* in the observed corridor, include: *Quercus pubescens, Quercus frainetto, Quercus trojana, Quercus cerris, Carpinus orientalis, Ostrya carpinifolia, Corylus colurna, Crataegus orientalis, Acer tataricum, Acer hyrcanum, Acer monspessulanum, Syringa vulgaris* and *Tilia argentea.* The most specific vertebrate species include amphibians and reptiles: *Testudo hermanni, Lacerta trilineata* and *Ablepharus kitaibelii*, birds: *Parus lugubris, Dendrocopus syriacus, Ficedula*

semitorquata, Streptopelia decaocto and *Accipiter brevipes* and mammals: *Dryomys nitedula, Apodemus flavicollis, Glis glis* and *Erinaceus roumanicus*.

Cold continental area occupies higher parts of the mountains, above the warm continental area, between 900 and 1,100 m a.s.l. Climate zonal community is the forest of Sessile oak (Orno-Quercetum petraeae Em). This zone overlaps with the *biome of South European, predominantly deciduous forests,* according to Matvejev. The most important habitats of this biome are natural habitats such as sessile oak forests, woodlots, rivers and clearings within oak forests and semi-natural and antropogeneous habitats such as degraded forests, meadows, orchards under apples, plums, pears, cherries, meadows under alfa-alfa, fields under wheat crops, gardens, alleys and several villages.

Among plant communities specific for this biome, Sessile oak forest (Orno-Quercetum petraeae) can be found within the boundaries of the corridor. Animal life forms specific for the observed area include *Theroaestisilvicola* and *Herboaestisilvicola* (Matvejev, 1995), minor share of evergreen phaerophytes is characteristic here. The most important plant species in this biome include: *Quercus petraea, Fagus sylvatica, Carpinus betulus, Corylus avellana, Berberis vulgaris, Sorbus aucuparia, Evonymus europaea, Acer campestre, Acer pseudoplatanus, Sorbus torminalis, Tilia platyphyllos, Ligustrum vulgare, Viburnum opulus, Prunus avium* and *Convallaria majalis*. Specific vertebrate species are the following amphibians and reptiles: *Triturus cristatus, Salamandra salamandra, Rana dalmatina, Hyla arborea, Anguis fragilis, Lacerta agilis, Natrix natrix*, birds: *Phylloscopus sibilatrix, Turdus philomelos, Parus caeruleus, Phoenicurus phoenicurus, Erithacus rubecula, Dendrocopus leucotos, Coccothraustes coccothraustes, Strix aluco* and mammals: *Capreolus capreolus, Clethrionomys glareolus, Glis glis, Muscardinus avellanarius*.

Main aspects of the biodiversity along the proposed OHL are discussed in the text below.

5.2.2 General Description of the Overhead Transmission Line Corridor

Existing substation Bitola 2 – OHL Corridor starting point

This site lies in the immediate vicinity of the thermal power plant REK Bitola, on non-irrigated arable land, which is part of the Pelagonia region which is considered an Important Bird Area (IBA) site - Pelagonia.

Section Bitola – Resen

The proposed corridor neigbouring Novaci and Mogila passes outside Bitola through meadows, pastures and complex cultivation patterns and crosses shrubberies, and planted mixed forest. Mixed forest is represented by both deciduous / coniferous trees (beech- juniper tree-fir, black pine tree, white pine, other deciduous trees and conifers). Then, the corridor is continuing through an area of vineyards and agricultural land ending up to the village Gjavato where the vegetation returns to coniferous forest. At this point the line neighbours with the National Park Pelister, which has large communities of Pinus peuce (Macedonian pine) and Fritillaria macedonica (subendemic species -liliaceous

plant). Pelister is an important habitat for butterflies (*Eyphydryas aurinia* – included in the Appendix of the Bern Convention and Annex II of the Habitat Directive, *Phengaris arion* – included in the Appendix II of the Bern Convention and Annex IV of the Habitat Directive and *Polyomatus eros*, of birds (*Aquila chrysaetos* – included in the Appendix II of the Bern and Bonn Convention and Annex I of the Birds Directive, *Aquila pomarina* – also included in the Appendix II of the Bern and Bonn Convention and Annex of the Birds Directive) and of mammals (*Rucicapra Rucicapra* – included in the Annex III of the Bern Convention.

The end part of this section is characterized by broad-leaved and deciduous forest (beech, oak-all kinds, other hard deciduous trees, poplar, other soft deciduous trees) and small part of non irrigated land, which leads to areas of fruit trees, mainly dominated by apples, outside Resen. Apart from apples, orchards in the investigated area include at a minor part cherry, sour cherry, walnut, pear and peach. Flora and fauna are highly dependent on the surrounding agricultural land, because of the small areas of orchards.

Section Resen – Ohrid

The proposed corridor crosses deciduous forest, which changes to coniferous forest (mainly black pine), mixed forest (Beech) and evergreen forests are distributed in small areas and then again to broad-leaved forest, reaching the highest altitude of the transmission line close to Svinista. For small parts, there is a change of vegetation and patterns, combining complex cultivation patterns and agricultural land with significant areas of natural vegetation.

The end part of this section ends up to Vapila, outside Ohrid. Ohrid is a famous bird habitat with representatives of *Buteo rufinus* and *Ciconia ciconia* – included in the Appendix II of the Bern and Bonn Convention and in Annex I of the Birds Directive 79/409/EEC. The area is dominated by broad-leaved forest with few elements of coniferous forest and shrubs.

Section Ohrid –Albanian / Macedonian border

The proposed corridor passes through complex cultivation patterns to mixed forests to end up to non arable land, complex cultivation patterns and finally to fruit trees area close to Struga. Most of the fields are separated by boundaries of trees or shrubs. Different oak species (*Quercus pubescens*, *Q. frainetto*, *Cornus mas*) are also found in hilly areas. Remains of Struga marsh are also found near the OHL corridor.

This marsh, as a result from the constant drainage, has been strongly degraded and transformed into cultivable land. This habitat type includes communities of the alliances *Phragmition* and *Magnocaricion elatae*. Struga area is also Prime Butterfly Area (PBA) with main species of *Licaena dispar* – included in Appendix II of the Habitat Directive and Annex II and IV of the Bern Convention and *Euphydryas aurinia* – included in the Appendix II of the Habitat Directive and Annex II of the Bern Convention. Additionally, Struga has representative species of *Aythya nyroca* – included in the Appendix III and Appendices I and

II of the Bern and Bonn Convention accordingly as well as in the Annex I of the Birds Directive and *Botaurus stellaris* included in the Appendix II of the Bern and Bonn Convention and Annex of the Birds Directive.

Then, the corridor crosses the willow belt of Crni Drim and meadows, which are constantly less or more intensively managed (humid and moderately humid), while they are not included from Macedonia as habitats for conservation under Annex of the EU Directive 92/43/EEC.

The end part of this section passes through permanently irrigated land and non irrigated land (mainly shrubs) to reach Jablanica mountain and continues through agricultural land and coniferous forest and shrub areas to Radolista and then broad-leaved deciduous forests (Oak and Beech) cover the whole region till the border.

5.2.3 Biotopes – Habitats

5.2.3.1 Natural Forests

Oaks

Oaks in the project area dominate the low hill and mountainous areas up to about 1,200 meters altitude. The main forest communities are usually season oak forests, willows (Salix Alba), poplar (Populous nigra) and others.

Forests of pubescent oak and oriental hornbeam (Querco-Carpinetum orientalis)

This habitat is characterized by the forest community **Querco-Carpinetum orientalis macedonicum** (Rud. 39 apud Ht 1946), which thrives at a great extent on semi-glay, alluvial-brown, vertisols, acid brown soils, eutric brown soils, humus silicate soils, chernozem and shallow limestone brown soils on alluvial, loam, limestone or silicate ground. The main species are the Oriental hornbeam (Carpinus orientalis) and Downy (Pubescent) oak (Quercus pubescens) and the combinations of European hornbeam (*Carpinus betulus*) and sessile oak (*Quercus petraea*), or European hornbeam and pedunculate oak (*Quercus robur*), or European hornbeam and Turkey oak (*Quercus cerris*), or European hornbeam and Italian oak (*Quercus frainetto*) Additionally, less abundant in the tree species, herbs and shrub strata are such as:

Acer monspessulanum, *A. tataricum*, *Crataegus monogyna, Ulmus campestris, Asparagus acutifolius, Ruscus aculeatus, Hedera helix, Acer campestre*, *Carpinus orientalis*, *Evonymus europaeus*, *Fagus moesiaca*, *Fraxinus ornus*, *Pirus communis*, *Staphyllea pinnata*, *Tilia tomentosa*, *Juniperus oxycedrus, Rubus sanguineus, Pyrus amygdaliformis, Cornus mas, Colutea arborescens*, *Coronilla emeroides*, *Prunus spinosa*, *Fraxinus ornus*, *Rhamnus rhodopaea, Cyclamen neapolitanum*, *Carex halleriana, Lathyrus venetus, Anemone apenina, Lithospermum purpureoviolaceum, Lamium purpureum, Cardamine graeca,* and other species.

Regarding the fauna, typical inhabitants of this region are:

Noctuid Moths: *Ochropleura melanura, Ochropleura renigera, Ochropleura signifera, Sideridis implexa, Hadena armeriae, Hadena gueneei, Cucullia formosa, Cucullia wredowi, Cucullia celsiae, Omphalophana anatolica, Cryphia tephrocharis, Amphipyra strix, Polyphaenis subsericata, Sesamia cretica, Janthinea frivaldskyi, Eutela adoratrix, Nycteola asiatica, Abrostola agnorista, Exophila rectangularis* and *Catocala lupina*.

Butterflies: *Pieris krueperi*, *Euchloe penia*, *Tarucus balkanicus*, *Hipporachia senthes*, *Carcharodus flocciferus, Gegenes nostradamus*, *Pseudophilotes schiffermuelleri, Leptidea duponcheli, Zerynthia polyxena*,*Nymphalis polychloros, Lybithea celtis, Vanessa atalanta, Colias crocea, Polyommatus icarus, Gonepteryx rhamni,* etc.

Beetles: *Lucanus cervus*.

Insects: *Carabus convexus, Calosoma sycophanta, Calosoma inquisitor, Myas chalybaeus, Cymindis lineata, Cymindis axillaris, Brachinus explodens, Brachinus crepitans, Calathus fuscipes, Calathus melanocephalus.*

Amphibians: *Lissotriton vulgaris*, *Rana graeca*, *Rana dalmatina*, *Pelophylax ridibundus*, *Bufo bufo, Bufo viridis.*

Reptiles: *Emys orbicularis*, *Eurotestudo hermanni*, Spur-Thighed Tortoise *Testudo graeca, Lacerta trilineata*, *Podarcis muralis, Podarcis erhardii rivetti, Lacerta viridis, Ablepharus kitaibelii*, *Algyroides nigropunctatus*, *Pseudopus apodus*, *Mediodactylus kotschyi*, *Typhlops vermicularis*, *Hierophis gemonensis*, *Zamenis longissimus*, *Zamenis situla*, *Platyceps najadum*, *Telescopus fallax*, *Malpolon monspessulanus*, *Coluber jugularis.*

Birds: *Hippolais pallida*, *Motacilla flava*, *Parus lugubris*, *Dendrocopos syriacus*, *Lullula arborea*, *Accipiter nisus*, *Streptopelia decaocto*, *Sylvia hortensis*, *Emberiza cirlus*, *Oenanthe hispanica*, *Luscinia megarhynchos*, *Oriolus oriolus*, *Lanius senato*r, *Regulus ignicapillus*, *Serinus serinus*, *Hieraaetus fasciatus*, *Passer hispaniolensis*, *Turdus merula*, *Larus melanocephalus*, *Garrulus glandarius*, *Streptopelia turtur*, *Oriolus oriolus*, *Erithacus rubecula, Fringilla coelebs, Troglodytes troglodytes, Carduelis chloris, Aegithalos caudatus,Turdus viscivorus.*

Mammals: *Erinaceus roumanicus*, *Crocidura suaveolens*, *Rhinolophus blasii*, *Rhinolophus euryale*, *Rhinolophus ferrumequinum*, *Myotis oxignathus*, *Myotis capaccinii*, *Myotis emarginatus*, *Myotis myotis*, *Myotis mystacinus*, *Pipistrellus kuhlii*, *Pipistrellus pipistrellus*, *Miniopterus schreibersii*, *Microtus levis*, *Apodemus epimelas*, *Apodemus flavicollis*, *Dryomis nitedula*, *Canis aureus*, *Sus scrofa*, *Felis silvestris*, *Vulpes vulpes, Canis lupus, Meles meles, Martes foina, Mustela nivalis, Lepus europaeus.* Brown bear is common visitor in the area of these forests.

Fungi: species developing on deciduous trees (*Radulomyces molaris*, *Vuilleminia comedens*, *Stereum hirsutum*, *Daedalea quercina*, *Dichomitus campestris*, *Hapalopilus rutilans* etc. (on *Quercus pubescens*) and

Hyphodontia crustosa, *Steccherinum ochraceum*, *Phellinus punctatus* etc. (on *Carpinus orientalis*)). Terricolous fungi develop also on thermophyllous species such as *Leccinum griseum*, *Amanita caesarea*, *Boletus fechtneri* etc.

Within the observed corridor, downy oak and Hop hornbeam forests could be found on minor areas, which often look like hilly pastures, such as part of the valley of Sateska Reka, the shore area of Ohrid Lake, close to Struga and the wider Bitola area (way from Bitola to Kazani).

Italian and Turkey oak forests (Quercetum frainetto-cerris macedonicum)

Italian and Turkey oak forests are one of the habitats that belong to the sub-Mediterranean biome, predominantly deciduous forests and shrubberies. Oak forests of this type can be met on flat or gently sloped thermophilous terrains, and rarely on steep shady places, in the hill belt, at elevations up to 1,000 m a.s.l. They thrive on limestone or silicate bedrock covered with different combinations of distric or eutric cambisols, often with large portion of skeleton fraction, ie. brown soils, lesivated brown soils, humic-silicate soils, vertisols, pseudogley).

The main species dominating the area are *Quercus cerris* and *Q. frainetto* with combinations of more mixed tree and shrub layers where other tree species can be found with considerable abundance: Oriental hornbeam (*Carpinus orientalis*), pedunculate oak (*Quercus robur*), large-leaf pubescent oak (*Quercus virgiliana*), hop hornbeam (*Ostrya carpinifolia*), sessile oak (*Quercus petraea*), pubescent oak (*Quercus pubescens*), hornbeam (*Carpinus betulus*), beech (*Fagus moesiaca*). Other plant species include: *Acer campestre, Acer tataricum, Crataegus monogyna, Fraxinus ornus, Prunus spinosa, Pyrus piraster, Sorbus torminalis, Cornus mas, Corylus avellana, Sambucus nigra, Rubus discolor, Clematis vitalba, Prunus vulgaris, Juniperus oxycedrus, Evonymus verrucosa, Geranium sanguineum, Euphorbia cyparissias, Asparugus acutifolius, Hieracium pilosella, Digitalis lanata, Lathyrus venetus, Festuca heterophylla, Melica uniflora, Symphytum tuberosum, Anemone apenina, Primula acaulis, Aremonia agrimonoides, Viola alba, Cyclamen neapolitanum, Veronica chamaedrys, Crataegus oxyacantha, Cytisus nigricans, Evonymus europaeus, Fraxinus ornus, Juniperus communis, Ligustrum vulgare, Malus sylvestirs, Pirus malus, Pirus piraster, Prunus spinosa, Rhamnus cathartica, Rosa arvensis, Rosa canina, Rosa glutinosa, Rosa rubiginosa, Rubus hirtus, Sorbus domestica, Sorbus torminalis, Tilia tomentosa, Ulmus campestris, Ulmus montana, Viburnum lantana.*

The fauna related to Italian and Turkey oak forests is very similar with the one in Downy oak and Hop hornbeam forests, while the difference has to do with the level of degradation which is higher and the occupied area which is smaller in the later category. Therefore, some indicative species are mentioned below.

Insects: *Myas chalybaeus, Carabus intricatus, Carabus violaceus, Carabus convexus, Molops rufipes, Harpalus serripes, Harpalus dimidiatus, Amara eurynota, Amara aenea, Calathus fuscipes, Calathus melanocephalus.*

Herpetofauna: *Rana dalmatina, Bufo bufo, Bufo viridis, Coluber jugularis, Anguis fragilis, Podarcis muralis, Podarcis erhardii rivetti, Lacerta viridis, Ablepharus kitaibeli, Testudo graeca*, *Testudo hermanni.*

Birds: *Dendrocopos major*, *Dendrocopos medius*, *Picus viridis*, *Columba palumbus, Aquila pomarina*, *Ficedula semitorquata* etc.

Mammals: *Vulpes vulpes, Canis lupus, Ursus arctos, Meles meles, Martes foina, Mustela nivalis*, *Mustela putorius, Lepus europaeus, Apodemus flavicollis, Apodemus sylvicollis*, *Glis glis.*

This forest community spreads mainly on the Balkan area, while in Macedonia it belongs as a climate zonal community in the warm continental area. It can be found in all valleys of the country (above 600 m a.s.l), while it is included in the Annex I of the EU Habitat and wild species Directive (conservation type species). In the area of the proposed transmission line corridor it is the most common along the route (Jablanica mountain, Resen area, Vapila etc.)

Sessile oak forests (Orno-Quercetum petraeae)

Sessile oak forests are a habitat of the biome of South European, predominantly deciduous forests and of the *cold continental area.* The dominant plant species is **Orno-Quercetum petraeae** Em 1968. It grows on shady and rather humid slopes, of skeletal, acid and siliceous substrate and usually of brown forest soils-cambisols, while it thrives between 600 m a.s.l. up to 1,300 m a.s.l.

The flora that characterizes this biotope has less variety of species than the one that describes the previous two oak habitats. More specifically, the floristic diversity mainly includes: *Acer hyrcanum, Acer tataricum* and *Tilia tomentosa, Fraxinus ornus, Sorbus torminalis* and *Quercus dalechampii,* while the grass plants are represented by *Luzula forsteri, Trifolium balcanicum, Lathyrus venetus, Festuca heterophylla, Cynanchum speciosum,* etc.

This habitat is very common in the Balcan area, and in Macedonia, while in the project area covers the highest slopes after Jankovec towards Svinista and other minor areas along the route.

Beech Forests

Beech forests vary from altitudes between 40 and 1,300 m a.s.l., covering frequently smaller or larger fragments in the oak forest zone. More specifically, they grow on steep and shady slopes (suitable ecological conditions – higher air humidity, smaller variations of the humidity and lower daily temperatures). As far as soil types are concerned, they might be brown acid soils on silicate ground and brown soils or rendzinas on limestone ground.

The main species of this habitat is Moesian beech (*Fagus moesiaca*) and Illyrian Fagus sylvatica (Aremonio-Fagion).and secondarily species such as *Tilia cordata*, *Tilia platyphyllos, Tilia argentea, Juglans regia*, *Quercus petraea* and related to herbs and shrubs *Ruscus aculeatus* and *Hypericum androsaeum*. Less

abundant are species such as *Acer campestre*, *Acer platanoides*, *Acer pseudoplatanus*, *Carpinus betulus*, *Cornus mas*, *Corylus avellana*, *Crataegus monogyna*, *Evonymus latifolia*, *Daphne laureola*, *Fraxinus excelsior*, *Fraxinus ornus*, *Prunus avium*, *Quercus cerris*, *Quercus robur, Ruscus hypoglossus*, *Salvia glutinosa*, *Sambucus nigra*, *Staphylea pinnata*, *Ulmus carpinifolia*, *Ulmus Montana*, *Ribes multiflorum, Sorbus aucuparia, Evonymus europaeus, Sorbus torminalis*.

Fauna species include:

Noctuid Moths: *Euxoa segnilis, Scotia obesa scytha, Xylina merckii, Callopistria latreillei, Cryphia ochsi, Autophila anaphanes, Pseudoxestia apfelbecki, Grammodes geometrica*, *Prodotis stolida* and *Raparna conicephala*.

Butterflies: *Spialia orbifer, Spialia phlomidis*, *Pyrgus armoricanus, Pyrgus cinarae, Car- charodus orientalis, Carcharodus lavatherae, Pieris balcanica, Pieris ergane, Anthocharis damone, Anthocharis gruneri, Syntarucus pirithous, Everes decoloratus, Plebicula dorylas, Lysandra coridon, Meleagrea daphnis, Limenitis reducta, Brintesia circe, Hipparchia fagi, Melanargia galathea, Kirinia roxelana.*

Beetles: *Rosalia alpina*.

Amphibians: *Triturus macedonicus*, *Salamandra salamandra*, *Hyla arborea*, *Rana dalmatina*, *Pseudepidalea viridis*, *Bufo bufo*.

Reptiles: *Lacerta agilis*, *Anguis fragilis*, *Natrix natrix*, *Podarcis muralis*, *Lacerta viridis*, *Coronella austriaca*.

Birds: *Phylloscopus sibilatrix*, *Turdus philomelos*, *Parus caeruleus*, *Sylvia curruca*, *Sylvia atricapilla*, *Phoenicurus phoenicurus*, *Erithacus rubecula*, *Dendrocopos leucotos*, *Dendrocopos medius*), *Coccothraustes coccothraustes*, *Strix aluco*, *Parus palustris*, *Hieraaetus pennatus*.

Mammals: *Neomys anomalus*, *Rhinolophus hipposideros*, *Nyctalus leisleri*, *Eptesicus serotinus*, *Plecotus auritus*, *Apodemus sylvaticus*, *Cervus elaphus*, *Capreolus capreolus*, *Myodes glareolus*, *Muscardinus avellanarius*, *Glis glis*, *Mustela nivalis*, *Mustela putorius*, *Martes foina*, *Meles meles*.

Within the investigated corridor, beech forests occupy the highest slopes, and more specifically they can be found close to the village Svinista, the locations Vrpcista, Pircista and minor areas of Jablanica mountain that transmission line crosses.

5.2.3.2 Azonal Forests

The corridor crosses rivers, hosts significant number of springs, nameless streams, drainage canals (artificial water bodies), the canal of the river Sateska (modified water body), as well as non-permanent water bodies, such as flooded areas (during spring upon rivers overflow), swamps and marshes (remains of Struga marsh). Non-permanent water bodies occur mainly during spring upon snow smelting and remain by the end of the spring or early summer (depending on the volumes of rain). Small areas of Struga marsh sustain throughout the year, but due to constant drainage, these areas are very small and fragmented.

Alder and Willow habitats

These habitat types are characteristic for middle and lower flows of streams and rivers in the area of the corridor of Satevska river, Crni Drim and Leva Reka. It occupies narrow belt along the rivers and streams. Habitat types that can be found in the area of interest are:

- Continental Salix galleries (white willow or *Salix alba* is dominant tree species)
- Willow and alder habitats along the fast flowing streams (*Salix alba* and *Alnus glutiosa*)
- Riparian willow and poplar forests (black poplar and white willow are dominant tree species)
- Floodplain white poplar forests (*Populus alba* dominant tree species)
- Mixed floodplain forests with black poplar and white poplar (*Populus nigra* and *Populus alba*)

Alder belts (Alnetum glutinosae)

These forests are considered as priority habitats for conservation under the EU Directive 92/43/EEC. Alder belts grow along almost all rivers and streams in the investigated corridor, while they have a very important ecological function in the prevention and mitigation of floods, reduction of pollution and simultaneously they are natural corridors for the movement of animals and have certain specific roles in the exchange of mineral matters.

They are characterized by the alder species (*Alnus glutinosa*), while woody and shrub species are also found here, such as: *Carpinus betulus, Salix amplexicaulis, Rubus discolor, Juglans regia, Clematis vitalba, Humulus lupulus, Sambucus nigra,* etc. As far as grass plants are concerned, *Caltha palustris, Ranunculus ficaria, Lamium purpureum, L. Maculatum* and other species can be found along the belts.

The few alder belts that the transmission line crosses are included in the alliance of Alnion glutinosae (Malcuit 1929) Meijer Drees 1936 with representative communities including: Geo coccinei-Alnetum Em 1964, Fraxino-Alnetum glutinosae Lj. Micevski & J. Matveeva 1978 and Carici elongatae-Alnetum glutinosae. However, the majority of alder belts have been destroyed during the years.

Concerning the fauna:

Birds: *Dendrocopos major, Parus palustris, Picus viridis*, *Motacilla cinerea, Cinclus cinclus*, etc.

Herpetofauna: almost all amphibian species can be found along small rivers or flooded areas covering these forests, such as the Aesculapian Snake *Elaphe longissima* and the Grass Snake *Natrix natrix*.

Mammals: *Lutra lutra, Neomys sp*, *Felis silvestris,* etc.

Along the investigated corridor, alder belts have been observed over the course of the river Sateska, along the river Leva Reka, close to Volino etc.

Willow belts (Salicetum albae-fragilis)

Willow belts within the investigated corridor are less frequently observed than alder belts. They are listed in Annex I of the EU Directive 92/43/EEC. Part of them that could constitute forest stands are not found within the investigated corridor; otherwise, they have priority for conservation under the EU Directive 92/43/EEC.

This type of communities can be found in the valleys of lowland rivers or in marshy and swampy areas where they represent the primary vegetation. They grow either on recent alluvial deposits or on hydromorphous soils of a different development stages. Alluvial deposits' layers are often several centimeters thick and with different mechanical composition – mostly fine sand and silt. They are permanently very wet. Gley soils are very compact and with heavy mechanical composition (clayey). Presence of underground water almost up to the topsoil may cause oxygen deficiency.

This habitat is included to the alliance Salicion albae Soô (1930) 1940 and association **Salicetum albo-fragilis** Issler 26 em. Soô 57. It refers to forests with short tree layer and sparse canopy, while the trees are over 20 m tall. Dominant species is the white willow (*Salix alba*), while other species (*Fraxinus angustifolia*, *Populus nigra* and *Quercus pedunculata*) are rare. The shorter tree stratum is composed of *Cornus sanguinea*, *Crataegus nigra*, *Populus alba*, *Salix amygdalina*, *Salix fragilis*, *Salix purpurea*, *Ulmus campestris, Ulmus effuse and Ulmus carpinifolia.*

Concerning herbs, some typical ones are: *Rumex sanguineum*, *Veronica anagalis-aquatica*, *Scirpus lacustris, Polygonum lapatifolium*, *Polygonum hidropiper Poa trivialis*, *Poa palustris*, *Carex vulpina* etc.

As far as fungi are concerned, species such as *Phellinus igniarius*, *Trametes gibbosa* and *Fomes fomentarius* are dangerous parazites on *Salix* spp. and *Populus nigra*. Others, such as *Pleurotus ostreatus*, *Laetiporus sulphureus, Perenniporia fraxinea*, *Funalia trogii*, *Ganoderma adspersum*, *Ganoderma resinaceum*, etc. are saprophytes.

Couple of other similar habitats (even though with poplar as dominant species) can be found on same or close locations as floodplain willow habitat. These are mainly floodplain forest with white poplar (*Populus alba*) (they occupy the driest parts of the river banks with underground water table below 2 m of the surface) and mixed floodplain forest with black poplar (*Populus nigra*) and white poplar (*Populus alba*). These habitats cover insignificant surfaces in the corridor.

Individual poplar trees growing along the rivers and channels are also included in this biotope, since they are integral part of the willow habitats. Planted poplar stands are distributed on very small areas in the area of project interest. The stands are usually open and ground vegetation is also well developed. It is very similar to that from neighbouring grasslands or other communities.

Willow belts are under threat in Europe because of the canalization of rivers (Annex I of Habitat Directive). Macedonia follows the same pattern, while in the project area the Satevska river lies in this case since it has been formed to a canal which ends up to Ohrid lake.

Protected and important plant species: *Althaea officinalis*, *Crataegus nigra, Epilobium hirsutum*, *Epilobium montanum, Epilobium parviflorum, Equisetum arvense*, *Ranunculus serbicus, Salix pentandra, Sambucus nigra.*

Fauna is very similar with the one in alder belts.

Invertebrates: *Arion subfuscus, Helix lucorum, Balea serbica* (snails) and *Pterostichus niger, Anchomenus dorsalis, Platynus assimilis, Nebria brevicollis, Bembidion decorum* (ground beetles - Carabidae).

Birds: *Remiz pendulinus* and *Cettia cett*). Many other species use willow trees for breeding and protection; *Luscinia megarhynchos*, *Erithacus rubecula*), *Sylvia atricapilla*

Reptiles: *Natrix natrix*, *Natrix tesselata*.

Amphibians: *Rana ridibunda* and *Triturus carnifex*.

<u>*Swamps and marshes*</u>

Marshes and swamps used to be widely distributed in Macedonia, but due to drainage activities in the major valleys (Pelagonia, Ohrid-Struga), many of these communities were destroyed or degraded and substituted by arable land. Additionally, apart from the valleys, along the corridor of the transmission line, there is a marsh close to the Macedonian-Albanian border (Lokovi). Communities of marshy oak in Macedonia are exceptionally rare and very important for the diversity of habitats and species and therefore they have been proposed to be “monuments of nature”. These forests belong to the alliance Quercion robori-petraeae Br.-Bl. 1932 and thrive on clayey soils during spring due to the rise of the groundwater level. In our region, such forests have been observed

along the river Satevska, in the village Moroista, where remains of the community Quercetum pedunculiflorae macedonicum Em. with trunks of up 6 meters may be found.

The corridor of the transmission line crosses swamps, marshes and artificial water bodies (irrigation and drainage canals). Small stands of reed are present close to Ohrid Lake, while the rest is represented with the communities of Caricetum elatae and Cyperetum longi. In segments with weaker flow, there is a growth of green algae (mostly *Spyrogira* spp.). Prevailing substrates for the growth of Diatomea are organic sediments and macrophytes. The following marshy communities are found in the fields of Struga: Scirpo-Phragmitetum, Sparganio-Glycerietum fluitantis Br.-Bl, Cyperetum longi, Caricetum elatae W. Koch 1926 lysimachietosum Mic.. This habitat type includes communities of the alliances Phragmition and Magnocaricion elatae.

Two of these communities that belong to the alliance Magnocaricion elatae (W. Koch) Br.-Bl. are the association Cyperetum longi Mic. with the main species *Cyperus longus* and the community of Caricetum elatae W. Koch lysimachietosum Mic. with the main species of *Carex elata*. They are found north of Struga, along the left bank of the river Crn Drim, close to the proposed corridor. The first is also characterized by the species of *Pulicaria dysentherica* and *Veronica scutellata,* while the second one, which is found in Macedonia only in the Ohrid valley, includes species such as *Roripa amphibia, Scirpus lacuster, Senecio paludosus, Galium palustre, Lysimachia vulgaris f. glanduloso-villosa, Lythrum salicaria, Sium latifolium, Alisma plantago-aquatica, Typha latifolia, Stachys palustris Scutellaria galericulata, Rumex hydrolapatthum, Iris pseudacorus, Polygonum amphibium,* etc.

In Bitola area, the community of Sparganio-Glycerietum fluitantis Br.-Bl. 1925 (sub-association Sparganio-Glycerietum fluitantis heleocharetosum Mic) can be found that belongs to the alliance Glycerieto-Sparganion Br.-Bl. et Siss. It grows along canals with slowly running water, it does not contain many species, the most numerous of which are *Glyceria fluitantis, Sparganium neglectum* and *S. Polyedrum.*

Swamps can be found mainly along the course of the river Sateska. As habitats, they are distrophic-eutrophic with rich deposits of organic sediment, low content of dissolved oxygen and high content of nutrients. The main substrates for algae growth are the numerous branches fallen into the water, while big populations of siliceous algae and less green algae (*Spyrogira* spp) especially in the spring period.

Species endangered due to drainage activities: *Carex elata, Ranunculus lingua, Rumex hydrolapathus* and *Senecio paludosus* (Ohrid and Struga Marshes); *Glyceria maxima* (Pelagonia Marsh); *Acorus calamus* (Crni Drim River) and *Sagittaria sagittifolia* (Pelagonia Marsh - Nocaci).

As far as birds are concerned, only few individuals can be found today, either as being disoriented or at migration or in low number for overwinter stay. This includes several species of heron and ibis (*Ardea cinerea*, *A. purpurea*,

Egretta gazetta, *Casmerodius albus*, *Nycticorax nycticorax*, *Platalea leucorodia*, *Plegadis falcinelus*). Flooding and humid conditions enable the presence of several species of snipes (*Gallinago gallinago*, *Tringa ochropus*, *Tringa glareola*, *Tringa totanus*, *Philomachus pugnax* etc.), storks *Ciconia ciconia* and Black-headed wagtail *Motacilla flava feldegg*. The most typical species of mammals that can be observed in the area is the otter *Lutra lutra.* Almost all amphibian species found in Macedonia can be found here.

Reeds (Scirpeto-Phragmitetum W. Koch)

Reeds (*Phragmites australis)* in Struga Fields between villages Volino and Meseista, in Radolista, the City of Struga, along the shore of Ohrid lake, near the village Radozda, and in Bitola area occupy large areas and enable high biological diversity. Apart from reed, other species found in the region are *Iris pseudacorus, Alisma plantago-aquatica, Typha* spp., *Scirpus lacustris, Mentha "aquatica",* etc. Due to hydro ameliorations in the past, major part of the area under belts was destroyed (Struga Marsh). In this regard, this habitat has limited significance for biological diversity and probably is not an area where many birds nest.

5.2.3.3 Anthropogenic Habitats

Anthropogenic habitats are frequently found in the proposed transmission line corridor, covering though small areas, while they are mostly surrounded by native forest vegetation or mixed with it. The most common habitat types are:

Black pine plantations

Forest plantations within the investigated corridor are represented by plantations of black pine more often (*Pinus nigra*) and much less often white pine trunks (*Pinus sylvestris).* Black pines are mostly found on the way from Gjavato to Resen (neighbouring area to Pelister mountain), in some small areas close to Bitola and towards Svinista and Vapila.

Protected and important plant species: *Achillea millefolium, Asarum europaeum*, *Athyrium filix-femina*, *Blechnum spicant*, *Campanula lingulata, Campanula sibirica, Carduus candicans, Carpinus orientalis, Centaurea phrygia, Centaurium erythraea, Cephalanthera damasonium, Cephalanthera longifolia, Cephalanthera rubra, Cornus mas*, *Corylus avellana*, *Crataegus laevigata, Crataegus monogyna, Crataegus pentagyna, Crocus weldenii, Cyclamen purpurascens, Cynoglossum germanicum, Daphne blagayana, Epipactis helleborine*, *Eryngium palmatum, Euphorbia carniolica, Fragaria vesca, Frangula dodonei, Fritillaria meleagris*, *Fritillaria montana, Gagea minima, Galanthus nivalis*, *Galium odoratum*, *Galium verum, Gentiana asclepiadea, Gentiana cruciata, Geranium robertianum, Glechoma hederacea*, *Hedera helix, Helleborus odorus*, *Hepatica nobilis*, *Ilex aquifolium, Inula helenium, Juniperus communis, Lamium album, Leonurus cardiaca, Leucojum aestivum, Lilium martagon, Listera ovata, Melampyrum heracleoticum, Melilotus neapolitanus, Melilotus officinalis*, *Melissa officinalis, Neottia nidus-avis, Origanum vulgare*, *Petasites hybridus*, *Platanthera bifolia*, *Platanthera chlorantha, Primula acaulis, Primula veris*, *Prunus spinosa*, *Pulmonaria officinalis*, *Pulsatilla montana, Pyrola media, Quercus pubescens, Quercus*

cerris, Quercus frainetto, Ranunculus cassubicus, Ranunculus ficaria, Ribes uva-crispa, *Rosa canina*, *Rubus idaeus, Rubus sanguineus, Ruscus aculeatus, Ruscus hypoglossum, Salix pentandra, Sambucus nigra, Scilla autumnalis, Senecio umbrosus, Silene viridiflora, Solidago virgaurea, Spiranthes aestivalis, Spiranthes spiralis, Staphylea pinnata*, *Symphytum officinale, Taxus baccata, Teucrium chamaedrys, Tilia cordata, Tilia tomentosa*, *Trifolium pretense, Veratrum nigrum*, *Veronica barrelieri*, *Veronica officinalis*, *Vicia sparsiflora, Viola macedonica, Viola odorata*

Related to the fauna of this habitat (protected and important animal species), it can be described as:

Amphibians and Reptiles: *Salamandra salamandra, Bufo bufo, Pseudepidalea viridis, Hyla arborea, Rana graeca, Rana dalmatina, Anguis fragilis, Lacerta viridis, Podarcis muralis, Coronella austriaca, Zamenis longissimus*, *Natrix natrix*, *Vipera ammodytes*

Birds: *Pernis apivorus, Haliaeetus albicilla, Hieraaetus pennatus, Milvus migrans, Buteo buteo, Accipiter gentilis, Bonasa bonasia, Scolopax rusticola, Columba oenas, Strix aluco, Picus canus, Picus viridis, Dendrocopos major, Dendrocopos medius, Phoenicurus phoenicurus, Turdus philomelos, Ficedula albicollis, Sitta europaea, Certhia familiaris, Garrulus glandarius, Fringilla coelebs, Pyrrhula pyrrhula, Hawfinch Coccothraustes coccothraustes*

Mammals: *Sorex alpinus, Sorex minutus, Sorex araneus, Plecotus austriacus, Muscardinus avellanarius, Dryomys nitedula, Glis glis, Sciurus vulgaris, Lepus europaeus, Ursus arctos, Canis lupus, Canis aureus, Vulpes vulpes, Mustela nivalis, Martes martes, Martes foina, Meles meles, Felis silvestris, Sus scrofa, Capreolus capreolus*

Meadows

Meadows are characterized with rather anthropogenized features, while those spreading over edge parts of forests or in the valleys are extensive. This biotope belongs to the habitat of Heleno-Mesian type of riparian and humid meadows, which is characterized mainly by several species of clovers (*Trifolium resupinatum*, *T. balansae*, *T. nigrescens*, *T. filiforme*, *T. patens*, *T. repens*, *T. pretense*, and frequently found *T. fragiferum*), then grasses (*Cynosurus cristatus*, *Anthoxanthum odoratum*, *Agrostis alba*, *Alopecurus utriculatus*, *A. pratgensis*, *Bromus racemosus*), sedges (*Carex hirta*, *C. vulpina*, *C. distans*, *C. divisa*), as well as *Lychnis flos-cuculi*, *Oenanthe stenoloba*, *Oe. silaifolina*, *Oe. fistulosa*, *Ranunculus acris*, *R. velutinus*, *Cirsium canum*, *Inula britanica* and many other meadow species.

Humid and moderately humid meadows in the project area are under threat related to their substitution with meadows with alfa-alfa which on the one hand are more productive, but on the other hand they have very low value in terms of biodiversity. They have not been listed as habitats with priority for conservation in Annex I of the EU Directive 92/43/EEC while since it is certainly a

priority habitat type for conservation, it could be under code 6410 or 6510 of Annex I of the EU Directive.

They are of particular significance for some bird species, primarily storks. In the corridor of interest, they are mostly observed in Struga Valley and close to Trebenista and throughout the corridor on minor areas (close to village Svinista, wider Bitola area). In some cases, meadows are mixed with small field plots and gardens.

Open areas - pastures

Hilly pastures are represented in the investigated corridor in minor parts such in Svinista, Jablanica mountain and at greater extent in the wider Bitola area. Generally, this biotope is characterized by hilly belts of mostly dry grass ecosystems which thrive to areas up to1,200 m. In our project region, most of the grass areas are in fact abandoned fields and meadows, which they do not show the typical characteristics of hilly pastures. Therefore, within the habitat of hilly pastures, we may find various stages, from open pastures to strongly degraded woods (Downy oak and Hop hornbeam and Italian and Turkey oak forests).

Reptiles: *Coluber caspius, Ablefarus kitaibelli, Vipera ammodytes, Podarcis taurica, P. erhardii rivetti*

Birds: *Anthus campestris, Lanius collurio, Lanius minor, Lanius senator, Carduelis cannabina, etc.*

5.2.3.4 Agricultural Habitats

Areas under intensive agricultural activities within the investigated corridor may be fields, vineyards and orchards.

Fields

Fields occupy large areas in Struga Fields, while mixed with meadows, gardens and orchards can be found along the river valleys (Sateska) or in Downy oak-Hop hornbeam forests (villages Radozda, Logovardi, Novaci). There are also many parts, that although they would be suitable for agricultural production, they were not treated as they could have. The arable agricultural land includes predominantly cereal and horticultural crops (corn-Zea mays, wheat-Triticum aestivum, barley-Hordeum vulgare), rye-Secale cereale, oats-Avena sativa, industrial sunflower-Helianthus annuus, sugar beet-Beta vulgaris, oil turnips-Brassica napus and others. In the examined region is also richly developed weed vegetation (ass. Geranio- Sylibetum) for which we can say that is present at a great extent in Bitola region.

Most of the fields are separated by boundaries of trees or shrubs such as *Juglans regia*, *Populus nigra* cv. *Pyramidalis, Prunus spinosa*, *P. cerasifera*, *P. cerasus*, and very frequently by remains of natural vegetation. In Struga Fields, boundaries are dominated by willows, alders and poplars, while in hilly areas different oak species (*Quercus pubescens*, *Q. frainetto*, *Cornus mas*) can be met.

As far as the importance for biodiversity is concerned, it seems to be very low.

Butterfly species: *Gonepteryx rhamni, Nymphalis polycholoros, Nymphalis antiopa, Vanessa atalanta, Colias crocea.*

Ground-beetles: *Harpalus distinguendus H. affinis, H. rufipes, Amara aenea, Chlaenius vestitus, Brachinus explodens, Pterostichus niger, P. nigrita, Carabus coriaceus, Bembidion lampros, Cicindela campestris.*

Birds: *Ciconia ciconia, Corvus cornix, Upupa epops, Garrulus glandarius, Fringilla coelebs, Carduelis carduelis, Turdus merula, Turdus viscivorus, Pica pica.*

Vineyards

Vineyards in the observed corridor cover small areas and are most often surrounded with fields. Due to the limited area they cover, they do not consist of are not specific plant. Along the corridor, vineyards can be observed in the Struga Fields region, especially between the villages Meseista and Trebenista, and Kazani area (Karejci, Kamici, Cvetkova Livada).

Orchards

Orchards in the investigated area include mainly apples, and less often garden cabbage (Brassica oleracea), onion (Allium fistulosum), plums (Prunus domestica), apricots (Prunus persica), cherry (Prunus avium), sour cherry (Prunus cerasus). Flora and fauna are highly based on the surrounding agricultural land, because of the small areas of orchards in the project region. Orchards are found mainly in Struga Fields and the wider Resen area.

Populated places and settlements

The investigated corridor also includes several villages and settlements. The plants that can be found are of low importance as far as the conservation level is concerned (mainly nitrophilic and ruderal plants). Bird fauna in rural areas mainly include the following species: *Hirundo rustica, Delichon urbica, Passer domesticus, Phoenicurus ochruros, Pica pica, Crovus monedula, Corvus cornix.*

5.2.3.5 Significant Habitats

It can be concluded that there are not so many habitats in the area of the transmission line that may have higher ecological significance. Such habitats along the corridor are mainly the alder and willow belts, remains of minor forests of marshy oak, reeds, Italian and Turkey oak forests and beech forests. Some habitats are widely distributed in Macedonia or really very few are listed in Annex I of the EU Directive 92/43/EEC. The latter means that an EU Member State or accession country (i.e. Macedonia) is obliged to protect them, while many other observed habitats along the corridor are widely distributed in Macedonia.

According to the Habitats Directive 92/43, the main habitat types in the project area can be summarised in the following table.

Code	Description
1020	Arable land
1050	Urban Areas
3190	Lakes – open water
6510	Lowland hay meadows
72A0	Reedbeds
7230	Alcalin fens
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
91K0	Illyrian Fagus sylvatica forests (Aremonio-Fagion)
91W0	Moesian beech forest
91Y0	Dacian oak & hornbeam forests
9190	Old acidophilous oak woods with Quercus robur
92A0	Salix alba and Populus alba galleries
924A	Thermophilous oak forests of Eastern Mediterranean and Balkans
9250	Quercus trojana woods
925A	Forests of Ostryo-Carpinion and mixed thermophilous forests
9280	Quercus frainetto woods
92A0	Salix alba and Populus alba galleries
9530	(Sub-)Mediterranean pine forest with endemic black pines

Table 5-5 – Main habitat types in the project area

The revised list of Emerald endangered natural habitat types (based on Resolution No. 4/1996) requiring specific conservation measures that are mainly present in the preoject area is given below.

Code	Habitat types
41.1	Beech forests
41.2	Oak-hornbeam forests
41.5	Acidophilous oak forests
41.7	Thermophilous and supra-Mediterranean oak woods
41.8	Mixed thermophilous forests
42.62	Western Balkan *Pinus nigra* forests
44.1	Riparian willow formations
44.9115	Eastern Carpathian alder swamp woods

Table 5-6 – Emerald habitat types in the project region

5.2.4 Natural Heritage and Protected Areas

A number of areas in the wider region of the OHL corridor are existing protected areas (PAs) according to the national legislation and one area is proposed for future protection. Two areas are also designated as sites of international importance. These are Prespa Lake and Ohrid region. Careful OHL corridor alignment has sought to identify a corridor which bypasses all existing protect-

ed and designated areas in the project region and, consequently, avoids any eventual impact on their natural values or their protection status.

An overview of these PAs as well as their international designation and importance or Emerald Network status is given in the table below. Maps of IBA (Important Bird Areas) sites, IPA sites (Important Plant Areas), PBA (Prime Butterfly Areas) and Emerald sites are given in the Appendix 1.6.

National context / designation			International context / designation	EU ecological networks context[iii] (Emerald Network / Natura 2000 Network)		Other international importance status[***]
Code	Name of the protected area	Category of Protection (Macedonian Law on Nature Protection)		Code (MK00000x)	Type of Emerald site[iv]	
Existing Protected Areas						
133	Pelister	National Park (NP), category II	/	4	B	IPA, PBA (as part of wider area – Baba Mountain)
422	Prespa Lake	Natural Monument (NM), category III	Wetland of International Importance Prespa Lake (since 1995) (Ramsar[i] site)	25	C	IBA, IPA
184	Ezerani	Strict Natural Reserve (SNR), category I	Note: Partly included in the above Ramsar site	2	C	/
487	Leskodol	Protected Landscape (PL), category V	/	/		/
186	Galicica	National Park (NP), category II	/	1	C	IPA, PBA
580	Ohrid Lake	Natural Monument (NM), category III	World Heritage Site Ohrid Region (since 1980) (UNESCO[ii] site) Category of site: Mixed natural and cultural site	24	C	IBA, IPA
Newly proposed Protected Area						
456	Jablanica	National Park (NP), category II	/	20	C	IPA

Table 5-7 – Designated areas in the project region

[i] Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar (Iran), 2 February 1971; UN Treaty Series No. 14583. As amended by the Paris Protocol, 3 December 1982, and Regina Amendments, 28 May 1987.

[ii] (UNESCO) Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 23 November 1972.

[iii] Project 00058373 - PIMS 3728 "Strengthening of ecological, institutional and financial sustainability of the system of protected areas in the Republic of Macedonia"; Report - Project Activity Ref. RFP 79/2009 "Development of representative protected areas network"; Macedonian Ecological Society, March 2011; supported by UNDP and the Macedonian Ministry of Environment and Physical Planning.

[iv] Emerald sites tegories

- A – Areas important for the protection of birds
- B – Areas important for other species and/or habitats
- C – Areas important for birds, other species and/or habitats

In addition:

- Pelagonia area is identified as an Emerald site, while its wider area as IBA.

- Struga reagion is identified as PBA.

More specifically, by World Conservation Union (IUCN) categorization, Macedonia's protected areas in the wider project area are as follows:

- ✓ Category I: Strictly Protected Natural Reserves, protected areas managed mainly for scientific research and monitoring; an area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species.
  - Ezerani, on Prespa Lake, with 2,080 ha, a wetland area. Biodiversity is represented mainly by swampy and grass vegetation and water birds. (habitat of approximately 200 bird species, including wild geese, pelicans, and local moorhens and is included in the World Ramsar list)
- ✓ Category II: National Parks, protected areas managed mainly for ecosystem protection and recreation; a natural area of land and/or sea designated to: (a) protect the ecological integrity of one or more ecosystems for present and future generations; (b) exclude exploitation or occupation inimical to the purposes of designation of the area; and (c) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible.
  - Pelister, with 12,500 ha, was established in 1948. The park has the only variety in the world for the five-needle Molica (Pelister or Macedonian) pine, covering approximately 1,600 ha. Pelister is also home to over 27 brown bears and other fauna.
  - Galicica, with 22,750 ha, is situated between Lake Ohrid and Lake Prespa and was declared a park in 1958. The vegetation in this park is particularly rich with 19 different forest communities and several extremely rare types of flora.
- ✓ Category III: Natural Monuments, protected areas managed mainly for conservation of specific natural features; an area containing one or more specific natural or natural/cultural features that is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities, or cultural significance. These include the two glacial, tectonic lakes in the project region (1977):
  - Ohrid Lake with an area of 23,000 ha
  - Prespa Lake with an area of 17,680 ha
- ✓ Category V: Protected Landscape, protected area managed mainly for landscape/seascape conservation and recreation; an area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological, and/or cultural value, and often with high biological diversity.
  - Locality Leskodol in the Resen area.

Careful OHL corridor alignment has sought to identify a corridor which bypasses all above protected areas in the project region.

The proposed transmission line passes through peripheral northern part of the World Heritage Site (WHS) Ohrid Region, distant from the area with main natural values of the site – the Ohrid Lake itself. In 1979, Ohrid Lake was inscribed on the World Heritage List under Natural criterion, while in 1980, the protected area was extended to include the historic area of the town under Cultural criteria. For ensuring better protection of the natural phenomenon of the Ohrid Lake and because of the rich cultural heritage in the adjacent areas of Ohrid and Struga, the borders of the WHS are approx. 15 km far from the lake to the North and approx. 5 km to the East and West of the lake. This area mainly consists of cultivated land, pastures and occasional woodlands and the cities of Ohrid and Struga with their fast developing suburbs and with the accompanying infrastructure (airport, roads, commercial developments, transmission lines, other energy infrastructure, etc.).

The proposed transmission line passes at peripheral north-west zone of the transboundary Prespa Lake park – an area that follows the boundaries of the lake basin. This zone is not core zone of the Prespa Lake park and is not considered to be of national importance in respect to the nature protection. On the Macedonian side, the Prespa Lake park includes the lake itself and parts of Galicica and Pelister National Parks.

The proposed transmission line passes through the peripheral south-east area of the proposed NP Jablanica[2)] avoiding the settlements spread out on the Jablanica Mountain. This particular area is not pristine one, as it includes number of human-caused intrusions: settlements, road lines, residential and commercial developments, etc. So far, this area has not been formally designated as natural heritage. It has not been subject of legally required exercise for assessment and valorization of its natural values, i.e. preparation of a Study for valorization, as an essential pre-requisite for official designation as protected area. According to the Law on Nature Protection and its associated by-laws, such study would need to include proposals and rationale for (i) the category of protection, (ii) the borders of the protected area and its zones and (iii) the main goals for future management and protection as a base for official designation and development of required spatial planning and management documents of the protected area.

Important Plant Areas (IPA) and Important Bird Areas (IBA)

A number of sites with international importance status regarding plants and birds exists in the wider project region (Table 4-7). More details for these sites are given in Appendix 2.

Important Plant Areas in the project region	IPA Criteria*)
IPA Galichica (Stara Galichica, Vojtino, Mala Galichica, Petrina Planina)	Aii; Aiii; Aiv; Ci; Cii

[2)] Project 00058373 - PIMS 3728 "Strengthening of ecological, institutional and financial sustainability of the system of protected areas in the Republic of Macedonia"; Report - Project Activity Ref. RFP 79/2009 "Development of representative protected areas network"; Macedonian Ecological Society, March 2011; supported by UNDP and the Macedonian Ministry of Environment and Physical Planning

IPA Jablanica	Aii; Aiii; Aiv; Cii
IPA Ohrid Lake	Aii; Aiii; Aiv; Cii
IPA Pelister	Aii; Aiii; Aiv; Ci; Cii
IPA Prespa Lake	Aii; Cii

Important Bird Areas in the project region	IBA Criteria**)
IBA Ohrid Lake	A4iii, B1i, B2
IBA Prespa Lake	A1, A4i, B1i, B2
IBA Pelagonija	A1, A4ii, B1iii, B2, B3

Table 5-8 – Important Plant and Important Bird Areas in the project region

*) IPA selection criteria:

(A) Criterion A (threatened species) - the site contains significant populations of one or more species that are of global or regional conservation concern. Four sub criteria are known from the Criterion A:
- A (i) – the site contains globally threatened species
- A (ii) – the site contains regionally threatened species;
- A (iii) – the site contains national endemic species with demonstrable threat not covered by A(i) or A(ii)) and
- A (iv) – the site contains near endemic/restricted range species with demonstrable threat not covered by A(i) or A(ii))

(B) Criterion B (botanical richness) – the site contains high number of species within a range of defined habitat or vegetation type

(C) Criterion C (threatened habitat or vegetation type) - the site is an outstanding example of a habitat or vegetation type of global or regional plant conservation and botanical importance. Two sub criteria are known for the Criterion C:
- C(i) - Priority threatened habitats and
- C(ii) - Threatened habitats

**) IBA selection criteria:

(A) Criterion A – Important Bird Areas of global importance
- A1 - Species of global conservation concern, the site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern
- A4 Congregations i) - the site is known or thought to hold, on a regular basis, $\geq$ 1% of a biogeographic population of a congregatory waterbird species
- A4 Congregations ii) - the site is known or thought to hold, on a regular basis, $\geq$ 1% of the global population of a congregatory seabird or terrestrial species
- A4 Congregations iii) - the site is known or thought to hold, on a regular basis, $\geq$ 20,000 waterbirds or $\geq$ 10,000 pairs of seabirds of one or more species

(B) Criterion B – Important Bird Areas of European importance
- B1 Congregations iii) - the site is known or thought to hold $\geq$ 1% of a flyway or other distinct population of other congregatory species
- B2 - Species with an unfavourable conservation status in Europe, The site is one of the 'n' most important in the country for a species with an unfavourable conservation status in Europe (SPEC 2 & 3) and for which the site-protection approach is thought to be appropriate
- B3 - Species with a favourable conservation status in Europe, the site is one of the 'n' most important in the country for a species with a favourable conservation status in Europe but concentrated in Europe (non-SPEC[E*]) and for which the site-protection approach is thought to be appropriate

Primary Butterfly Areas (PBA)

Three Primary Butterly Areas exist in the project region. These are: PBA Baba Mountain, PBA Galicica and PBA Struga. More details for these sites are given in Appendix 2.

5.2.5 Valorization of Flora and Fauna

Related to Fungi to Algae, there are no species along the corridor of the proposed transmission line that lie under Habitats Directive (Annex II and Annex IV) and IUCN Globally Threatened Species.

Flora

The table below describes rare and significant plants found at the wider area of the corridor of interest. None of these species are in the immediate vicinity of the OHL corridor. Plants' species along the corridor belong neither to Annex II and Annex IV of the Habitats Directive nor to IUCN Globally Threatened Species.

Type	Location
Sagittaria sagittifolia L.	Novaci
Lathyrus palustris L.	Struga Swamp
Sium latifolium L.	Struga Swamp
Salvinia natans L.	Struga – Struga Swamp (Bern Convention, Appendix I)
Acorus calamus L.	Struga Swamp
Ranunculus fluitans Lam.	Crn Drin near Struga
Ranunculus circinatus Sibth.	Struga Swamp

Table 5-9 – Rare and significant plants in the project region

Fauna

In recent decades, particular attention is devoted to the protection of endangered species in Europe, followed by a series of international conventions and treaties to protect them. All observation conclusions from the field in relation to the proposed transmission line project are taken under the following conventions and directives:

- Directive on conservation of wild birds (79/409/EEC as amended by 2009/147/EC) - includes the annexes in which species is listed).
  - ✓ Annex I – Species with special measures for conservation with regard to their habitat in order to secure their survival and reproduction in their area of spread. In this context, the following should be taken into account:
    - Species endangered with extinction
    - Species vulnerable by specific changes in their habitats
    - Species considered rare because of their small population or limited local distribution

- Other species requiring particular attention because of the specific nature of their habitat

✓ Annex II – Due to their population level, geographical distribution and reproduction degree in the community, species listed in Annex II may be subject of hunting under the international legislation. Member States should ensure that the hunting of these species does not jeopardize the conservation efforts in their area of distribution.

✓ Annex II/1 – Species related to Annex II/1 may be hunted in seas and on land where this Directive is applicable.

✓ Annex II/2 - Species related to Annex II/2 may be hunted only in Member States as specified in their legislations.

✓ Annex III – Member States should prohibit, with regard to all birds occurring in wild on the European territory of the Member States, sale, transport and breeding for sale, offers for sale of alive or dead birds and any recognizable part or derivative of such bird.

- Bern Convention for the protection of wild flora and fauna and natural habitats in Europe– Resolution No. 6) (includes the annexes in which species is listed).
  - ✓ Annex II - Strictly protected fauna species
  - ✓ Annex III - Protected fauna species
- Bonn Convention on the protection of wildlife species migration (includes the annexes in which species is listed).
  - ➢ Appendix I - Species threatened with extinction
  - ➢ Appendix II – Migratory species protected by agreements.

  Migratory species that have unfavourable status of conservation or would have significant benefit from the international cooperation organized by concluded agreements, are listed in Appendix II of the Convention. Therefore, the Convention encourages the parties to carry out global or regional agreements and management of individual species or, very often, group of listed individuals.
- IUCN Red List of globally threatened species Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) Data Deficient (DD), Near Threatened (NT), Least Concern (LC) or Least Risk (LR)
  - ✓ EXTINCT (EXT). A taxon is Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
  - ✓ EXTINCT IN THE WILD (EW). A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
  - ✓ CRITICALLY ENDANGERED (CR). A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria for Critically Endangered, and it is

therefore considered to be facing an extremely high risk of extinction in the wild.

- ✓ ENDANGERED (EN). A taxon is Endangered when the best available evidence indicates that it meets any of the criteria for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
- ✓ VULNERABLE (VU). A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
- ✓ NEARLY THREATENED (NT). A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
- ✓ LEAST CONCERN (LC). A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
- ✓ DATA DEFICIENT (DD). A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
- ✓ NOT EVALUATED (NE). A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

- Natural Habitats Directive 92/43/EEC
  - ➢ Annex II – Animal and plant species of interest for the community the conservation of which requires designation of special areas for conservation
  - ➢ Annex IV - Animal and plant species of interest for the community in need for strict protection

Taking into account the number of habitats through which the line route passes, significant number of vertebrate species has been recorded or expected. Also, owing to the biggest conservation interest on European level for these groups (i.e. birds), a big number is considered important. It should be pointed out that high number species, mentioned here as important in

relation to their coverage by the annexes, are frequent and widely distributed in Macedonia.

Common name	Scientific name	IUCN	BERN	Bonn	HD
Eastern hedgehog	Erinaceus concolor		III		IV
Greater horseshoe bat	Rhonolophus ferrume-	LR	II	I	II/I
Lesser horseshoe bat	Rhonolophus hipposideros	VU	II	I	II/I
Mediterranean horseshoe bat	Rhonolophus euryale	VU	II		II/I
Blasius' horseshoe bat	Rhonolophus blasii	LR	II	I	II/I
Whiskered bat	Myotis mystacinus		II	I	IV
Geoffroy's bat	Myotis emarginatus	VU	II		II/I
Long-fingered bat	Myotis capaccinii	VU	II	I	II/I
Leisler's bat	Nyctalus leisleri	LR	II		IV
Kuhl's pipistrelle	Pipistrellus kuhli		II	I	IN
Schreiber's bat	Miniopterus schreibersii	LR	II	I	II/I
Rabbit	Oryctolagus cuniculus	NT			
Fat dormouse	Glis glis	LR	III	-	-
Common dormouse	Muscardinus avellanarius	LR	III		IV
Forest dormouse	Dryomys nitedula	LR	III		IV
Wolf	Canis lupus	LR	II		II,I
Brown bear	Ursus arctos		II		II/I
Beech marten	Martes foina		III		
Badger	Meles meles		III		
Otter	Lutra lutra	NT	II		II/I
Wildcat	Felis silvestris	VU	II		IV

Table 5-10 – Important mammal species in the project region

Common name	Scientific name	IUCN	BERN	HD
Fire salamander	Salamandra salamandra	-	III	
Green toad	Bufo viridis	-	II	II
Common toad	Bufo bufo	-	III	
European tree frog	Hyla arborea	LR	II	II
Agile frog	Rana dalmatina	-	II	II
Stream frog	Rana graeca	-	III	III
Lake frog	Rana ridibunda	-	III	II

Table 5-11 – Important amphibian species in the project region

Common name	Scientific name	IUCN	BERN	HD
European pond terrapin	Emys orbicularis	LR	II	II;IV
Mediterranean spur-thighed tor-toise	Testudo graeca	VU	II	II;IV
Hermann's tortoise	Testudo hermanni	LR	II	II;IV
Slow worm	Anguis fragilis		III	
Sand lizard	Lacerta agilis		II	
Three lined lizard	Lacerta trilineata		II	IV
Green lizard	Lacerta viridis		II	IV
Erhard's wall lizard	Podarcis erhardii		II	IV
Common wall lizard	Podarcis muralis		II	IV

Balkan wall lizard	Podarcis taurica		II	IV
Snake-eyed skink	Ablepharus kitaibelii		II	IV
European whip snake	Coluber caspius		III	
Smooth snake	Coronella austriaca		II	
Aesculapian snake	Elaphe longissima		II	IV
Montpellier snake	Malpolon monspessulanus		III	
Grass snake	Natrix natrix		III	
Dice snake	Natrix tessallata		II	IV
Cat snake	Telescopus fallax		II	IV
Nose-horned viper	Vipera ammodytes		II	IV

Table 5-12 – Important reptile species in the project region

Species	Latin name	IUCN	Bern	Bonn	BD
Little Grebe	Tachybaptus ruficollis	LR	II		
Black-necked Grebe	Podiceps nigricollis	LR	II		
Great Crested Grebe	Podiceps cristatus	VU	III		
White Pelican	Pelecanus onocrotalus	EXT	II	I/II	I
Dalmatian Pelican	Pelecanus crispus	CR	II	I/II	I
Pygmy Cormorant	Phalacrocorax pygmaeus	LR	II	II	I
Bittern	Botaurus stellaris	VU	II	II	I
Little Bittern	Ixobrichus minutus	VU	II	II	I
Little Egret	Egretta garzetta	LR	II		I
Grey Heron	Ardea cinerea	LR	III		
Purple Heron	Ardea purpurea	VU	II	II	I
White Stork	Ciconia ciconia	LR	II	II	I
Black Stork	Ciconia nigra	VU	II	II	I
Lesser White-fronted Goose	Anser erythropus	DD	II	II	I
Bean Goose	Anser fabalis	LR	III	II	
Mute Swan	Cygnus olor	DD	III	II	
Whooper Swan	Cygnus cygnus	DD	II	II	I
Mallard	Anas plathyrhynchos	LR	III	II	
Gadwall	Anas strepera	LR	III	II	
Wigeon	Anas penelope	LR	III	II	
Garganey	Anas querquedula	VU	III	II	
Pochard	Aythya ferina	LR	III	II	
Ferruginous Duck	Aythya nyroca	VU	III	II	I
Goldeneye	Bucephala clangula	LR	III	II	
Red-breasted Merganser	Mergus serrator	DD	III	II	
White-headed Duck	Oxyura leucocephala	EXT	II	I/II	I
Red Kite	Milvus milvus	CR	II	II	I
Black Kite	Milvus migrans	VU	II	II	I
Goshawh	Accipiter gentilis	LR	II	II	
Sparrowhawk	Accipiter nisus	LR	II	II	
Buzzard	Buteo buteo	LR	II	II	
Booted Eagle	Hieraaetus pennatus	EN	II	II	I
Spotted Eagle	Aquila clanga	EN	II	II	I
Lesser Spotted Eagle	Aquila pomarina	EN	II	II	I

Golden Eagle	Aquila chrysaetos	LR	II	II	I
Egyptian Vulture	Neophron percnopterus	VU	II	II	I
Griffon Vulture	Gyps fulvus	VU	II	II	I
Short-toed Eagle	Circaetus gallicus	VU	II	II	I
Pallid Harrier	Circus macrourus	NE	II	II	I
Marsh Harrier	Circus aeruginosus	VU	II	II	I
Peregrine	Falco peregrinus	VU	II	II	I
Merlin	Falco columbarius	LR	II	II	I
Red-footed Falcon	Falco vespertinus	VU	II	II	I
Lesser Kestrel	Falco naumanni	CR	II	II	I
Kestrel	Falco tinnunculus	LR	II	II	
Hazel Grouse	Bonasa bonasia (Tetrastes bonasia)	LR	III		I;II/2
Capercaillie	Tetrao urogallus	EN	II		I
Rock Patridge	Alectoris graeca	VU	III		I;II/1
Grey Patridge	Perdix perdix	LR	III		II/1;III
Quail	Coturnix coturnix	LR	III	II	II/2
Pheasant	Phasanius colchicus	NE	III		
Little Bustard	Tetrax tetrax	CR	II		I
Water Rail	Rallus aquaticus	VU	III		
Little Crake	Porzana parva	DD	II	II	I
Moorhen	Gallinula chloropus	LR	III		
Coot	Fulica atra	LR	III		
Little Ringed Plover	Charadrius dubius	LR	II	II	
Golden Plover	Pluvialis apricaria	LR	III	II	I
Lapwing	Vanellus vanellus	LR	III	II	
Dunlin	Calidris alpina	VU	II		
Spotted Redshank	Tringa erythropus	LR	III	II	
Redshank	Tringa totanus	VU	III	II	
Black-tailed Godwit	Limosa limosa	VU	II	III	
Curlew	Numenius arquata	VU	III	II	
Woodcock	Scolopax rusticola	VU	III		II/1
Great Snipe	Gallinago media	VU	II	II	
Jack Snipe	Lymnocryptes minimus	VU	III		
Black-headed Gull	Larus ridibundus	LR	III		
Yellow-legged Gull	Larus cachinnans	LR	III		
Whiskered Tern	Chlidonias hybrida	VU	II		
Wood Pigeon	Columba palumbus	LR	III		II/1;III/1
Stock Dove	Columba oenas	LR	III		
Rock Dove	Columba livia	EN	III		
Collared Dove	Streptopelia decaocto	LR	III		
Turtle Dove	Streptopelia turtur	VU	III		
Cuckoo	Cuculus canorus	LR	III		
Long-eared Owl	Asio otus	LR	II		
Scops Owl	Otus scops	LR	II		
Little Owl	Athene noctua	LR	II		
Tawny Owl	Strix aluco	LR	II		
Barn Owl	Tyto alba	VU	II		
Nightjar	Caprimulgus europaeus	VU	II		I

Swift	Apus apus	LR	III		
Roller	Coracias garrulus	LR	II	II	I
Kingfisher	Alcedo atthis	LR	II		I
Bee-eater	Merops apiaster	LR	II	II	
Hoopoe	Upupa epops	LR	II		
Wryneck	Jynx torquilla	VU	II		
Green Woodpecker	Picus viridis	VU	II		
Grey-headed Woodpecker	Picus canus	VU	II		
Great Spotted Woodpecker	Dendrocopos major	LR	II		
Syrian Woodpecker	Dendrocopos syriacus	LR	II		I
Middle Spotted Woodpecker	Dendrocopos medius	LR	II		I
White-backed Woodpecker	Dendrocopos leucutos	VU	II		I
Lesser Spotted Woodpecker	Dendrocopos minor	LR	II		
Short-toed Lark	Calandrella brachydactyla	VU	II		I
Calandra Lark	Melanocorypha calandra	EN	II		I
Horned Lark	Eremophila alpestris	VU	II		
Crested Lark	Galerida cristata	VU	III		
Woodlark	Lullula arborea	VU	III		I
Skylark	Alauda arvensis	VU	III		
Sand Martin	Riparia riparia	VU	II		
Barn Swallow	Hirundo rustica	VU	II		
House Martin	Delichon urbica	LR	II		
Tawny Pipit	Anthus campestris	VU	II		I
Meadow Pipit	Anthus pratensis	LR	II		
Red-throated Pipit	Anthus cervinus	DD	II		
Water Pipit	Anthus spinoletta	LR	II		
Yellow Wagtail	Motacilla flava	LR	II		
Grey Wagtail	Motacilla cinerea	LR	II		
Pied Wagtail	Motacilla alba	LR	II		
Red-backed Shrike	Lanius collurio	VU	II		I
Woodchat Shrike	Lanius senator	VU	II		
Lesser Grey Shrike	Lanius minor	VU	II		I
Grey Shrike	Lanius excubitor	LR	II		
Oriole	Oriolus oriolus	LR	II		
Starling	Sturnus vulgaris	LR	III		
Rose-coloured Starling	Sturnus roseus	DD	II		
Jay	Garrulus glandarius	LR	III		
Magpie	Pica pica	LR	III		
Nutcracker	Nucifraga caryocatactes	VU	II		
Cough	Pyrrhocorax pyrrhocorax	EN	II		I
Alpine Cough	Pyrrhocorax graculus	LR	II		
Jackdaw	Corvus monedula	LR	X		
Rook	Corvus frugilegus	LR	III		
Hooded Crow	Corvus cornix	LR	III		
Raven	Corvus corax	LR	III		
Dipper	Cinclus cinclus	LR	II		
Wren	Troglodytes troglodytes	LR	III		
Dunnock	Prunella collaris	LR	II		

Alpine Accentor	Prunella modularis	LR	II		
Cetti's Warbler	Cettia cetti	LR	II	II	
Savi's Warbler	Locustella luscinioides	LR	II	II	
Moustached Warbler	Acrocephalus melanopogon (Lusciniola melanopogon)	LR	II	II	I
Sedge Warbler	Acrocephalus schoenobaenus	LR	II	II	
Marsh Warbler	Acrocephalus palustris	LR	II	II	
Reed Warbler	Acrocephalus scirpaceus	LR	II	II	
Great Reed Warbler	Acrocephalus arundinaceus	LR	II	II	
Barred Warbler	Sylvia nisoria	VU	II	II	I
Orphean Warbler	Sylvia hortensis	VU	II	II	
Garden Warbler	Sylvia borin	LR	II	II	
Blackcap	Sylvia atricapilla	LR	II	II	
Whitethroat	Sylvia communis	VU	II	II	
Lesser Whitethroat	Sylvia curruca	LR	II	II	
Sardinian Warbler	Sylvia melanocephala	LR	II	II	
Subalpine Warbler	Sylvia cantillans	LR	II	II	
Willow Warbler	Phylloscopus trochilus	LR	II	II	
Chiffchaff	Phylloscopus collybita	LR	II	II	
Goldcrest	Regulus regulus	LR	II	II	
Firecrest	Regulus ignicapillus	LR	II	II	
Red-breasted Flycatcher	Ficedula parva	VU	II	II	I
Spotted Flycatcher	Muscicapa striata	LR	II	II	
Whinchat	Saxicola rubetra	LR	II	II	
Stonechat	Saxicola torquata	VU	II	II	
Wheatear	Oenanthe oenanthe	LR	II	II	
Black-eared Wheatear	Oenanthe hispanica	VU	II	II	
Rufous Bush-chat	Cercotrichas galactotes	DD	II	II	
Rock Thrush	Monticola saxatilis	LR	II	II	
Blue Rock Thrush	Monticola solitarius	VU	II	II	
Black Redstart	Phoenicurus ochruros	LR	II	II	
Redstart	Phoenicurus phoenicurus	EN	II	II	
Robin	Erithacus rubecula	LR	II	II	
Nightingale	Luscinia megarhynchos	LR	II	II	
Fieldfare	Turdus pilaris	LR	III	II	
Ring Ouzel	Turdus torquatus	LR	II	II	
Blackbird	Turdus merula	LR	III	II	
Redwing	Turdus iliacus	LR	III	II	
Song Thrush	Turdus philomelos	LR	III	II	II/2
Mistle Thrush	Turdus viscivorus	LR	III	II	II/2
Bearded Tit	Panurus biarmicus	LR	II		
Long-tailed Tit	Aegithalos caudatus	LR	II		
Marsh Tit	Parus palustris	LR	II		
Willow Tit	Parus montanus	LR	II		
Sombre Tit	Parus lugubris	LR	II		
Crested Tit	Parus cristatus	VU	II		
Coal Tit	Parus ater	LR	II		
Blue Tit	Parus caeruleus	LR	II		

Great Tit	Parus major	LR	II		
Nuthatch	Sitta europea	VU	II		
Wallcreeper	Tichodroma muraria	LR	II		
Treecreeper	Certhia familiaris	LR	II		
Short-toed Treecreeper	Certhia brachydactyla	LR	II		
Penduline Tit	Remiz pendulinus	LR	III		
Spanish Sparrow	Passer hispaniolensis	VU	III		
Tree Sparrow	Passer montanus	LR	III		
Chaffinch	Fringilla coelebs	LR	III		
Brambling	Fringilla montifringilla	LR	III		
Serin	Serinus serinus	LR	II		
Greenfinch	Carduelis chloris	LR	II		
Siskin	Carduelis spinus	VU	II		
Goldfinch	Carduelis carduelis	LR	II		
Linnet	Carduelis cannabina (Acan-	LR	II		
Common Crossbill	Loxia curvirostra	LR	II		
Bullfinch	Pyrrhula pyrrhula	LR	III		
Hawfinch	Coccothraustes cocco-	LR	II		
Yellowhammer	Emberiza citrinella	LR	II		
Rock Bunting	Emberiza cia	VU	II		
Ortolan	Emberiza hortulana	VU	III		I
Cirl Bunting	Emberiza cirlus	LR	II		
Black-headed Bunting	Emberiza melanocephala	VU	II		
Reed Bunting	Emberiza schoeniclus	VU	II		

Table 5-13 – Important bird species in the project region

Species	Endemism	IUCN	European Red List	Emerald Network	Bern	HD
Euphydryas aurinia	Marsh Fritillary		LC	Included	Appendix II	Annex II
Lycaena dispar	Large Copper	NT	LC	Included	Appendix II	Annex II; IV
Phengaris arion	Large Blue	NT	EN	Not includ-ed	Appendix II	Annex IV
Polyomatus eros	False Eros Blue		NT	Not includ-ed	Not includ-ed	not in-cluded

Table 5-14 – Important butterfly species in the project region

5.2.6 Assessment of Sensitivity of Habitats

The habitats' and natural ecosystems' sensitivity was evaluated and assessed using a matrix tool that has developed for similar infrastructural projects. The criteria chosen intend to reflect the national and international (European and global) importance of ecosystems/habitats. The more valuable the habitat (more applicable criteria), the more sensitive it is.

The ecosystems assessed are the following:

- Downy oak-Hop hornbeam forests, Italian and Turkey oak forests, Sessile oak forests, beech forests, black pine plantations, alder forests,

willow belts, rivers, streams, marshes and marshes oak forests - swamps, hilly pastures, meadows, fields, vineyards, orchards, gardens, urban habitats and rural habitats.

Habitat Sensitivity Estimation Matrix

Matrix for sensitivity assessment of the habitats along the proposed transmission line is given below.

Criterion 1	Habitat Directive (Council Directive 92/43/EEC concerning the protection of natural habitats and wild flora and fauna). Types of natural habitats of interest for the Community the conservation of which requires designation of special areas for conservation.
Criterion 2	Rare communities in Macedonia. Rareness of the communities was assessed on the basis of the expert experience and current knowledge on communities distribution.
Criterion 3	Well preserved natural communities. Extent of naturalness i.e. scope of human intervention and manner of land use was assessed on the basis of the expert judgment.
Criterion 4	Presence of species from IUCN Global Red List. Number of species enrolled in the IUCN Global Red List in the habitat determines its value.
Criterion 5	Presence of species important for Europe. This criterion takes into account European Habitat Directive and IUCN Red List.
Criterion 6	Presence of endangered birds. This criterion is based on several conventions. Birds are assessed separately because of their good elaboration in international conventions
Criterion 7	Presence of rare species. This criterion assesses the number of present rare species in the habitat.
Criterion 8	Landscape values. Landscape value has been assessed on the basis of several characteristics: structural and functional importance of certain landscape, aesthetic value, rarity in Macedonia, etc.
Criterion 9	Economic values. The importance of the economy determines this criterion. The most important economic values in the project area are connected with forestry, water potential and livestock breeding.
Criterion 10	Diversity of species. The overall value of biodiversity, i.e. diversity of species has been assessed on the basis of expert judgment.
Criterion 11	Geo-morphological and geological value. It should be pointed out that the result of the matrix relates only to some sites within the range of the assessed habitat.
Criterion 12	Protection from erosion
Criterion 13	Value of the protection from pollution - absorption capacity for pollutants

Table 5-15 – Criteria matrix for assessment of habitats' sensitivity

Scoring and ranking

Scoring of all habitats for each of the 13 listed criteria ranged from 0 to 3.
The meaning of these scores is as follows:

- 0 – no occurrence/insignificant
- 1 – low occurrence/significance
- 2 – medium occurrence/significance

- 3 – strong occurrence/significance

The sum of scores for the habitat determines its sensitivity. The highest possible sum is 39. Ranking of sensitivity was made on the basis of the following table:

- 0 - 9 – low sensitivity (ls)
- 10-19 – medium sensitivity (ms)
- 20-29 – high sensitivity (hs)
- 30-39 – very high sensitivity (vhs)

The meaning of each extent of sensitivity is described below:

(i) **ls** – no specific obstacle for construction activities; yet, aesthetic value of the landscape should be protected and unnecessary destructions and excessive disturbances should be avoided.

(ii) **ms** – construction activities are allowed, but the work should be carried out with precaution, destruction of these habitats or their parts should be avoided; if destruction is unavoidable.

(iii) **hs** – such places, biotopes and sites have enormous significance with regard to natural or economic values.

(iv) **vhs** – all construction activities are prohibited; any construction activity near such places or sites should be restricted.

Based on the described methodology, assessment of the sensitivity of habitats found in the investigated corridor was made. There is no habitat that is very highly sensitive (vhs). Six habitats were assessed as highly sensitive (hs): Italian and Turkey oak forests, Sessile oak forests, beech forests, alder belts and forests, marshes, swamps and marshy oak forests, meadows. The group of medium sensitive (ms) includes 8 habitats: downy oak-hop hornbeam forests, willow belts, black pine plantations, hilly pastures, rivers and streams, fields, vineyards and rural habitats. Three habitats were assessed as lowly sensitive (ls): orchards, gardens and urban habitats.

HABITAT	CRITERIA														
	EU Directive 92/43/EEC	Rare communities in Macedonia	Well preserved natural communities	Presence of species from IUCN Global Red List	Presence of species important for Europe	Presence of endangered birds	Presence of rare species	Landscape values	Economic values	Abundance in species	Geomorphological and geological value	Protection from erosion	Value of the protection from pollution	TOTAL	SENSITIVITY
Downy oak-Hop hornbeam forests	2	0	0	1	2	1	1	1	0	1	0	1	1	11	ms

Italian and Turkey oak forests	1	0	2	1	1	2	1	2	3	2	1	3	2	21	hs
Sessile oak forests	1	1	2	1	1	1	1	3	3	1	1	3	2	21	hs
Beech forests	3	0	2	0	2	1	1	2	2	2	2	2	2	21	hs
Alder forests	2	1	2	1	1	1	1	2	2	1	1	2	3	20	ms
Willow belts	2	1	2	2	1	1	1	2	2	1	1	1	2	19	hs
Hilly pastures	2	0	0	1	1	1	1	1	0	1	1	1	1	11	ms
Rivers and streams	2	2	3	2	2	1	1	3	1	1	1	0	0	19	hs
Marshes, swamps and marshy oak forests	3	2	2	1	2	2	2	2	1	1	1	2	2	23	hs
Black pine plantations	2	1	1	1	1	1	1	2	2	2	1	1	2	18	ms
Meadows	2	2	1	1	1	2	2	2	2	2	1	1	2	21	hs
Fields	1	0	0	0	1	2	0	2	3	1	0	0	0	10	ms
Vineyards	0	0	1	0	2	1	0	2	3	1	0	0	1	11	ms
Orchards	0	1	0	0	2	2	0	1	2	0	0	0	1	9	ls
Gardens	0	0	0	0	1	1	0	2	2	1	0	1	0	8	ls
Urban habitats	0	0	0	0	0	1	0	1	3	0	0	0	0	5	ls
Rural habitats	1	1	1	1	1	1	1	1	2	1	0	1	0	12	ms

Table 5-16 – Assessment of habitats' sensitivity

High Sensitive Ecosystems

It is important to note that there are no habitats of a very high sensitivity and no construction disqualifications (or total restrictions) will be necessary. High sensitive (hs) habitats are distinguished from others, based on the likely conflict situations emerging from the construction works and operation of the proposed transmission line. Medium sensitive (ms) and low sensitive habitats (ls) are not treated in details. Nevertheless, whenever impacts on them are identified, they are discussed in the section on impacts.

- Italian and Turkey oak forests (hs-21)

This is not a high sensitivity habitat for conservation according to the EU HD, but is of a European concern according to the CE Bern Convention. It includes important species and is of a great economic and ecosystem value

- Sessile oak forests (hs-21)
- Beech forests (hs-21)

Beech forest is an important habitat type at European scale (EU HD Annex I habitat). It hosts important species and it has great economic and pollution prevention value.

- Alder belts (hs-20)

Alder belts are priority species for conservation under the EU Habitat Directive. These communities are important for their specific ecological functions (control of pollution, protection from floods and erosion, symbiotic nitrification, enrichment of soil with nitrates). This riparian habitat supports rich faunal and floral diversity and is recognized as threatened habitat internationally value.

- Marshes, swamps and Marshy oak stands (hs-23)

Marshy oak in Macedonia is a rare species, and its stands are even rarer. Apart from the national importance, communities of marshy oak are enrolled in the list of habitats for conservation under the EU Habitat Directive. Marshes and swamps are habitats that are strongly affected on global and European level which is the ground for their inclusion in different international conventions.

- Meadows (hs-20)

Meadows support high biological diversity and are significant for their ecological functions (economic value, protection from erosion). They are also faunistically and floristically very rich and possess high biodiversity value.

6 Description of the Existing Socio-Economic Conditions

6.1 Methodology

The definition of baseline social conditions for the project area has relied on data collected by direct communication with stakeholders, the review of printed materials and by site visits to the area affected by project implementation.

There are two types of data utilized, namely:

- Direct data - referring to sources of information collected directly in the project area
- Indirect data – referring to the data that has already been published.

This derives from the necessity to understand local social concerns, ongoing social processes, cultural and social habits, as well as socio-economic conditions of the residents in the wider project area, in view of identifying potential impacts and how these can be avoided, minimised or mitigated.

6.1.1 Direct Data Colection

Methodologies for the engagement with and approach to stakeholders in the proposed transmission line are explained within the Stakeholder Engagement Plan (SEP). This is a separate document, developed in compliance with EBRD and IFC requirements. This approach, besides assisting in the planning and realization of the proposed project, this approach generated valuable information and led towards a better appreciation of the social landscape of the area. Such data, analyzed and crosschecked with official data published by governmental institutions forms the foundation of this baseline description of the social environment of the project area.

Questionnaire and Site Visits

Residents in rural settlements close to the route of the proposed transmission line were surveyed in August and September 2012 using a pre-prepared questionnaire to find their expectation regarding the impact the project would have on their community. Generally, the questionnaire dealt with potential challenges created by the construction and operation of the proposed transmission line. This includes possible critical issues affecting environmental and social systems, expectations and benefits, the level of information disclosed to the public and the willingness for future participation in meetings and/or events related to the next implementation stages of the proposed project.

6.1.2 Indirect Data Colection

Indirect data collection was based on official publications and databases that have been developed mainly by the central and local governmental bodies/institutions as well as by the national statistical authorities. This data was supplemented by a review of commercial websites and publications to support an analysis of tourism and recreational activity.

6.2 Population and Settlement Patterns

6.2.1 Basic Demographic Data

The proposed OHL corridor passes through the territory of seven Macedonian municipalities: Novaci, Mogila, Bitola, Resen, Ohrid, Debrca i Struga.

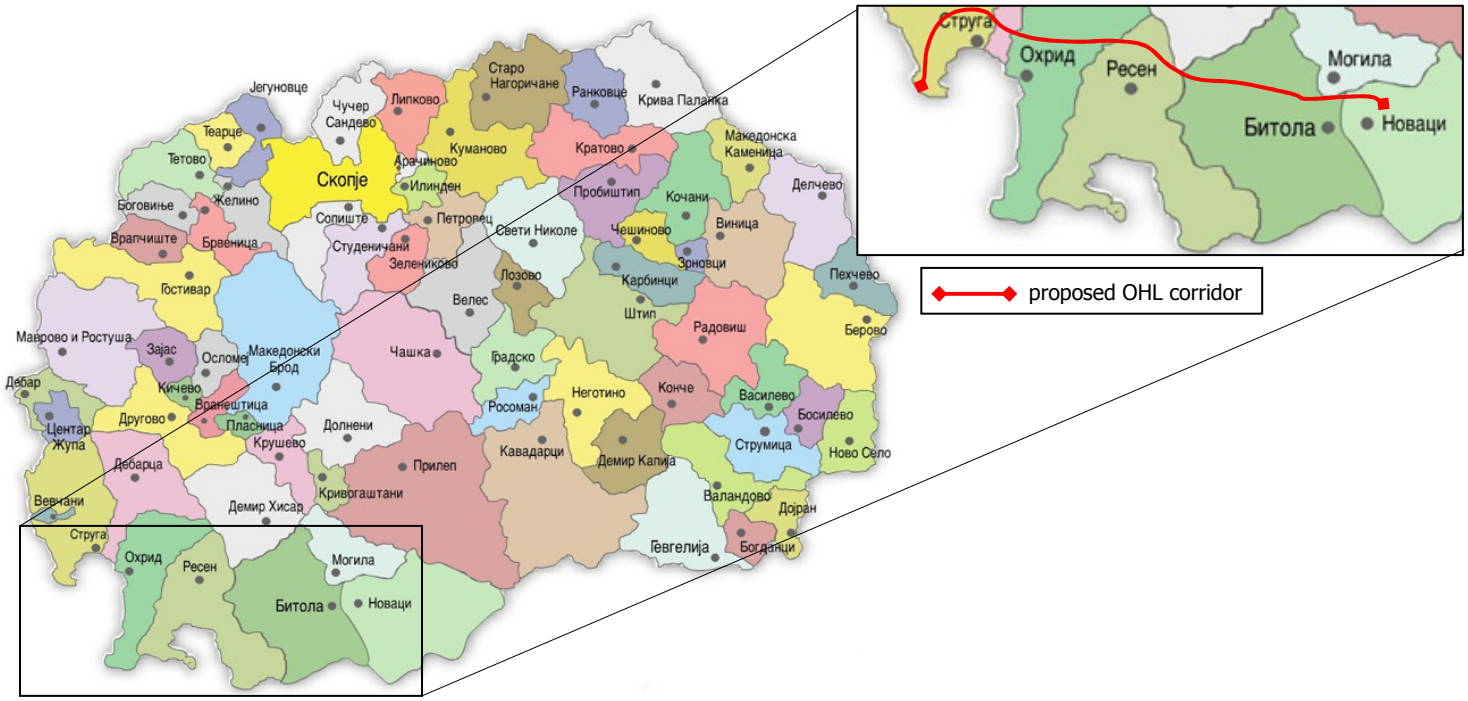


Figure 6-1 –- Route of the proposed transmission line and overview of concerned municipalities

An administrative map of the project area is given in Appendix 1.7.

Basic demographic data of the affected municipalities is given in the table below.

Municipality	Population			Households	Dwellings
	Total	Male	Female		
Novaci	3,549	1,847 (52%)	1,702 (48%)	1,125	1,723
Mogila	6,710	3,558 (53%)	3,152 (47%)	1,851	2,385
Bitola	95,385	46,969 (49%)	48,416 (51%)	28,942	37,225
Resen	16,825	8,413 (50%)	8,412 (50%)	4,849	8,233
Ohrid	55,749	27,598 (49.5%)	28,151 (50.5%)	16,012	28,437
Debrca	5,507	2,748 (49.9%)	2,759 (50.1%)	1,995	4,355
Struga	63,376	31,633 (49.9%)	31,743 (50.1%)	14,485	18,834

Table 6-1 – Basic population data of the concerned municipalities

Settlements in vicinity to the proposed OHL corridor are given in the table below.

Settlements – by Municipality – close to the proposed transmission line			
Municipality	**Settlement**	**Population 2002*)**	**Relative distance from the proposed OHL**
Novaci	Novaci	1,054	>1,000m
	Dobromiri	285	500m
Mogila	Mogila	472	>1,000m
Bitola	Trn	30	1,000m
	Krklino	205	> 1,000m
	Kukurecani	1,121	> 1,000m
	Bratin Dol	154	> 1,000m
	Rotino	106	> 2,000m
	Capari	422	> 2,000m
	Kazani	65	> 1,000m
	Gjavato	111	600m
Resen	Sopotsko	184	500m
	Kriveni	25	400m
	Leva Reka	54	600m
Ohrid	Svinista	63	300m
	Rasino	8	200m
	Vapila	97	1,000m
	Livoista	150	1,000m
Debrca	Volino	362	750m
Struga	Moroista	224	750m
	Vranista	1,174	> 1,000m
	Dolna Belica	693	> 1,000m
	Zagracani	753	1,000m
	Radolista	1,961	500m
	Frangovo	1,154	500m
	Mali Vlaj	61	750m

Table 6-2 – Settlements along the proposed transmission line corridor

*) Source: Census of Population, Households and Dwellings in Macedonia, 2002

Population figures presented above show the settlements close to the proposed transmission line – with the clear exceptions of few of them - to have relatively small populations. Census figures and meetings with rural stakeholders show the population of the rural settlements close to the OHL to be shrinking and ageing as young people leave these areas in search of better economic opportunities elsewhere. As a result, the age structure within the rural settlements in the project region is clearly becoming more elderly.

6.2.2 Migrations

The villages, especially the hilly and mountainous ones, face a high rate of emigration. Therefore, some of them have been reduced to one third or one fourth of their population for the last decades due to the low incomes of their households and poor infrastructure facilities causing difficulties in their lives. The emigrations have been directed towards their nearest cities, the capital - Skopje or abroad. Emigrations towards foreign countries in the inception period (from the 1960s) have been usually by a single family member that later on provided conditions for emigration of the rest of the members of their families. The recent ones are characterized by abandonment of the whole families of their native villages especially if the emigrations are oversees (Australia, Canada, USA). Emigrations have reduced dramatically the economic and overall social capacities of the villages.

6.3 Socio-Economic Baseline

National Context

Macedonia has a population of 2,022,547 according to the last census of 2002, and there is an estimate that in 2011 their number is 2,058,539[3)]. Its economy can be characterized as a small, open, middle income economy. The Macedonian Gross Domestic Product (GDP) is in total 7,057 million Euros (at current exchange rate) or 3,434 Euros per capita (at current exchange rate) in 2010, which is one of the lowest in Europe. The activities that contribute the most to the GDP (2010[4)]) are: industry with 17,8% where manufacturing is dominant with 12,6%; next is wholesale and retail trade and repair of motor vehicles and motorcycles which is 13.1% of GDP; next is agriculture, forestry and fishing contributing with 10,1% of GDP; followed by public administration and defense which is 8.3% of GDP; construction 5.5% of GDP; information and communication 4.2% of GDP, etc.

Macedonia has a high rate of unemployment that is 31,3% in 2011[5)]. The low national income and the high unemployment rate need new economic investments. The bulk of the existing and future economic investments are in the field of industry or manufacturing where some factories in construction are located in the industrial zones throughout Macedonia and the efforts of the Government are directed the most towards attracting investments in industry which is the

[3)] Statistical Yearbook of RM, Statistical Office of RM, Skopje, 2012
[4)] Macedonian GDP, Statistical Office of RM, Skopje, 2011
[5)] Labor Force Survey, Statistical Office of RM, Skopje, 2012

largest consumer of electricity (and some other sorts of energy like gas, etc). Therefore the existing and future industries need permanent growth of the electricity capacity of the country regardless it is produced in the country or is imported from abroad and all efforts towards the enlargement of the system of production and transmission of electricity are crucially important for the economic growth and development of Macedonia.

Urban Areas in the Project Region

The cities in the project region, which are municipal centers, have better general living conditions in comparison with the rural areas. Bitola has number of industrial and agricultural facilities, tourist facilities, trade and crafts and some types of economic services and is the center of the region with widespread network of primary, secondary and tertiary (University) educational institutions and a network of both primary and secondary health care institutions. Resen is a smaller city with some manufacturing, trade and crafts, as well as agricultural facilities. Ohrid and Struga are developed tourist centers, and have number of manufacturing facilities as well as trade and crafts. Anyhow, cities face considerable economic problems since many industrial facilities were closed in the course of the 1990s. The salaries of a significant number of the employees in the private sector are low, much lower than those in the public sector. As well, they have a high unemployment rate (about 30%), which is a little bit lower than the average Macedonian unemployment rate (31.3%)`.

Rural Areas in the Project Region

All of the villages in the project region have the agriculture as the main economic activity. The prevailing agricultural products in the flatland villages in Pelagonia are the corn cultures, mainly wheat, maize and barley as fodder for the cattle and sheep, somewhere tobacco is cultivated. In the villages located in the hilly areas, potato is the most cultivated agricultural product. In the villages in the Resen, Ohrid and Struga regions, the most of the households work on fruit production, mainly apples, pears and plums and somewhere grapes. The animal husbandry is widespread occupation of the rural population in all of these regions where the cattle breeding is more represented while the sheep breeding exist as an occupation in lesser number of rural households.

Some of the households, between 10% and 50% of the overall households in the villages, in addition to agriculture have at least a member of theirs working in the nearest towns and cities as worker in industry or administration in order to increase the family revenues. Most of the rural households possess their own land, minor number of village inhabitants - 10% or less than it, have not their own land and have leasehold on the land.

The lesser number of the households in the villages along the proposed corridor are satisfied of their revenues. The most of the households have low incomes, some of them earn a bare living that is due to the unfavorable situation of the agricultural sector in the Republic of Macedonia which is characterized in some areas with lack of modern means and technology of production, cultivation of small agricultural plots, large areas that are not irrigated, high cost of oil and

other cost of production and lack of state subsidies for many agricultural products that exist for comparison in the more developed economies. Even when a member of households is employed in the nearest town to increase the family revenues, he/she usually works in the economic sectors that are not paid very much and cannot dramatically change the economic situation of his/her household.

6.4 Public Services

6.4.1 Education

Macedonia has an all-inclusive system of education. It covers all degrees of education – primary, secondary and tertiary, consisted of undergraduate and postgraduate courses. The educational system in Macedonia, as elsewhere in Europe is comprised of common and professional education. Primary schools generally are schools of common education. At the level of secondary education gymnasiums are schools of common education, while the others include professional education courses, as well as higher education. Primary and secondary education is free and compulsory. The tertiary undergraduate education is attended by participation while the graduate courses are paid completely by the students.

Macedonia has a widespread network of educational institutions at all levels. With a population of a little more than 2 million, Macedonia has 990 schools of common primary education lasting 9 years with enrolled 201,914 pupils. In the secondary schools, lasting 3 or 4 years 92,848 students are enrolled in 114 schools throughout the country and in the 112 tertiary educational institutions (faculties and institutes) 61,148 students are enrolled.

The secondary educational institutions in the project region are located in the cities, while primary educational facilities might be located both in the cities and villages. A number of tertiary educational institutions are located in Bitola, Ohrid and Struga.

In the villages along the proposed transmission line, the largest villages have educational facilities that cover the whole primary education population (9 grades). Several of them have primary schools that cover pupils of the first 5 grades and several of them have not primary schools at all on their territories due to the small number of children at the age of primary education and the latter attend the classes in the schools of the nearest villages and towns using free transport (organized and paid by the public authorities).

6.4.2 Health Care

The health system is composed of three segments: primary, secondary and tertiary health care. The primary health care in Macedonia is provided through a network of private and public health institutions: outpatient practices and health centers. The primary health care system extends to preventive, promotional and curative services through various profiles of health workers and related professionals: physicians, general practice specialists, dentists and pediatricians, specialists in school medicine, gynecologists and labor medicine specialists. The secondary health care is provided through a system of specialist-consultative services, general and specialist hospitals, bureaus and institutes. The tertiary

care is practiced in clinical hospitals and the University Clinical Centre in Skopje. These two levels are responsible for provision of preventive, curative and rehabilitation medical services by various specialists and subspecialists. Macedonia has a comprehensive health care system, with geographic and financial accessibility, control over the communicable diseases and nearly full national inoculation coverage.

The health system is chiefly funded through the compulsory health insurance which creates opportunities for all citizens to be medically insured. The obligatory health insurance is financed by means of salary deductions earmarked for medical insurance, the amount of which is determined by the National Assembly. Also, the state budget of Macedonia provides funds to cover health insurance costs for those citizens who are not eligible to health insurance on any of the abovementioned grounds including groups like children below the age of 18 (and 26 if they are studying); pregnant women, nursing mothers; persons older than 65 years, etc.[6)]

The primary health care institutions are mostly located in the cities and larger villages. The secondary and tertiary medical institutions are located (with few exceptions) in the cities. Therefore, the vast majority of the villages along the proposed transmission line, being small sized in population, have not primary health care institutions on their territories but use the services of the primary health care institutions either in the nearest larger villages or in the nearest cities. Few of them, the largest ones have primary health institutions like health centers and dentists on their territories. As mentioned, the inhabitants of all villages in the project region use the secondary and tertiary medical services in the nearest cities (Bitola, Resen, Ohrid and Struga) which are accessible to them since they are linked to them by asphalted roads on distances usually between 5 and 10 kilometers and a number of them are connected with these cities by public transport.

As regards the average life expectancy, Macedonia is by five years behind the EU member-states. Overall life expectancy at birth is 74.81 years: the male population has life expectancy of 72.72 while females have life expectancy of 76.96 years of age. Similarly to the other European countries, Macedonian men can expect to live 4-5 years less than the women. The most usual causes for death are circulatory diseases (cardiovascular diseases) represented with 59.2% of all causes for death; next are neoplasms (cancerous diseases) represented with 18.2%, followed by symptoms, signs, and abnormal clinical findings not elsewhere classified with 6.9% and endocrine, nutritional and metabolic disease represented with 3.9 % of all causes for death in Macedonia[7)].

6.4.3 Infrastructure

The settlements in the project region have infrastructure facilities but the most of them are in poor condition or incomplete.

[6)] Vladimir Kendrovski, Health Care, Sustainable Development in the Republic of Macedonia, SIDA project, Skopje, 2009

[7)] Macedonia, World Health Organization (WHO), 2011 and Statistical Yearbook, Statistical Office of RM, Skopje, 2011

As concerning their road infrastructure few of the villages are directly connected to the cities in their close vicinity that are municipal centers. The most of the villages have road links to the main road in the area, i.e. the road Bitola-Resen-Struga-Ohrid. The local roads are mainly asphalted but are narrow and usually poorly maintained so their asphalt is damaged but not repaired.

The villages, without exception face problems with electricity supply. The first problem comes from the very frequent disconnections or electricity supply stoppages that can last from several hours to (rarely) several days which are seldom publicly announced. The second problem comes from oscillations in the electrical voltage of the electricity they receive. The electrical voltage normally is 220 volts, but often it varies to 180 or 160 volts. This implies problems of various kinds like insecurity in planning and operation of their business activities as well as in their everyday life activities and might cause damages to the technical equipment either used in business or domestic activities.

As concerning their water supply networks, the most of the villages, but not all, are connected to water supply systems. Those which are not, use water from their own wells dug on the properties of the village households. Few villages - the largest ones - are connected to the sewerage systems. However, the most of the villages have not sewerage on their territories.

6.5 Archaeological Cultural Heritage

Number of cultural heritage sites and archaeological zones exists in the wider project area. The Spatial Plan 2002-2020 [Ref. 5] identifies Ohrid-Struga and Bitola regions as important areas in Macedonia regarding the cultural heritage protection.

An archaeological zone in Struga Field (identified archaeological sites close the villages Trebenista, Volino and Mislesevo) as well the archaeological zone consisted of number of sites in the area close to the settlements located on the lower slopes of Jablanica Mountain (villages Radolista, Frangovo, Mali Vlaj) are located in the wider project area.

“Trenebiste” necropolis [Ref. 34] in the Ohrid area is considered as most important archaeological site in the project area. It is located on more than 2 km from the proposed transmission line, immediately next to the village of Gorenci and covers the locations of Suva Cesma, Tri Čeljusti and Vrtuljka, close to the regional road Ohrid-Kicevo-Skopje, close and east of the north half of the runway of the Ohrid international airport.

No known archeological cultural site or monument of cultural value are located at the vicinity of the proposed transmission line.

6.6 Main Infrastructure in the Project Region

6.6.1 Existing Infrastructure

Energy Infrastructure

In general, the proposed transmission line follows, as much as practicable, the corridor of the existing 110kV OHL Bitola-Resen-Ohrid-Struga. In number of localities the new line intersects the mentioned exisiting 110kV line.

Traffic infrastructure

The route of proposed transmission line will intersect or will pass close to the following main roads (M-roads) and regional roads (R-roads):

- M5 / Bitola - Prilep. The crossing point is close to the railway station "Nikola Karev" in Pelagonija valley.
- R-1305 / Bitola - Demir Hisar – Kicevo. The crossing point is in the section Bitola - Demir Hisar, south from the village Kukurecani at the locality Garvan.
- R-1302 (E65) / Bitola - Resen. The crossing point is north from the village Bratin Dol, at the locality Ramnishta.
- M4 / Ohrid - Kicevo. The crossing point is north from the village Trebenishta ate the locality Veljo Pole.
- R-1308 / Struga – Debar. The crossing point is south from the village Vranista.
- M4 / Struga - Kafasan (border station) - Albania. There will be two crossing points - the first one close to the village Mali Vlaj at locality Karpuziste and the second one at the locality Lokovi in the vicinity of the Macedonian/Albanian border.

The route of proposed transmission line would intersect or pass close to the following local roads (L-roads):

Bitola area:

- Novaci – (TPP REK Bitola) - Makovo. The crossing point is immediate vicinity to the MEPSO's substation Bitola 2.
- Novaci – Dobromiri - Aglarci. The crossing point is north from the village Dobromiri, at the locality Aglarsko Pole.
- Bitola - (Mogila) - Prilep alternative (local) road. The crossing point is very close to the railway station "Nikola Karev".
- Crossing point with R-1302 (Bitola – Resen) – (Ramna) - (Lera) - Strezevo Lake.
- Crossing point with R-1302 (Bitola – Resen) – (Lera) - Strezevo Lake.
- Kazani - Dolenci (to Strezevo lake).

Resen area:

- Sopotsko – Zlatari.
- Resen – Zlatari. The crossing section is at the locality Poroj.
- Jankovec – Kriveni (L-road). The crossing section is in the vicinity of the village Kriveni on its south side.

Ohrid area:

- Locality Prentov Most (on the R-1302 (Resen - Ohrid) – Svinista.
- Vapila – Rasino
- Vapila – Sirula

- Trebenista – Volino
  Struga area:
- Mislesevo – Moroista
- Sum – Dolna Belica

The route of proposed transmission line will intersect the railway Bitola-Prilep.

Ohrid Airport

The Ohrid airport is located on north-east at 10 km from Ohrid along the road E65 (Ohrid -Skopje). It is on relative distance of more than 4 km from the proposed transmission line.

6.6.2 Planned Infrastructure

Various new transport and energy infrastructural projects are planned in the area of the corridor from Struga to Rajce in Albania. These projects are part of the Pan European Corridor 8, which is seen as energy and infrastructure axis connecting the Adriatic with Black Sea through Italy, Albania, Macedonia and Bulgaria, linking Greece and Turkey. An indicative map of the planned linear infrastructure in the Struga region vis a vis the proposed OHL corridor is given in Appendix 1.8.

New Highway East-West (M2 & M4)

The new highway East-West: M2 and M4 (from Bulgaria via Kumanovo-Skopje-Tetovo-Gostivar-Kicevo-Struga to Albania) will be passing through Struga Field in vicinity to the proposed transmission line corridor. Intersection between the proposed line and the new highway is most likely in the section from Struga to Kafasan (border station with Albania).

New Railway Kicevo (Macedonia) – Lin (Albania)

This new 60km long railway will be electrified on 25kV level and would include mixed traffic, i.e. passenger traffic and industrial traffic. It will be passing through Struga Field in vicinity to the proposed transmission line corridor. Intersection with the proposed line is most likely in the section Meseista – Struga.

New Pipelines

Overall existing gas infrastructure system in Macedonia includes only one branch from Bulgaria to the Macedonian capital – Skopje where two regulation stations exist. An extension of the system throughout the country and interconnection with Greece and Albania is planned. Such extension would include new pipelines from Klecovce (Kumanovo) via Negotino to Prilep-Bitola region and from Skopje via Tetovo/Gostivar/Kicevo to Ohrid-Struga region and further on to Albania, passing in the same energy corridor with the proposed transmission line.

Intersections

Intersections of the proposed transmission line with above infrastructure would need to take into consideration safety heights and distances prescribed in existing Macedonian technical standards for construction of transmission lines.

7 Environmental Impacts

7.1 Air Quality

7.1.1 Dust and Particulate Matter during Construction Activities

During the construction of the proposed 400 kV transmission line, there will be site preparation and construction activities, all of which have the potential to generate dust. Such emissions can be divided into dust and particulate matter (PM10).

Dust comprises of large airborne particles of material, which are resident in the atmosphere for short periods of time after release, as they are heavy enough to fall out of suspension in the air relatively quickly. Therefore, effects of these emissions will be localized and they do not cause long-term or wide spread changes to local air quality but their deposition on nearby properties causes soiling and may therefore result in complaints of nuisance, which is usually temporary.

The main sources of dust during the construction activities include:

- construction vehicle movements and other project related traffic on unpaved roads
- soil excavation, handling, storage, stockpiling
- site preparation and restoration after completion
- construction of towers and access roads
- internal and external construction works on substations.

The majority of the dust emissions are likely to occur during the working hours of construction activity.

The precise behavior of the dust, its presence in the atmosphere, and the distance it may reachl would depend upon a number of factors. These include wind direction and strength, local topography and the presence of screening structures (buildings, trees etc.) that may intercept dust before it reaches sensitive locations. Each of these factors would differ along the route of the proposed transmission line. The sections of the OHL in the hilly and mountainous areas would be exposed to stronger winds which can carry the dusts further. However, these are areas with very low populations and there are few sensitive receptors. The mountainous areas also experience high annual average rainfalls which would prevent the transportation of the dust as rain has a dampening effect.

Depending on wind speed and turbulence during construction it is likely that the majority of dust will be deposited in the area immediately surrounding the source (up to 200 m away). Therefore properties within 200 meters of the construction site are most likely to experience nuisance, without appropriate mitigation measures. Still, the nuisance would be temporary, and provided that site

specific mitigation measures are implemented, no significant dust effects are predicted.

Particulate matter (suspended particles), is released during disturbance of aggregate material in the same manner as dust. However, it is much smaller in size (typically less than 10 micrometers) and it remains suspended in the atmosphere for a longer period and can be transported over a wider area than dust, by wind. It is small enough to be drawn into the lung during breathing, which in sensitive members of the public could cause an adverse reaction. As a result of this potential impact on health, limit value for PM10 is defined in the Macedonian legislation on air quality.

Typical sources of PM10 during the construction phase are similar in nature to those for dust. Particulate matter is also released from the running engines of site plant, such as compressors, generators, etc. As the magnitude of the PM10 emissions is relatively small, any adverse effects resulting from them are likely to be relatively short-term with no significant effects outside the boundaries of the construction sites.

7.1.2 Emissions from Traffic

The main pollutants of concern associated with road traffic are NO_2, PM10, CO, benzene (C_6H_6) and benzo[a]pyrene ($C_{20}H_{12}$). Of these pollutants, NO_2 and PM10 are the emissions most likely to result in exceeding relevant air quality standards or objectives.

The greatest potential for impacts on air quality from traffic associated with construction of the proposed project would be in the areas immediately adjacent to the principal means of access for construction traffic. In construction zones, the dust generated by vehicle movements and local air pollutant emissions from vehicles may be temporarily elevated during the busiest periods of construction activity, however no significant local air quality effects are predicted.

Air emissions during operation of the proposed transmission line will be very minor and only occur during routine inspections and maintenance activities.

7.2 Construction Noise and Vibrations

Construction noise

In a general context, construction activities could be divided into a number of distinct processes. They may be described as follows:

- construction of substation in Ohrid area (area of village Livoista)
- construction of access to tower sites and substation in Ohrid area (area of village Livoista)
- construction of tower foundations
- tower assembly and erection
- attachment of the conductors

- general road improvements and other similar works.

Based on available project information, there are no blasting requirements during the construction process. Noise and vibration effects associated with blasting are, therefore, not expected during construction activities. However, any eventual requirement for blasting will be agreed in advance by the contractor with the relevant local authority.

There are no plans to use helicopters during construction activities and, therefore no noise implications associated with helicopters are expected. However, any eventual requirement for use of helicopter would make noise audible to people within 2 km. The duration of the noise would be short-term, on the order of minutes to an hour, and over a very limited number of days.

Mechanical equipment which is planned to be involved in the construction of the proposed 400 kV transmission line includes, but is not limited to: track loader, excavator, hydraulic hammer and breaker, mobile crane, air compressor, dump trucks, generators, concrete pump, etc.

The table below gives an overview of the noise levels at a reference distance of 16 m from the source for various machines that will be most frequently used in construction. The values in the table are based on data from the available literature.

Noise during construction	Level of noise (dBA) at 16 m from the source
Compressor	81
Excavator	80
Ballast equalizer	82
Ballast tamper	83
Compactor	82
Concrete mixing	85
Pump for concrete	82
Vibrator for concrete	76
Crane	88
Mobile crane	83
Bulldozer	85
Generator	81
Machine for flattening	85
Circular saw (metal cutting)	76
Woodcutter	84
Track loader	85
Track	88

Table 7-1 – Noise levels from construction equipment

Hilly-mountainous sections of the proposed transmission line, where the population is sparse, will have extremely low background noise levels and therefore the noise from construction or transport sources would be audible over a greater distance although this in itself would not necessarily constitute a significant effect. In more urban areas, it is likely that the noise effects of construction

would be less as a higher background noise level from other sources would mask the construction noise, reducing audibility at greater distances.

The table bellow presents noise predictions for the different construction processes previously identified, based on information available in relevant literature as well as in studies of transmission line developments of similar size. These predictions represent a worst case scenario as they do not consider eventual noise barriers or air absorption. It is likely that natural or man-made barriers would exist between the source and the noise-sensitive receptor particularly as distance from the source increases. Such barriers may consist of natural features in the landscape or other buildings or structures between the source and the receptor.

Distance from the source [m]	Construction of access tracks [dB]	Construction of tower foundations [dB]	Tower assembly and erection [dB]	Attachment of conductors [dB]	Construction of new substation [dB]
0-50	≤76	≤77	≤68	≤70	≤75
50-100	≤69	≤70	≤62	≤63	≤68
100-200	≤62	≤63	≤56	≤56	≤61
200-400	≤55	≤56	≤50	≤48	≤54
400-600	≤51	≤52	≤46	≤44	≤49
600-800	≤48	≤49	≤43	≤41	≤46
800-1,000	≤46	≤46	≤41	≤39	≤44
Duration	2 days/tower	2 days/tower (excavation+ concreting)	1.5 day/tower (assembly+ erection)	1 .7 day/tower	2 years (360 days)

Table 7-2 – Noise prediction for each construction process

Typical noise levels produced by various sources are presented in the table below.

Source / Activity		Sound level [dB (A)]
Threshold of hearing		0
Rural night-time background		20 – 40
Quiet bedroom		35
Wind farm at 350 m		35 – 45
Average home conditions		50
Car at 100 m		55
Busy general office or conversational speech		60
Vacuum cleaner at 1 m		70
Kerbside of busy road at 5 m		80
Truck	at 100 m	65
	at 10 m	90
Pneumatic drill at 7m		95
Disco (1 m from speaker)		100

Jet aircraft	at 250 m	105
	at 50 m	140
Threshold of discomfort		120
Threshold of pain		130 / 140

Table 7-3 – Noise level from various sources

Significant effects could be expected when the noise level is higher than 75 dB in urban areas and higher than 70 dB in tourist and rural areas.

The above predictions indicate that a wide area is potentially affected by construction noise, although the noise effects predicted at any location will not to be present at a consistent level throughout the entire construction period due to the discontinues nature of construction activities in terms of locations (such as foundation and tower locations). This is also particularly true of 'linear' activities such as access road upgrading, and the attachment of the conductor where relatively high noise levels could potentially occur in the immediate vicinity of any works, but with noise levels soon returning to normal as the work moves on.

An assessment of the significance of the potential impacts is given in the following table.

Potential impact	Significance of impact
Noise from construction of access tracks	Major: within 50 m Moderate: 50 - 200 m
Construction of tower foundations	Major: within 100 m Moderate: 100 - 400 m
Tower assembly and erection	Moderate: within 200 m
Attachment of conductors	Major: within 50 m Moderate: 50 - 200 m
Noise from construction of new substation	Major: within 50 m Moderate: 50 - 200 m

Table 7-4 – Significance of impacts from noise construction

Note: No residential property exists within a zone of 50 meters from the proposed OHL

Construction vibrations

Planned construction activities and use of equipment and machinery will be a source of vibration.

The response of people to vibrations on the ground is influenced by many factors. Some of those factors are physical, like amplitude, duration and frequency content of vibrations, while other factors like the type of population, age, gender and expectations are physiological. This means that people's reaction to vibrations is subjective and differs for different people. It is generally accepted that for the majority of people, vibration levels in excess of between 0.15 and 0.3 mm/s peak particle velocity are just perceptible.

The table bellow presents distances at which vibration may be perceptible for certain type of construction activity. These figures are based on historical field measurements and information available in literature.

Construction activity	Distances at which vibration may be perceptible [m]
Excavation	10-15
Vibratory compaction	10-15
Heavy vehicles	5-10

Table 7-5 – Distances at which vibration may be perceptible

Due to the fact that there are no residential properties within 50 meters from the proposed transmission line, it is highly unlikely that vibration from the construction of the proposed overhead transmission line would be perceptible.

7.3 Operational Noise

7.3.1 Overhead Transmission Line

An operational transmission line can be a source of a phenomenon known as "corona discharge" (a limited electrical insulation breakdown of the air) which can also occur naturally during storms when highly charged clouds induce high electric fields around tall objects.

Whilst the conductor systems of overhead transmission lines are designed and constructed to minimise corona and hence acoustic noise, surface irregularities on the conductors, caused by physical damage such as burrs, or debris such as insects, pollen, industrial pollution, raindrops or other forms of contamination, may locally enhance the electric field strength sufficiently for discharges to occur. Any corona discharge would act as a source of audible noise i.e. a crackling sound occasionally accompanied by a low frequency hum in certain wet conditions.

Corona noise is generated only when the conductor surface electric stress exceeds the inception level for corona discharge activity. The transmission line conductors are designed to operate below this threshold. Surface contamination of a conductor, resulting in a modification to its otherwise smooth profile, would cause a very local enhancement of electric stress that may initiate discharge activity. At each discharge site, a limited electrical breakdown of the air occurs. A proportion of the energy associated with the corona process is released as acoustic energy, which is launched into the air as sound pressure waves.

Highest noise levels generated by a transmission line generally occur during rain. Water droplets collect on the surface of the conductor and may initiate additional corona discharges. Fog may also give rise to increased noise levels. Fog noise is caused by droplets of water condensing onto the line and hence causing discharge activity in a similar way to rain.

Operational noise generated by a transmission line increases noise levels in the

surrounding environment and may cause nuisance to affected populations. The high variability in the response of individuals to identical noise sources makes the prediction of annoyance very difficult. Each individual's response to increased noise levels is subjective and highly personal.

Transmission line audible noise is generally categorised as "crackle" or "hum", according to its tonal content. Crackle may occur alone, but hum would usually occur only in conjunction with crackle. Hum is only likely to occur during rain when rates of rainfall exceed 1mm/hr. Crackle is a “broad band” noise containing a random mixture of frequencies, typically ranging from 1 kHz to 10 kHz. No individual pure tone can be identified for any significant duration. Crackle has a generally similar spectral content to the sound of rainfall. Hum is a sound consisting of one or more pure tones. Generally 100 Hz is most dominant, but other harmonics of 50 Hz may also occur, to a lesser magnitude, as the harmonic increases in frequency, and only for the first few harmonics.

During dry weather conditions, noise due to corona effect will be in a range between 40 dB and 50 dB, in areas below the line conductors, while in wet weather conditions the noise level may rise up to 60 dB. The noise level changes along a transmission line and depends on surface irregularities or physical damages on the conductors. The corona noise attenuates with the distance from the line and on approx. 20 meters from the line it becomes unnoticeable.

The subjective response of individuals to increased noise levels is summarised in the following table[8)].

Noise in dB(A) by which the new sound level exceeds the background noise	Category	Response description
0	none	No reaction
5	little	Sporadic complaints
10	medium	Widespread complaints
15	strong	Threats of community action
20	very strong	Vigorous community reaction

Table 7-6 – Estimated community response to noise exceeding the normal background noise level

Source: Acoustic Noise Measurements; Hassall JR, Zaveri K, Burel & Kjaar, 1988

During the OHL routing process, MEPSO has achieved to avoid acoustic effects from corona discharge by routing the proposed transmission line away from residential areas. There are no properties and other sensitive receptors along the OHL route at distances where the corona noise would cause nuisance effects and thus, it is not likely that impacts on people from corona noise will occur. The establishment of a sanitary zone along the OHL route would restrict any future residential or other similar developments along the line and would

[8)] Acoustic Noise Measurements; Hassall JR, Zaveri K, Burel & Kjaar, 1988

ensure that no future acoustic impacts from the OHL corona may occur as result of any eventual urban development.

7.3.2 Substation(s) Audible Noise

In general, there are three basic sources of audible noise from substations. Each of these has its own characteristic spectrum and pattern of occurrence due to the nature of the noise-generating mechanisms involved:

(i) The transformer noise is approximately constant with a low frequency hum occurring at harmonics of the supply frequency (100 and 200 Hz are usually dominant).

(ii) The transformer coolers generate more broadband noise, although they are not in continual operation.

(iii) Switchgear noise is generated by the operation of circuit breakers and has short duration.

Noise generated by an operational substation increases noise levels in the surrounding environment and may cause nuisance to affected population. The high variability in the response of individuals to identical noise sources makes the prediction of annoyance very difficult. Each individual's response to increased noise levels is subjective and highly personal.

The distance of the closest residential properties to the new substation in Ohrid area (area of village Livoista) is more than 1,000 meters and acoustic nuisance to residents will not occur.

There are no residential properties in vicinity of the existing substation SS Bitola. No new transformers are planned in this substation as it will be upgraded only with switchgear in order to accommodate the new 400 kV transmission line and increased noise levels would not be significant in comparison to the current level.

7.4 Hydrology

7.4.1 Sensitivity of Catchment Areas

Criteria for measuring the sensitivity of the catchment areas for the main watercourses in the project region are based approximately on a number of factors including international and national designations, water quality information, site visits and professional judgment. These criteria have been used to guide the analysis of the sensitivity of the water quality along the OHL proposed route. These criteria are listed in the table below.

Sensitivity	Criteria
High sensitivity	• Designated area • Identified Emerald site • Wetland / watercourse habitat of national / international importance
Moderate sensitivity	• Wetland / watercourse of ecological importance • Moderate vulnerable aquatic habitats present
Low sensitivity	• Low vulnerable aquatic habitats present

Table 7-7 – Sensitivity criteria of catchment areas

The table below summarizes the sensitivity of the two broad catchment areas identified in the project region – the Crna River and the Crn Drim River (including catchment areas of Prespa Lake and Ohrid Lake), and present the key aquatic baseline features.

Catchment	Key sensitivity issues	Sensitivity
Crna River, including tributaries	• Poor water quality • Absence of any designation	Low

Crn Drim River, including Prespa Lake and Ohrid Lake	• Internationally designated area
	  ○ UNESCO WHS Ohrid region
	  ○ Ramsar site Prespa Lake - Wetland of International Importance
	• Identified Emerald site(s)
		High

Table 7-8 – Sensitivity of catchment areas along the route of the transmission line

7.4.2 Potential Impacts on Waters during Construction

Watercourses will be crossed by a single span with standard length shorter than 600 meters and with towers located on minimum distance of 10 meters for the watercourses. There will be no construction works within watercourses and river beds.

The table below represents an overview of potential impacts on the hydrology and aquatic environment associated with construction activities for the proposed 400 kV transmission line. The impacts have been identified using the available information for OHL construction methods.

Project component	Activity	Potential impact
Construction of access roads, earthworks and drainage	Changes in surface waters drainage patterns and run-off, removal of vege-	• Increased suspended solids in waters • Risk of impact to water supply

	tative cover	facilities • Changes in hydrological regimes
Construction vehicle movements and operations / Construction of OHL crossings over watercourses	Compaction of soils and soft ground, spillage of fuels and oils	• Disturbance of watercourses • Increased suspended solids in waters • Changes to sub-surface water levels • Pollution risk from fuel and oil spillage • Temporary habitat disturbance
Construction of transmission line tower foundations	Disruption to surface and near surface drainage from excavations and dewatering, concrete pouring, removal of vegetative cover	• Change in surface run-off of locality • Risk of alkaline concrete spillage to watercourses

Table 7-9 – Overview of potential impacts on waters during construction

7.4.3 Potential Impacts on Waters during Operation

During its operational phase, the proposed transmission line will not directly discharge pollutants in the waters.

The operational transmission line could result in minor potential impacts on water quality, especially due to maintenance activities and the control of infrastructure and equipment.

The table below represents an overview of potential impacts on the hydrology and aquatic environment associated with operational and maintenance activities for the transmission line and the substations.

Project component	Activity	Potential impact
Drainage of access roads	Potential for increased flows of run-off through new drains	Change in hydrological regime and sub-surface water
Maintenance traffic to access transmission line route	Spillage of oils and fuels from vehicles, compaction of land around tower foundations	• Potential risk of water pollution from fuel / oils • Local effects on hydrology from compaction
Operation of substations	Spillage of transformer oils	Potential risk of groundwater pollution from transformer oil
Transmission line tower foundation	Barrier effect from concrete foundations on hydrology	Local effects on hydrological patterns and water levels

Table 7-10 – Overview of potential impacts on waters during operation

7.4.4 Assessment of the Potential Impacts on Waters

A typical methodology was used to assess the impacts on hydrology from the proposed project and is presented below. This methodology has been commonly used in similar types of projects as the proposed 400 kV transmission line Bitola – Macedonian/Albanian border (to Elbasan, Albania).

Criteria for assessing the magnitude of impact are given in the table below.

Level	Typical criteria
High	Total loss or adverse change of key characteristics and quality (change of watercourse direction, fragmentation effect due to intake of water, fencing / dam, waste water discharge, etc.)
Medium	Loss or change of key characteristics and quality (permanent structures – bridges, aqueducts, siphons, surface or underground pipelines, etc.)
Low	Small detectable changes, but the characteristics and quality would be similar to pre-project conditions (culverts, embankments, etc.)
Negligible	Very small changes, which are not easily distinguished (short term compaction due to vehicles movements, temporary crossing structures, etc)

Table 7-11 – Criteria for assessment of magnitude of impacts on waters

The significance of effects is typically assessed as a combination of sensitivity and magnitude as presented in the following tables.

Significance matrix for impacts on waters			
Magnitude	Sensitivity		
	High	Moderate	Low
High	Major	Major	Moderate
Medium	Major	Moderate	Minor
Low	Moderate	Minor	Minor
Negligible	Minor	Minor	None

Table 7-12 – Significance matrix of effects on waters

Significance	Typical criteria	Description
Major	A fundamental change to the environment	Changes in water quality or quantity affecting widespread catchment area, or changes resulting in substantial loss of conservation value to aquatic habitats and designated areas.
Moderate	A material but non-fundamental change to the environment	Changes in water quality or quantity affecting part of a catchment area or changes resulting in loss of conservation value to aquatic habitats or designated areas.
Minor	A detectable but non-material change to the environment	Local changes in drainage patterns or changes resulting in minor and reversible effects on quality or aquatic habitats.
Negligible	No detectable change to the environment	No effects on drainage patterns and water quality or aquatic habitat.

Table 7-13 – Criteria for assessment of significance of the effects on waters

In the above classification, fundamental changes are those which are permanent, detrimental and would result in widespread change to the environment.

The significance of impacts on the catchment areas in the project region assessed based on the above approach is presented in the following table.

Catchment	Typical effects and magnitudes	Significance
Crna River (low sensitivity)	Magnitude generically assessed as negligible. Key effects are from access roads and of short-term nature. Use of existing forest tracks would reduce effects of constructing new access tracks.	Minor
Crn Drim River (high sensitivity)	Magnutide assessed as negligible. Key effects are from access roads and forest cut / tree felling and of short-term nature. Use of existing forest tracks would reduce effects of constructing new access tracks.	Minor

Table 7-14 – Significance of impacts on the catchment areas in the project region

7.5 Impacts on Soils

7.5.1 Sensitivity Classification of Soils

The indicative criteria for the sensitivity of soils in the project region are based on a number of factors including international and national designations, existing literature and geology maps, site visits and professional judgment. These criteria have been used to guide the analysis of the sensitivity of soils along the OHL proposed route. The criteria are listed in the table below.

Sensitivity	Criteria
High sensitivity	• Designated area as important geological site • Steep / unstable sloping ground susceptible to excessive or intensive erosion
Moderate sensitivity	• Lesser sloping grounds • Soils that may support arable agriculture
Low sensitivity	• Soils that may support pastures • Soils in developed areas • Flat and well consolidated soils

Table 7-15 – Sensitivity classification of soils

The table below summarizes the areas along the proposed route that are classified as areas with high soils sensitivity. These areas are identified in Section 4.1.6 as susceptible to intensive erosion.

High sensitive area	Key sensitivity issues
Hilly terrain, along the northern side of the main road Bitola – Resen.	Unstable sloping ground with absence of vegetation and susceptible to erosion
Sothern and south-western slo[es of Bigla Mountain	Unstable sloping ground susceptible to excessive or intensive erosion
Jablanica Mountain	Steep / unstable sloping ground susceptible to excessive or intensive erosion

Table 7-16 – Sensitivity of high sensitive soils along the route of the transmission line

7.5.2 Potential Impacts on Soils

The potential impacts of the proposed transmission line on the geological structures and soils during construction would be in the form of soil degradation and erosion, and violation of certain geological formations due to:

- Construction of access roads and construction of towers
- Excavation for construction of tower foundations
- Spillage of oils and fuels from vehicles
- Inadequate waste management

The risk of soil erosion is limited to the zones identified as susceptible to erosion (Section 4.1.6), mainly along the access tracks and to localities where the preparation, assembly and installation of the towers will be done.

The table below represents an overview of the generic potential impacts on the soils associated with construction activities for the proposed 400 kV transmission line.

Project component	Potential impact
Geology and soils	
Construction of access roads, earthworks and construction of towers	• Loss of deposits / soils through excavation and removal for construction purposes • Increased erosion of deposits / soils through removal of surface cover, including forest cut and vegetation clearance • Compaction of soft ground leading to an alteration in the structure of the deposits / soils. This includes loss of agricultural land through compaction of agricultural soils. • Pollution risk from fuel and oil spillage
Hydrogeology occurrences and objects	
Construction of access roads, earthworks and construction of towers	• Potential direct and indirect pollution of aquifer rock masses (hydro-geological collectors), through infiltration of fuel, oil, or cement solution from vehicles and construction machinery

Table 7-17 – Overview of potential impacts on soils during construction

7.5.3 Assessment of the Potential Impacts on Soils in Sensitive Areas

A typical methodology was used to assess the impacts on soils from the proposed project and is presented below. This methodology has been commonly used in similar types of projects as the proposed 400 kV transmission line Bitola – Macedonian/Albanian border (to Elbasan, Albania).

Criteria for impact magnitudes are given in the table below.

Level	Typical criteria
High	Total loss or adverse change of key characteristics and quality (large scale removal of soil or total loss of agricultural land, large fuel and oil spillage, intensive erosion, etc.)
Medium	Loss or change of key characteristics and quality (partially loss of agricultural land, long term ground compaction – alteration of soil structure, etc.)
Low	Small detectable changes, but the characteristics and quality would

	be similar to pre-project conditions (temporary removal of surface cover, etc.)
Negligible	Very small changes, which are not easily distinguished (short term ground compaction due to vehicles movements, etc.)

Table 7-18 – Criteria for assessment of magnitude of impacts on soils

The significance of effects is typically assessed as a combination of sensitivity and magnitude as presented in the following table.

Significance matrix for impacts on soils			
Magnitude	**Sensitivity**		
	High	**Moderate**	**Low**
High	Major	Major	Moderate
Medium	Major	Moderate	Minor
Low	Moderate	Minor	Minor
Negligible	Minor	Minor	None

Table 7-19 – Significance matrix of effects on soils

Any major or moderate effects from the significance matrix are to be considered as potential significant effects.

The significance of impacts at the high sensitive areas along the proposed OHL route assessed based on the above approach is presented in the following table.

High sensitive area	Typical effects and magnitudes	Significance
Hilly terrain, along the northern side of the main road Bitola – Resen.	Magnitude of the effects is generically assessed as negligible to low. Key effects are: • Loss and disturbance of soil deposits through extraction and removal • Increased erosion through surface cover loss • Temporary compaction of ground through construction works, construction of access tracks and vehicle movements	Minor
Sothern and south-western slo[es of Bigla Mountain		Minor
Jablanica Mountain		Minor

Table 7-20 – Significance of impacts on soils in the high sensitive areas in the project region

7.6 Impacts on Biological Diversity

7.6.1 Impacts on Biological Diversity during Construction

Generally, the construction activities of the proposed 400 kV transmission line will affect the biological diversity (vegetation, the autochthonous flora and fauna communities and natural habitats) in various ways. These impacts could be grouped as listed below:

- Degradation of certain plant communities and removal of vegetation
- Degradation of some animal communities by affecting the communication between habitats (fragmentation of habitats)
- Wildlife disturbance and/or (temporary) migration caused by noise, and the presence of humans and mechanization

- Disruption of nesting birds or breeding animals due to disturbance and noise during construction activities
- Dust deposition and pollution on habitats
- Pollution of habitats from construction waste
- Risk of fire in vicinity to construction sites
- Potential erosion processes on inclined habitats (mountain slopes) leading to degradation of conditions needed to support biodiversity.

However, it should be noted that the impacts on biodiversity during the construction phase are short-term and will be reduced to minor with implementation of appropriate preventive measures and procedures.

The impacts on biodiversity during the project construction stage are described in the following sections.

7.6.1.1 Impacts on Habitats and Flora

Impacts on Forests

Main construction impact as well as operational requirement of potential significance is the need in certain areas to provide and maintain a corridor where the proposed transmission line is routed through forest. The scale of adverse impact in a particular area is related to the nature conservation importance of the woodlands through which this corridor is required. The actual impact would depend on past management, the existing structure and species composition of the woodlands affected.

An impact on forest habitats is expected in areas where oak-European hornbeam forests, beech and sessile forests and black plantations are distributed. Such impact is most significant in areas where transmission line route is new one. Negative impact on forests from the construction activities will be various, but mostly it will be demonstrated in two ways – loss of biomass (economic value) and fragmentation effect. The table below presents the affected forest habitats in relation to wood biomass loss.

Forest type	Affected surface (ha)	Unit wood volume*) (m^3/ha)	Total affected volume – cut (m^3)
Beech forest all types	21	233	4,893
Oak forests (Italian and Turkey, Downy and Sessile forests)	35	130	4,485
Black pine natural forests	22	130	2,743
Total:	**78**		**12,121**

Table 7-21 – Forest habitat types under impacts from construction activities

*)There is no available Macedonian national reference (stand classification parameters) for interpreting wood volume per area unit (hectare). For the purpose of this ESIA, parameters for similar forest types are used, as presented in Brankovic et al. (2008): National Forest Inventory of the Republic of Serbia. For mixed forest stands, average values for their typical / dominant trees / forests are used.

For the calculation of wood volume that has to be cut during construction of the proposed transmission line, different forest types (different wood species have different production and accumulation of wood biomass) were taken into account and deep dales and valleys were excluded from the calculations since they will not be affected. It was calculated that, for a 30 m wide zone, 78 ha of forests will be directly affected and 12,121 m^3 of wood will be cut. The area with the forest cut mainly covers the biggest part of the route Gjavato-Sopotsko-Svinista-Vapila and from Radolista to the Macedonian-Albanian border. The impact is considered of major significance. Degraded and hornbeam forests that reach up to 10 meters high and shrub vegetation will not be affected due to the fact that there is no need for their cut in the areas that proposed transmission line crosses such forests.

However, clear cut of forest and shrub vegetation need to be done at sites of the OHL (angle and suspension) towers as well as along routes for construction of new or expansion of existing access roads to construction areas, in the case where these roads pass through forest /shrub areas. At this project stage, length and area of new access roads and area for expanding existing roads are not known, so estimation / assessment of areas with clear cut of forest and shrub vegetation cannot be precisely done. As an assumption, it could be estimated that clear cut of forest and shrub vegetation for the access roads would affect length of maximum 30% of the total length of OHL (approx. 90 km) for average road width of 6 meters, which results in an area of approx. 18 hectares maximum.

Ecosystem value (ecosystem services) of all forest types will be irreversibly (moderately to significantly) affected because forests will be damaged to a certain level.

Impact on forest fragmentation was assessed as low due to the fact that the forests in the area of interest are already fragmented, the actual level of fragmentation is low since clearing of the forest belt of approximately 30 m width represents the distance that can be passed by almost all vertebrate animals and most of invertebrates, and the surface in the clear-cut belt will not be transformed into artificial ground, since shrub vegetation will continue to grow.

Wetland Habitats

Riparian forests and belts along the rivers and streams are among the most sensitive habitat types. However, in the case of this project no significant impacts are expected since these habitats are distributed in the dales, ravines or valleys which will be crossed over by the OHL wires. The willow stands are not very tall except in rare cases and no major cuts are expected (Satevska river and Crni Drim). Reeds (between villages Volino and Moroista) will be hardly affected by the construction of proposed transmission line (by eventual discharge of matters from construction sites or wastewater from camping sites for the workers, disposal of solid municipal waste, etc), while the opening of possible access roads may cause direct destruction of part of this habitat. Therefore, during the OHL construction, direct destruction of alder communities or modi-

fication of hydrological regime in their biotopes is possible, while no major problems are expected in relation to willow belts.

Meadows

The proposed transmission line passes through few meadows and pastures. While posting of towers on such habitats will have negative impact, the rest of the transmission line will not have significant impact. The impacts will be represented by land occupation and habitat destruction. This loss of habitat is not considered to be significant, although actual effects depend on the final layout of the working area. However, these areas would not all be disturbed and most vegetation affected would recover over the short to medium term since grazing on meadows by wild and domestic animals will continue. Also, vegetation of grassy areas could be affected with the construction of new access roads and expanding existing roads. The level of the impact could be assessed as low (insignificant habitat loss and insignificant species loss).

Anthropogenic Habitats

Impacts on agricultural land, orchards and vineyards, rural and urban habitats will be low and insignificant, although destruction of certain parts of the prementioned habitats will be direct through the construction of towers and construction of new access roads.

Protected Areas

Careful OHL route alignment has sought to identify a line which bypasses all existing protected areas in the project region and, consequently, avoids any eventual impact on their natural values or their protection status.

Therefore, no impacts from the construction will occur on protected areas. In a case of Jablanica Mountain, which is an area proposed for protection, the OHL route passes through its peripheral part and does not affect its core areas or any other important areas.

7.6.1.2 Impacts on Fauna

Main impacts on different fauna groups from the construction of the proposed transmission line can be classified as disturbance and loss or fragmentation of habitats. For the fragmentation impacts, see section on forest fragmentation in this chapter.

Construction involving clearing of vegetation, excavation of soils, movement of vehicles or equipment over roads and terrain, loading and unloading of materials and other activities can result in injury or mortality of animals. Such impacts can be significant if they involve large numbers of organisms, occur on a regular basis or affect animal populations that are particularly sensitive, unable to reasonably compensate the losses, or are already low in numbers.

Migratory pathways can be affected in a way that seasonal migration patterns can be interrupted or modified. On the other hand, habitat modifications can

create positive effects: increasing the availability of forage area (at least for certain species) and improving overall habitat diversity.

Situations where workers can perform illegal activities in relation to use of biological resources (e.g. poaching) may appear during construction of the proposed OHL.

Birds

The proposed transmission line could enhance the increased temporary disturbance to birds during construction, due to the general presence of human activity in many areas that are otherwise subject to generally low human disturbance levels. More specifically, species that have a relatively high adult survival and low breeding rate for which even low levels of mortality or reduced breeding success could be significant.

During the breeding season, disturbance effects would be greater in open areas where construction workers and machinery would be visible from a wider area. Levels of disturbance would also depend on the sensitivity of the species. Sensitivity to disturbance would depend on the stage of the breeding season, with birds being particularly prone to disturbance at egg-laying and chick-hatching stages.

The impact on birds during construction can be estimated as moderate and reversible.

Mammals

There is potential of direct loss of resting up sites through construction works, including: tower foundations; access track construction and woodland felling to create the transmission line corridor. Most mammal species would use a number of different resting up sites and bats would use a number of difference roost sites throughout the year. In many cases, loss of any one of these sites is unlikely to have an impact on the species population. During breeding and rearing seasons (from March to July or August), animals may not be able to leave the area to avoid disturbance. The impact could be estimated as low and reversible.

Invertebrates, amphibians and reptiles

Impacts during the construction activities for invertebrates, amphibians and reptiles arise from construction activities and from the construction/upgrading of access roads, causing habitat loss. In addition, potential effect during construction concerns direct destruction of the populations of amphibians and reptiles, as well as invertebrate fauna due to mortality from vehicles. The significance of the above impacts could be assessed as low.

7.6.2 Impacts on Biological Diversity during Operation

No significant impacts are expected on the flora and the fauna in general, and on the endemic, rare or endangered species in particular, during operation stage.

The adverse impacts of the project on the biodiversity of the affected area are expected to be restricted to the OHL route, but they will be expressed on lon-term basis.

7.6.2.1 Impacts on Habitats and Flora

Impacts on Forests

During the operation of the proposed transmission line, regular cleaning of the forest shrubs and seedlings in the belt of the predetermined width will be performed. However, the operation of the project will make this impact permanent, at least for the duration of the life of the proposed transmission line. Thus, the impact from the project operation could be defined as fragmentation effect only and not habitat destruction. As far as fragmentation is concerned, it was assessed as of low intensity impact. Due to natural succession processes, re-vegetating of the areas being cut shall mitigate, over the time, forest / habitat fragmentation effects.

Impacts on Flora

Plant species that will be affected during the project operation and maintenance are tree species directly below the proposed transmission line - cutting of immature tree individuals. Uncontrolled growth of tall trees and accumulation of vegetation within the corridor may result in power outages through contact of branches and trees with transmission lines and towers, ignition of forest and brush fires, corrosion of steel equipment, blocking of equipment access and interference with critical grounding equipment. Regular maintenance of the line corridor to control vegetation will involve the use of mechanical methods, such as mowing, weed cutting, tree trimming, inspections, tower and foundation repairs, and maintenance of damaged/downed transmission wires or pruning machinery. This impact will be significant but on very limited surface, long-term and partly reversible with re-vegetation.

7.6.2.2 Impacts on Fauna

Birds

Birds are potentially most vulnerable animal group vis-à-vis operational transmission lines, due to following risks:

1. Bird collision with OHL conductors, especially the larger species of birds (geese, ducks, swans, and birds of prey), as well as collision of smaller birds with OHL conductors during wanderings in larger clusters and migration.

Mortality due to collision is considered potentially to represent the most important operational impact of transmission lines on birds. Birds can collide with power lines because they can be difficult to see, although the degree of risk depends on a number of factors. These relate both to the species and their behavior, environmental factors and type and design of the power lines themselves. However, collisions are not thought to be random but are often concentrated in

relatively short sections of a power line, where these factors interact to create a collision problem or "hotspot" (e.g. Morkill & Anderson 1991, Brown & Drewien 1995, Guyonne *et al*. 1998). The majority of bird collisions appear to be associated with earth wires (e.g. Scott *et al.* 1972). Therefore, birds seem to be generally capable of recognizing the supporting towers and conductors, but the earth wire can in certain situations appear almost invisible (APLIC[9] 1994). Also important is that birds may take avoiding action of the towers and conductors by increasing flight height, resulting in collision with the earth wire.

Besides darkness and low visibility at twilight, environmental conditions such as fog, dense clouds and several types of precipitation, reduce the visibility of power lines, which increases the collision risk for birds. Certain characteristics of the landscape, such as rivers and mountain valleys, concentrate birds into certain flight routes. Power lines crossing narrow rivers bordered by trees taller than the height of the power line have a lower collision risk than broad rivers because most birds will fly over the tree tops and cross the valley way above the power line. The placement of a power line close to areas where large numbers of birds congregate, can lead to a higher collision risk if these birds are regularly disturbed.

In the project area, bird species that can collide with the OHL wires are *Aquila chrysaetos* (golden eagle)*, Gyps fulvus* (griffon vulture) and *Circaetus gallicus* (short-toed eagle). Historically, almost all wildfowl species are found as collision victims.

Pelagonia and Struga area are areas along the proposed transmission line which are assessed as sensitive for potential impact on birds due to collision.

Empirical data regarding the population effects of collision mortality on most species are not available and predicting collision risk and therefore significance of this impact is difficult. However, APLIC (1994) states that most researchers agree that collisions are not a biologically significant source of mortality for thriving populations of birds. Having in mind size and ecological characteristics of aforementioned areas, overall impact on birds based on expected mortality due to collision hazard could be estimated as minor to moderate.

2. Electrocution, which is the biggest threat to birds from an operational transmission line. This usually happens to the larger bird species, but may occur to some small species (the size of sparrows and starlings).

There are several reasons for electrocution, mainly:

- Inappropriate locations of the transmission line conductors and isolators.
- Contact of the bird faeces in semi solid state with the phase conductor, which is the cause for electrocution and death of birds. These cases are typical for rainy days.
- Contact of two phases or two conductors with different voltage, with larger birds.

Mortality due to power line electrocution is directly related to the spacing between elements that can comprise a phase-to-phase or phase-to-ground contact

[9] Avian Power Line Interaction Committee – APLIC (www.aplic.org)

(e.g. via earth wires or towers). The risk of electrocution varies for different power line designs. High voltage or transmission lines (220 kV or greater) typically comprise steel structures or towers around 25-50 m high, with conductors that are spaced 3 meters or more apart with large insulators. Electrocution of birds is primarily caused by direct contact involving simultaneous skin-to-skin or foot-to-skin with two conductors or a conductor and an earth wire. Large size (in terms of wingspan, length of reach and tail length) is by far the most important factor that makes birds susceptible to electrocution. Risk is also potentially increased when birds undertake display or territorial defense behavior.

Most of the mentioned reasons that may lead to electrocution are low probable and may not pose significant threat to the bird fauna. It is not expected that electrocution will happen during operation of the proposed transmission line since the distance between the conductors is large enough, more than 500 cm, even for the biggest known birds in Macedonia.

It should be stated that transmission lines, poles and towers may be of benefit to birds, such as storks, raptors and corvids, for nesting, roosting or perching, especially in areas where suitable natural nest sites and roosting substrates are rare, such as in cultivated areas and plains[10)].

Other fauna

The proposed operational OHL could have minor impacts on other fauna groups including herpetofauna, invertebrates and mammals. After the completion of the construction phase, these animals will have adjusted their life cycle to new, partly changed living environment with new physical objects (towers, wires, access roads) and open space habitats due to periodical forest cut.

7.7 Visual and Landscape Effects

7.7.1 Introduction

Landscape effects can be defined as the result of physical changes to the landscape arising as a result of new development, or from indirect effects such as poor management, resulting in the deterioration of a landscape. Such physical changes may include the addition, alteration or removal of trees and woodlands, structures (overhead transmission towers, buildings, walls, etc), or other features such as roads. Landscape effects may be positive (beneficial) or negative (adverse) or neutral (no overall change or a balance of positive and negative effects).

Visual effects relate closely to landscape effects but concern changes in views. Visual assessment relates to people's perception and response to changes in visual amenity, i.e. the value of a particular area or view in terms of what is seen. Effects may result from new elements located in the landscape that cause visual intrusion (i.e. interference with or interruption of the view) or new features that physically obstruct views across the landscape. Visual effects may

[10)] MEPSO, in cooperation with the Macedonian Ecological Society (MES), has started implementation of a project for installment of a number of platforms for nesting of the Imperial Eagle (*Aquila heliaca*) on high-voltage (400 kV) transmission lines in the Ovce Pole region in East Macedonia.. These platforms will serve as replacement of the natural nests built by the eagles on the power lines.

also occur where a new view results from the removal of trees or other existing obstructions. Visual effects may be positive (beneficial) or negative (adverse) or neutral (no overall change or a balance of positive and negative effects).

In a general context, the visibility of objects in the landscape relates to a range of factors. These are: (i) the distance from the viewer to the object; (ii) the extent to which landform, vegetation cover or structures such as buildings may interrupt, or screen all or part of the view; (iii) the degree of solidity of the object in question, and (iv) the extent to which the object differs in colour from its background. In addition, the extent to which the object 'breaks' the horizon is also important in affecting its visibility.

For OHL towers, the open lattice structure allows the background to be seen through the structure and the structure itself reduces in importance as the distance from the viewer increases. Therefore, the OHL towers are less visible than more solid structures of the same size. According to experience, in normal weather conditions, overhead line towers are not normally observed by an average viewer, at a distance greater than 10 km, even when viewed against the skyline. In addition, where the background is a varied colour or pattern, this is more effective in reducing the visual effect of towers than where the background is a dark or uniform colour, such as occurs with conifer plantations.

The proposed 400 kV overhead transmission line is likely to be visible from the roads in both the immediate and wider area around the route of the line. Adverse effects are most likely, however, in areas closest to, or on roads which pass beneath the line. Views from roads are transient views, in that the view changes as the traveler passes through the landscape, and are therefore less sensitive than views from fixed locations such as residential properties.

Based on past experience it can be concluded that the visual aspects associated with OHL developments do not represent a crucial aspect for their acceptance by local population and it is likely that the majority of the communities will regard the visual impact as being acceptable. The OHL towers will be more noticeable at first, but nearly all people would become adapted to them so they become part of the landscape.

7.7.2 Typical Methodology for Assessment of Landscape Effects

A typical methodology was used to assess the landscape effects from the proposed project and is presented below. This methodology has been commonly used in similar types of projects as the proposed 400 kV transmission line Bitola – Macedonian/Albanian border (to Elbasan, Albania).

Landscape effects could be typically assessed using a combination of factors:

- The sensitivity of the landscape (as identified in the table bellow). The degree to which change from a particular development can be accommodated also takes into account aspects such as land use (the function of the landscape), the pattern / diversity and scale of the landscape, its openness, the value of the landscape resource including areas designated for such value.

Sensitivity	Typical criteria	Typical scale	Typical exam-ples
High	Landscapes that are: • Highly valued / important scenic areas • Particularly rare or distinctive • Susceptible to small changes	International National	• World Heritage Site • National Scenic Area / Protected Landscape
Moderate	Landscapes that are: • Valued more locally • Tolerant of moderate levels of change	Regional Local	• Area of Great Landscape Value • Undesignated area but valued (demonstrable or specific land use)
Low	Landscapes that are: • More common place • Potentially tolerant of noticeable change • Undergoing substantial development	Local	Undesignated area

Table 7-22 – Criteria for assessment of landscape sensitivity

- The scale or magnitude of effects (as identified in the table bellow), considering the degree of change to the landscape resource.

Level	Typical criteria
High	A noticeable change to the landscape over a wide area or an intensive change over a limited area
Medium	Minor changes to the landscape over wide area or noticeable change over a limited area
Low	Very minor changes to the landscape over a wide area or minor changes over a limited area
Negligible	Not relevant to this project with reference to landscape effects

Table 7-23 – Criteria for assessment of magnitude of landscape effects

The significance of effects is typically assessed as a combination of sensitivity and magnitude as presented in the following table.

Significance	Typical criteria	Description
Major	A fundamental change to the environment	Noticeable change to a highly sensitive or nationally valued landscape, or intensive change to less sensitive or regionally valued landscape
Moderate	A material but non-fundamental change to the environment	Noticeable change to a landscape tolerant of moderate levels of change, or minor change to a highly sensitive or nationally valued landscape
Minor	A detectable but non-material change to the	Minor changes to a landscape considered tolerant of change

	environment	
Negligible	No detectable change to the environment	No discernible change to the landscape

Table 7-24 – Criteria for assessment of significance of landscape effects

7.7.3 Visual Effects of the Proposed Transmission Line

The proposed transmission line does not pass through or in vicinity to important scenic areas or areas of landscape that is highly valued, rare or distinctive. Overall, the landscape along the proposed OHL route is not sensitive and is tolerant to changes and this is reflected in the absence of any designations.

Careful corridor alignment resulted in avoidance of all existing protected areas / scenically important areas in the project region.

The proposed OHL is considered within the sections relating to the key physical and visual properties of landscape types identified along the corridor.

The proposed transmission line will be visually exposed and visible where its route passes through open terrains. Such cases are the OHL sections in Pelagonija Field and Struga Field. These areas represent large-scale open and flat landscapes with number of anthropogenic land uses and developments and as such their scenic quality is low and tolerant to change. Therefore, the proposed OHL would be experienced as part of the wider landscape and would cause only indirect visual effects in conjunction with existing features in the landscape. Number of transmission lines exists in the area around the starting point of the proposed OHL – the existing SS Bitola 2 in Pelagonija Field - and therefore cumulative impact on the landscape seen from different viewpoint in this area is expected. In certain sections in the Struga Field, the proposed OHL passes close to the existing 110 kV OHL Bitola-Resen-Ohrid-Struga and limited cumulative impact is likely.

The OHL section between the roads Bitola-Kicevo and Bitola-Resen (locality Korija) represents hilly open landscape on altitude between 600 and 1,000 m a.s.l. which would shelter the proposed OHL and it would not be exposed to the transient viewers, i.e. travellers using the roads. The OHL section from locality Korija to locality Prevalec passes in parallel with the road Bitola-Resen and will be visible from this road, eventually occasionally sheltered by the topography.

The area from the locality Prevalec up to the locality Djavato is flat open landscape with mainly agricultural land use. As such, this landscape could be classified to be of low sensitivity and tolerant to change. The proposed OHL would be visible from the road Bitola-Resen but experienced as part of the wider landscape and would cause only indirect visual effects in conjunction with existing features in the landscape.

From the locality Gjavato to village Sopotsko, further on to village Zlatari and Kriveni (Resen region), the proposed OHL route would pass distant from the road Bitola-Resen, through hilly and mountainous terrain. Therefore, the pro-

posed OHL would not be visible from the road with certain exceptions in the area around the village Gjavato and from the road section from village Jankovec to village Izbista. It will be exposed to local residents in the area at the crossing points with the local roads leading to Sopotsko, Zlatari and Kriveni.

The OHL section from village Leva Reka to village Svinista, further on to Rasino in Ohrid region will be not be exposed to the road Resen-Ohrid as it would be sheltered by the topography and vegetation. Due to the reason that in this section, the proposed OHL will follow the corridor of the existing 110 kV OHL Bitola-Resen-Ohrid-Struga, cumulative visual effect and additional fragmentation of the landscape in this area is expected. The proposed OHL will be exposed to local residents in the area at the crossing points with the local roads leading to settlements on the region (Svinista, Rasino, Vapila, Livoista and Sirula).

The section of the proposed OHL which passes through lower parts of the Jablanica Mountain will be exposed to the residential areas along the local road Dolna Belica-Radolista, sheltered in particular sectors by the topography. Due to scenic values, the landscape in this area could be classified to be of moderate sensitivity, but due to existing developments and various infrastructure, it could be considered as tolerant to moderate change.

The proposed OHL route avoids highly valued scenic landscape and touristic areas along the western shore of the Ohrid Lake at the area of village Radozda as experienced from the lake.

7.7.4 Visual Effects of the New Substation

The substation in Livoista (Ohrid area) will be a newly introduced structure in the landscape of the location and as such will change the physical appearance of the particular area. In terms of its scenic values, the landscape at the location could be classified to be of low sensitivity as it is tolerant to change and is not valued as scenically important.

The location is not exposed to any regional road and will not cause any negative visual effect for transient viewers.

The location is exposed and visible to the people living in the residential properties on its south-eastern side – residents of village Livoista. The substation itself will not have a significant visual effect on these residents as it is located on distance of more than 1,000 meters and would be occasionally sheltered by existing vegetation.

7.7.5 Cumulative Visual Effects

Cumulative visual effects arise where it is possible to see more than one development of a similar type on the skyline. In general, such developments in a case of the proposed transmission line would be other overhead lines or wind farms. During the time this ESIA was carried out, there were no other OHL and wind farm development applications in the wider region of the project area.

7.7.6 Summary of Visual Effects

Following table summarizes the visual effects on the landscape along the proposed transmission line.

Area / Landscape	Sensitivity of the landscape	Magnitude of the impact	Significance of the impact
Pelagonija Field, including substation Bitola 2	Low • not valued as scenically important • tolerant of noticeable change • existing human intrusion • undergoing substantial development	Low • minor changes over a limited area • indirect effects in conjunction with existing features in the landscape	Negligible No discernible change to the landscape
Sections: • Bitola –Resen • Resen - Ohrid	Low • tolerant of noticeable change • existing human intrusion	Low to medium • minor to noticeable changes to the landscape over a limited area • OHL mainly sheltered to distant viewers by forest and topography • Occasionally exposed to the road Bitola-Resen • Exposed to local roads	Minor A detectable but non-material change to the environment (changes to a landscape considered tolerant of change)
Locality of the new substation (Livoista, Ohrid region)	Low • not valued as scenically important • tolerant to noticeable change • common area	Low to medium • noticeable change over a limited area	Minor A material but non-fundamental change to the environment (noticeable change to a landscape tolerant of change)
Struga Field	Low • not valued as scenically important • common area • tolerant of noticeable change • existing human intrusion • undergoing substantial development	Low • minor changes over a limited area • indirect effects in conjunction with existing features in the landscape	Negligible No discernible change to the landscape
Jablanica Mountain	Moderate • Valued landscape in wider context • Tolerant of moderate levels of change	Low • minor changes to the landscape over a wide area • OHL sheltered	Minor A material but non-fundamental change to the environment (noticeable change to

	• existing human intrusion	by topography and forest	a landscape tolerant of change)

Table 7-25 – Summary of visual effects

7.8 Waste Generation

During its life cycle, mainly during the construction, the proposed transmission line will create different types and fractions of waste, including municipal waste, packaging waste and waste from construction activities. Additionally, creation of minor quantities of certain fractions of hazardous waste (paints, varnishes, adhesives, anti-corrosive substances, etc.) is expected, as in the phase of construction, and in the operational phase.

Construction phase

At this stage, the main source of waste will be the construction activities themselves, and waste generated by the workforce.

Taking into consideration the fact that most of the total volume of construction activities will be of a prefabricated type, the amount of construction waste will be not significant. The fractions of waste that will be created as a result of construction activities are in relation to the types of materials and equipment to be used during the performance of the various construction stages (earth and concrete works, electro-mechanical works, installation works, etc.).

Technical maintenance of construction machinery and other vehicles will not be conducted within the construction zones. For these reasons, creation of waste, characteristic for this type of activity (used tires, batteries, oils, etc. from vehicles) is not expected.

Fuel storage facilities would not be necessary and therefore would not be provided within any construction areas or contractor's compound. Where fuels are taken to site, this would be restricted to the minimum amount required for the plant and equipment on site. Tanker vehicles will be used for that purpose.

Solid and sanitary wastes will be produced by the workers during their stay on construction sites. The soild waste is municipal waste and according to its composition is similar to the waste from the households.

Wood and vegetation clearance along the proposed transmission line will generate wood and other organic wastes. These wastes will normally be composed of branches, the tops of the trees and small dead trees unacceptable for timber processing. They will be retained and redistributed on the site which would allow production of nutrient capital and facilitate natural regeneration. Depending on the site conditions this waste may serve for matting purposes for access roads which will allow shelter to the ground.

The table below gives an indicative overview of the expected types of waste during the construction, systematized according to the classification in the European Waste Catalogue and the Macedonian List of Wastes.

group 02 – Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing	
02 01 07	Waste from forestry
group 15 – Packaging waste	
15 01	Packaging waste, paper and cardboard, plastics, wood, metal, composite packaging, glass, etc.
group 17 – Construction and demolition waste	
17 04	Waste from metals
17 05 04	Waste from land excavation
17 06 04	Isolation materials (that don't contain asbestos or dangerous substances)
17 09 04	Other construction waste (mixed waste)
group 20 – Municipal waste (+ similar waste from the industry), including fractions of selected waste	
20 03 01	Mixed municipal waste
20 03 07	Bulky waste

Table 7-26 – Expected waste types during construction

Operational phase

During its operation, the proposed transmission line will create waste that will result from the activities of MEPSO regarding the maintenance and control of the installation.

Common types of waste that will be created in the operational phase of the project include electrical waste (consumables, spare parts and obsolete equipment), as well as packaging waste and waste from use of tower coating - paint.

The tables below give an indicative overview of the expected types of waste during the operation, systematized according to the classification in the European Waste Catalogue and the Macedonian List of Wastes.

group 08 – Waste from use of coatings (paints, varnishes, etc)	
08 01	Wastes from use and removal of paint and varnish
group 15 – Packaging waste	
15 01	Packaging waste, paper and cardboard, plastics, wood, metal, composite packaging, glass, etc.
group 16 – Waste not otherwise specified in the EU Catalogue	
16 02	(discarded) Wastes from electrical and electronic equipment

Table 7-27 – Expected waste types during operation

8 Socio-economic Impacts and Opportunities

8.1 Methodology

This social impact assessment provides an analysis of the possible impacts from the proposed transmission line on the people within their societal setting. Potential direct and indirect socio-economic impacts of significance from implementing the proposed project are assessed. Recommendations on how the identified negative externalities may be mitigated and who should be responsible for implementing these mitigating measures are included in this assessment.

A survey of key stakeholders was conducted and individual stakeholders interviewed in order to gather pertinent information. A combination of methodologies was applied:

i. Review of available technical specifications related to the proposed transmission line to predetermine potential societal impacts and to identify individuals and groups likely to be affected.

ii. Analysis of the relevant legislation.

iii. Observations of land use in close proximity to the proposed transmission line.

iv. Stakeholder engagement via consultation meetings with representatives of various stakeholder groups. An overview of the stakeholder consultation is given in Appendix 3. The stakeholder group includes:

   a. National authorities (ministries and agencies)

   b. Local authorities

   c. Inhabitants in local communities in the project area

   d. Non-governmental organisations (NGOs)

v. Secondary data have been collected and scrutinized. Review of various comparative studies and reports including available statistical material has been done.

vi. EBRD policy and EBRD Performance Requirements (PRs).

8.2 Local Attitudes

A number of consultation meetings with residents of the settlements in the project region was held throughout the ESIA process (see Appenidix 3). The overall impression gained during this consultation process is that there is clear understanding of the importance of the project regarding the necessity to improve power systems and electrical transmission infrastructure in Macedonia as well as support for the development of the proposed transmission line from Bitola to Elbasan in Albania as a step toward national and regional network improvement.

In general terms, the following concerns or opportunities were raised vis-à-vis the proposed project:

- Land acquisition and related compensation issues regarding land used by the proposed transmission line and the new substation.
- Exposure to the electric and electro-magnetic fields generated by operational electrical equipment.
- The continuing influence of an inadequate local electrical supply on the strength of local communities, on their ability to sustain themselves and take advantage of new and emerging economic opportunities as they arise. In general, the strengthening of the local electricity distribution system in a long-term context (improvement of voltage levels and security / reliability of the electricity supply), was seen as an eventual consequential benefit of the proposed project.
- Effect on agricultural activities and associated irrigation practices in particular areas along the OHL route (Pelagonija and Struga Field).
- The impact of construction and maintenance activities on individual households, on entire communities and on the infrastructure they depend upon. Of particular concern would be the project's impact on:
    - Local roads and tracks used by residents
    - Fields, field boundaries and waterways – rivers, streams and springs

8.3 Exposure to Electric and Magnetic Fields

8.3.1 Introduction

Electric and magnetic fields (often referred to as EMFs) and the electromagnetic forces they represent are an essential part of the physical world. Their sources are the charged fundamental particles of matter (principally electrons and protons). Electric fields are measured in volts per meter (V/m) or kilovolts per meter (kV/m). Magnetic fields are measured in microteslas (μT) or nanoteslas (nT). The amplitude of the electric field modulation depends on the voltage of the OHL equipment, which remains more or less constant as long as the OHL equipment is under operation. The strength of the magnetic field modulation depends on the electrical current (the load) carried by the OHL equipment, which varies according to the demand for power at any given time.

8.3.2 Legal Context

8.3.2.1 National Legal Context

There is no legislation in Macedonia related to the non-ionizing radiation which refers to the exposure limits of the EMF.

8.3.2.2 International Legal Context

In 1998, based on available information, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued recommendations for low-frequency fields exposure limits, listed in the "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)"[11)]. ICNIRP recommendations are applicable both to the long-term exposure of the general public and the short-term exposure at the industrial

[11)] This document could be found at www.icnirp.org

sites. The exposure limits established in the recommendations are widely accepted all over the world. They were adopted in:

(i) the Recommendation of EU Council 1999/519/EC of 12 July 1999 Limiting the Public Exposure to Electromagnetic Fields (0 Hz to 300 GHz), and

(ii) the Directive 2004/40/EC of the European Parliament and EU Council of 29 April 2004 on the Minimum Health and Safety Requirements regarding the Exposure of Workers to the Risks Arising from Physical Agents (Electromagnetic Fields).

Exposure of public		Industrial exposure	
Electric field	Magnetic field	Electric field	Magnetic field
5 kV/m	100 μT	10 kV/m	500 μT

Table 8-1 – Limit values for exposure to electric and magnetic fields (ICNPR / EU), 1998

In 2010, the ICNIRP issued a new guideline for Limiting Exposure to Time-Varying Electric and Magnetic Fields (from 1 to 100 KHz)[12]. The reference exposure levels of this new guideline are given in the table below. These limit values have not yet been adopted by the EC.

Exposure of public		Industrial exposure	
Electric field	Magnetic field	Electric field	Magnetic field
5 kV/m	200 μT	10 kV/m	1000 μT

Table 8-2 – Limit values for exposure to electric and magnetic fields (ICNPR), 2010

8.3.3 Calculations of Magnitudes of Electric and Magnetic Fields

8.3.3.1 Overhead Transmission Line

In Macedonia, in 1999 and 2001 the Faculty of Electrical Engineering (Skopje) conducted tests for human exposure to electric and magnetic fields near 400 kV transmission lines [Ref. 41 and Ref. 42].

Research results can be summarized as follows:

- The model for calculating the EMF near high-voltage OHL is based on standardized procedures, specified in the document "Electric and magnetic fields produced by transmission systems. The description of the phenomenon - Practical guide for calculating", issued by the Conference Internationale des Grands Reseaux Electriques (CIGRE) in 1980 in Paris. The results of the measurements were validated by comparison with recognized published reference results.
- The results of the calculation of the electric field with intensity of 5 kV/m (exposure limit value by ICNIRP) or more is limited in an area of about 9.5 m below the OHL conductor, and about 7 meters left and right of the outer conductors of the transmission line.

[12] This document could be found at www.icnirp.org

- The results of the calculation of the magnetic field show that, under symmetric regime, magnetic fields with an unacceptable intensity of 100 μT (exposure limit value by ICNIRP) or more are limited in an area of about 4 m below the OHL conductor, and about 2 meters left and right of each conductor of the transmission line.

In 2009, the Electro-Technical Institute "Nikola Tesla" (Belgrade, Serbia) has conducted a research on environmental impacts from overhead transmission lines and has proposed measures for protection against exposure of population and working force to electric and magnetic fields. This research included transmission lines with 110 kV, 220 kV and 400 kV. Its findings are presented in the Study on Environmental Impacts from 110 kV – 400 kV Overhead Transmission Lines and Protection Measures [Ref. 43].

The following table summarizes the calculated results for 400 kV OHL at maximum working regime for "Y" tower type, which will be used as tower type for the proposed 400 kV transmission line Bitola – Macedonian/Albanian border (further on to Elbasan).

Parameter		Unit	Tower type - "Y"
Minimum needed height of the lowest conductor that allows compliance with the limit values of exposure to EMF determined by the EU at the 1 m height from the ground		(m)	12.90
Maximum values of EMF at 1 m height from the ground in cases when the lowest conductor is on the minimum height as required above			
	Electric field:	(kV/m)	5.0
	Magnetic field:	(μT)	30.5
Minimum needed horizontal distance of a location on the ground from the outer conductor that allows on that location achievement of values for exposure to EMF with safety factor 10 *)		(m)	30.1
EMF values at the roof of building with height of 5 m above which OHL passes on a safety height determined in compliance with current technical legislation **)			
	Electric field:	(kV/m)	7.9
	Magnetic field:	(μT)	105.4
EMF values at a building which is located from the outer conductor on a safety distance determined in compliance with current technical legislation **)			
	Electric field:	(kV/m)	7.3
	Magnetic field:	(μT)	78.5

Table 8-3 – Calculated intensity of electric and magnetic fields

*) Safety factor is determined as ratio between EU limit values of exposure and actual values of exposure (measured or calculated). Electric field at safety factor 10 is 0.5 kV/m. Magnetic induction at safety factor 10 is 10 μT.

**) Regulation on the technical principles for construction of overhead power llines with nominal voltage of 1 kV to 400 kV

Based on the above data, the Study [Ref. 43] has concluded that:

1. The limited factor for determination of the minimum height of the conductor is the intensity of the electric field.
2. The safety factor 10 is achieved at distance of 35 meters from the outer conductor.
3. The values of the EMF resulting from an OHL that passes above a roof of a building at a height which is in compliance with the requirements with current technical legislation are higher than the EU limit values of exposure.
4. The values of the EMF resulting from an OHL that passes near building at the safety distance which is in compliance with the requirements with current technical legislation are higher than the EU limit values of exposure.

Following recommendations are given in the Study:

- ✓ It is recommended that the limit values for exposure should be in compliance with the ones defined on EU level.
- ✓ Safety factor 10 is recommended for schools, kindergartens and hospitals.
- ✓ Recommended minimum allowed heights of the phase conductors above the ground in the areas where long-term presence of people is likely is 13 meters.
- ✓ It is recommended to avoid crossings over buildings and residential areas. If such measure is not feasible, safety factor should be determined via measurement of EMF values. The safety factor needs to be higher than 5. If not, additional protection measures are required.
- ✓ Recommended minimum distance from buildings to the closest outer conductor is 30 meters.

In 2011, calculations of both electric fields and magnetic fields for the proposed OHL Lastva Grbaljska (Budva) – Pljevlja in Montenegro are performed by "Dalekovod Project" (Zagreb, Croatia) [Ref. 44]. The calculations have been performed for the following OHL parameters:

- Tower type: "Y".
- Minimum height of the OHL conductor from the ground (at the middle of the span): 11.26 m.
- Height of the calculation point: 1.6 meters above the ground.

An overview of the distribution of the electric field is given in the following figure. The highest value of the electric field is below the OHL conductors and its intensity is decreasing with the distance from the OHL. At the height of 1.6 meters from the ground at the middle of the span it would be 4.3 kV/m, which is lower than the limit value of exposure determined by the ICNIRP and EU regulations (5 kV/m). On approximately 30 meters from the OHL central axis, the intensity would be lower than 1.0 kV/m.

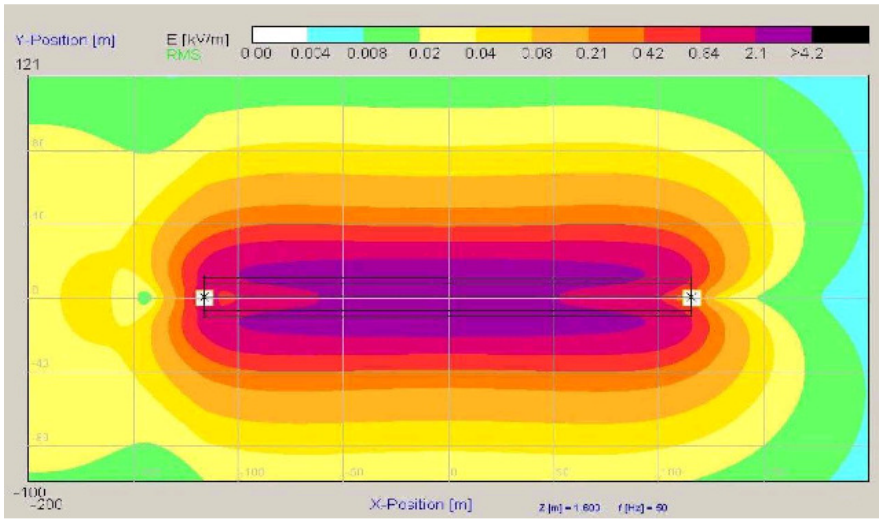


Figure 8-1 –- Distribution of the electric field (1.6 meters from the ground)

An overview of the distribution of the magnetic field is given in the following figure. The highest value of the magnetic field is below the OHL conductors and its intensity is decreasing with the distance from the OHL. At the height of 1.6 meters from the ground at the middle of the span it would be 39.2 μT, which is much lower than the limit value of exposure determined by the ICNIRP (200 μT (2010)) and EU regulations (100 μT).

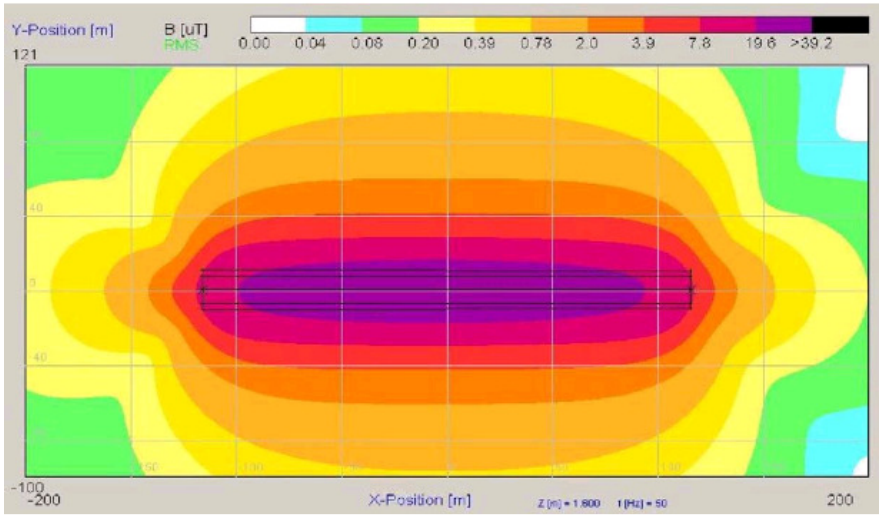


Figure 8-2 –- Distribution of the magnetic field (1.6 meters from the ground)

8.3.3.2 Substations

For substations, the highest fields found round the perimeter are normally those produced by the overhead lines entering or leaving the substation. The fields produced by the equipment within the substation are generally rather smaller.

Past research and measurements of the EMF associated with similar substations as the new substation in Livoista (Ohrid area) have shown that on height be-

tween 1.5 and 2 meters from the ground on critical locations in the substation (such as switch gear), the highest values of the electric field is around 10 kV/m [Ref. 44]. Hence, these values attenuate intensively with distance from the electrical equipment and on the edge of the equipment bays they are below 5 kV/m and on the substation perimeter the fall to value between 1 to 2 kV/m, which is below limit values for exposure.

The magnetic field generated in a substation attenuates much intensively than the electric field and on the substation perimeter they values are close to zero.

A safety zone in range between 50 to 100 meters around the substation perimeter would be proposed. This would ensure that EMF values in public accessible areas are well below the limit values.

8.3.4 Potential Impacts from Electric and Magnetic Fields

A person standing in the electric field beneath a 400 kV transmission line power line would have an alternating surface charge induced on his or her body and an associated alternating current induced within the body. Over the past 20 years it has been suggested that exposure to power-frequency magnetic or electric fields of the magnitude encountered in the environment could be linked with various health problems, ranging from headaches to Alzheimer's disease. The most persistent of these suggestions relates to childhood cancers.

A number of epidemiological studies have suggested an association between the incidence of childhood cancers and the proximity of homes to power transmission wires. Other studies, notably the world’s largest ever study of its type, conducted in the Great Britain during the 1990s, have failed to confirm such associations, but the statistical association remains. However, no causal link has been established between cancer or any other disease and EMF and indeed there is no established mechanism by which these fields could cause or promote the disease.

In terms of the potential impacts on human health from an operating transmission line, based on the above calculated fields magnitudes, the intensity of an electric field is considered as more dominant parameter than the intensity of a magnetic field.

In a case of the single circuit 400 kV OHL, the calculated EMF intensities are below limit values for exposure determined by the ICNIRP and EU regulations even at the location below the OHL conductors.The attenuation of the EMF intensity with the distance from the OHL central axis is very intensive phenomenon and outside of 50-60 meters wide OHL corridor (25-30 meters from the OHL central axis), the health risk of human exposure to EMF is insignificant.

The planned protection zone for the proposed single and double transmission lines is minimum 50-60 meters wide. No residential or other developments would be allowed within the OHL protection zone. The above, and the fact that the proposed OHL route does not pass in immediate vicinity to residential properties, lead to a conclusion that significant impacts to the population from the EMF generated by the proposed transmission line would not be likely.

8.4 Land Acquisition

Both publically and privately owned land will be affected by the implementation of project activities. Land acquisition (temporary and permanent) shall be conducted in accordance with the relevant Macedonian legislation[13)] and EBRD requirements, specifically – EBRD's PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement. All land purchases, temporary occupation of land and compensation issues will be guided by the development and implementation of a land acquisition and compensation framework and plans.

Some land will be permanently acquired, mainly land needed for the construction of the new substation in the area of the village Livoista (Ohrid region) (approximately 3.5 Ha)[14)], the construction of the towers of the proposed transmission line and access roads, where needed roads do not exist. Some of the affected land will only be temporarily occupied during construction, to enable access to areas where the towers will be built. The planning transmission line corridor is 500 meters wide, which will enable micro-alignments of the transmission line to additionally reduce impacts. For example, the transmission line will be aligned with the edges of properties and land plots, so that there is least possibility for severance of private land plots and land acquisition (as well as impacts on crops, trees, etc.) is reduced to a minimum.

During the operational stage, the project will not cause significant impacts on livelihoods of affected farmers and/or agricultural companies, as the transmission lines are facilities that are fully compatible with all forms of agricultural activity, i.e. they can continue during the project's operations.

All affected assets, including land, annual and perennial crops and plants, trees and any other assets (i.e. structures, irrigation systems), will be identified and compensated in accordance with Macedonian legislation and EBRD requirements. If land acquisition causes economic and/or physical displacement of people, as defined by EBRD's PR 5, appropriate measures to assist with restoration of livelihoods and standards of living will be included in the land acquisition framework and plans.

Any eventual loss of land, forest and other property, and possible damage during the construction phase, or during operation and maintenance of the infrastructure will be subject to compensation under positive Macedonian regulations and best international practices, as stipulated in the EBRD's PR 5. This PR applies to physical or economic displacement[15)], which can be full, partial, permanent, or temporary, with a main objective that no person should emerge from the project process less well off economically than at its beginning. The basic principle of this PR is that land-based compensation or compensation in-kind is preferred over cash compensation, where feasible.

[13)] Law on Expropriation (OG of RM no. 33/95, 20/98, 40/99, 31/03, 46/05 and 10/08).
[14)] No additional land is needed for the operations pertaining to SS Bitola 2, as they only involve upgrading of the substation.
[15)] Displaced persons may be classified as persons: (i) who have formal legal rights to the land (including customary and traditional rights recognised under national laws); (ii) who do not have formal legal rights to land at the time of the census, but who have a claim to land that is recognised or recognisable under the national laws; or (iii) who have no recognisable legal right or claim to the land they occupy.

8.5 Labour and Working Conditions

Occupational health and safety is a cross-disciplinary area concerned with the protection of the safety, health and welfare of people engaged in work or employment. The goal of all occupational health and safety programs is to foster a safe work environment. As a secondary effect, it may also protect co-workers, family members, employers, customers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment. It may involve interactions across many subject areas, including occupational medicine, occupational (or industrial) hygiene, public health, safety engineering, chemistry, health physics.

Both main project phases, construction and operation, will imply the engagement of a work force. The construction phase of the proposed transmission line will be much more demanding with a greater influx of workers in the area expected in this project stage.

In general, according to Macedonian legislation, employment may be on a permanent and/or a temporary basis. Depending on the concrete needs and project activities, the manner of engagement of the work force will be decision of the employer. In any case, the employer(s) and the employees would be obliged to follow the stipulations included in the various legal acts in the areas of labour and social protection legislation.

Protection of employees is recognised as a key priority in the construction and operation of the proposed transmission line and associated substations. Measures need to be outlined in terms of the protection of employees during the construction and operation of the project including: only qualified personnel undertaking tasks relevant to their duties, provision of suitable personal protection equipment, no activities to be undertaken in adverse weather conditions, provision of sanitary services and welfare amenities on site, and risk assessments and identification. These measures, together with the commitment to comply with Macedonian health and safety laws will provide the foundation on which the the welfare of employees and workers health and safety would be based.

Working conditions and work camps will be set in compliance with relevant Macedonian labour legislation. All contractors will be responsible for Occupational Health and Safety Plan(s) which provide workers with a safe and healthy work environment. MEPSO will review and approve these plans and will be responsible for overseeing contractor performance. All workers will be trained in proper safety rules and procedures.

The accommodation for workers shall be appropriate and be clean, safe and, at a minimum, meet the basic needs of workers. In particular, the provision of accommodation shall meet national legislation and international good practice in relation, but not restricted, to the following: provision of minimum amounts of space for each worker; provision of sanitary, laundry and cooking facilities and potable water; provision of fire safety and safety from or other hazards; provision of first aid and medical facilities; and heating and ventilation.

8.6 Community Health, Safety and Security

Construction stage

The construction activities will bring limited changes to the way of life of local residents. Formerly free and unlimited movement of people and children on the roads and localities around the proposed transmission line should be restricted due to the presence of trucks and machinery on the local roads. The same applies for livestock since they can also become a traffic-safety problem. During the construction period, local residents and property users may be forced to use specific roads.

Other important issue related to the community safety is the distinction of construction sites from the local environment. This is a safety issue which needs to be carefully considered. Unauthorized approaches to the core construction sites by children and adults can cause serious consequences to the individuals concerned.

During the construction phase, there is minor or no opportunity for workers to suffer from certain infectious disease. Potential public health impacts from various disease vectors species are, at this point not considered to be a major factor affecting the implementation of the project.

The Contractor will be obliged to develop and implement procedures to protect public health and safety. This will include an introduction of rules for workers and site security to prevent unauthorized access to active construction sites, workers camps, transport vehicles, construction machinery and equipment storage areas. The Contractor will prepare emergency response plans in order to respond to accidental and emergency situations in a manner appropriate to the construction risks. This plan will be based on the prior identification of major-accident hazards, and will include measures necessary to prevent major accidents and to limit their consequences for local communities.

Transport safety practices will be adopted and implemented according to the Transport Management Plan in order to prevent eventual traffic incidents and nuisance impacts to people.

Operational Stage

During the operational phase, the proposed transmission line and associated substations will release electrical and magnetic fields and operational noise, which may be considered as a community health risk. During the operational phase the transmission line will not release polluting and harmful substances in the environmental media (air, water and soil) and will not generate significant quantities of waste. In that respect the proposed project will not create environmental conditions which may lead to the deterioration of the health situation in the project area.

Current irrigation forms in Pelagonija Field include water cannons which may compromise the operation of the proposed 400 kV transmission line and may

pose safety risk for the affected farmers and agricultural companies. Higher OHL towers may be needed to ensure higher safety height of the OHL conductors in order to guarantee safe and undisturbed irrigation activities below the proposed transmission line.

MEPSO will identify and evaluate the risks and potential impacts to the health and safety of the affected communities during the operation of the project and will establish preventive measures to address them in a manner appropriate with the identified risks and impacts. These measures will favour the prevention or avoidance of risks and impacts over minimisation and reduction and will be identified in an appropriate emergency response plan which will, *inter alia* include organizational structures, responsibilities, procedures, communication, training, resources and other aspects required to implement such policy and to respond effectively to emergencies associated with project hazards. The plan will include reporting mechanisms, will define roles of an emergency preparedness team and identify necessary communication issues with local communities.

8.7 Construction Traffic and Transport

8.7.1 Introduction

Construction works, heavy machinery and large transport vehicles and increased intensity and volume of the traffic will affect the normal traffic regime in the project area.

Construction traffic of the proposed transmission line implies a need for adequate attention because of (1) likely increase in the intensity and volume of the traffic on roads with (on average) lower traffic loads, and (2) use of bulky and heavy vehicles for construction purposes. Key traffic aspects can generally be grouped in (1) off-site aspects, and (2) in-site aspects.

The off-site aspects concern conditions outside the construction sites of the proposed transmission line:

- Selection of routes of access roads and travelling time
- The ability of local roads to accept the planned volume and intensity of the traffic during the construction phase, taking into account technical and operational requirements of large and heavy vehicles
- Safety of the roads
- Plan for transport and traffic

The in-site aspects concern the conditions within the construction sites of the proposed transmission line:

- Standards for access roads, including the possible need for the upgrading of existing tracks
- Measures for erosion and landslide control
- Restoration of the potentially needed temporary roads upon completion of construction works.

8.7.2 Modes of Transportation

The principal means of transport proposed to service project construction is by road. This is primarily due to the well developed road network in the project area, flexibility required in delivering machinery and materials to locations in remote areas over difficult terrain, and across a corridor which is dispersed.

Transportation and delivery of the transformer to the proposed substation may include railway transport. The road transport to the substation site would be made using specialized vehicles which would have non-standard dimensions. Some advance works along public roads used for access to substations may be required, including eventual strengthening of bridges and minor improvements to alignments and road geometry.

8.7.3 Key Construction Transport Routes

The table below identifies the main construction routes which would be used for the import of machinery and equipment, materials and labour for construction of the proposed 400 kV transmission line.

OHL section	Principal routes	Access routes
Bitola – Resen	• Prilep - Bitola - Resen	• Bitola – Novaci • Novaci – Dobromiri – Aglarci • Bitola – Orizari –Karamani – Trn • Bitola - Mogila • Bitola – Kicevo • Road to Krklino • Road to Ramna / Lera / Strezevo Lake • Kazani - Dolenci
Resen region	• Bitola - Resen - Ohrid	• Sopotsko – Zlatari • Resen – Zlatari • Road to Kriveni • Road to Leva Reka
Ohrid region	• Resen – Ohrid • Kicevo - Ohrid	• Road to Svinista • Vapila – Rasino • Vapila – Sirula • Trebenista – Volino • Trebenista – Livoista
Struga region	• Ohrid – Struga • Struga – Debar • Struga - Cafasan	• Mislesevo – Moroista • Sum – Dolna Belica • Struga – Radolista

Table 8-4 – Key construction transport routes

8.7.4 Assumed Construction Vehicle Inventory

Table below presents information on the assumed types of light and heavy vehicles which would be used to satisfy construction transportation requirements.

Light vehicles	Heavy vehicles
Cars	Trucks and truck for ready mix concrete
Vans	Cranes
Light tractors	Heavy tractors
4 wheel drive vehicles	Trucks with drums for conductors
	Truck with trailors (for substation transformer)

Table 8-5 – Assumed construction traffic inventory

8.7.5 Construction Traffic Generation

Substations

For the standard truck deliveries, the total usage is estimated at nearly 700 truckloads for the electro-mechanical works. The number of truckloads for civil works would be determined during the preparation of the main technical design, but it is currently estimated to be in the range between 2,000 and 3,000 truckloads for the entire construction period. In addition, probably 1 truck load with trailer trucks would be needed for transport of the transformer in the new substation in Ohrid region.

Overhead Transmission Line

Indicative construction traffic generation has been calculated on the basis of a "per tower" number of heavy vehicle movements for each key stage of tower construction (tower foundations, tower erection and conductor stringing). This has allowed for a gross estimate of the number of heavy vehicles which would be needed to serve the construction over its period for the whole transmission line.

The table below presents summaries of the estimated heavy vehicle numbers required to construct the proposed new overhead transmission line over the whole period of construction.

Transport activity	Estimated vehicle transport requirements for construction	Estimated vehicle transport requirements for an area that in considered that would affect population in one locality**)
Ready mix concrete	750	12
OHL tower elements	1,250	20
Construction equipment and materials	500	8
OHL electrical equipment	500	8
OHL conductors and winching equipment	33*)	NA

Table 8-6 – Estimated vehicle transport requirements for construction

*) Based on the "a per angle tower" number, where winching works will be performed. More vehicle requirements may be needed depending on specific conditions along the route.
**) Area associated with 4 towers (or approx. 2 km) along the proposed transmission line is considered as respective in these terms.

8.7.6 Traffic Effects

It is clear that project construction traffic would increase traffic flows on some roads, particularly the local road network and unclassified roads, where the levels of traffic are typically low. The effects of construction traffic on such roads would cause significant increases over baseline traffic flows, however these effects would be short term, limited to the duration of the works in each location, and would be controlled through traffic management measures where appropriate.

During the next stage of the project development, construction routes need to be finalized and traffic predictions made to estimate overall construction traffic generation. Construction routes need to be agreed with relevant roads authorities. This information would be used in the development of the traffic and transport management plan which would ensure that appropriate traffic management and mitigation measures are employed on the principal access routes, and to minimize impacts on communities affected by such traffic.

8.8 Employment Opportunities

The proposed project will provide employment opportunities for members of the local, regional and wider communities. Increased possibilities for employment of about 270 workers during construction of the proposed transmission line and the new substation are expected. Priority for temporary employment during the construction works will be given to the population in the affected area.

Once operating, the proposed project will be monitored and controlled in accordance to the technical requirements for the operation and maintenance of transmission lines and substations. A mobile team of skilled staff from MEPSO will carry out maintenance work on a regular bases. No new permanent jobs in maintenance of the transmission line may be expected.

8.9 Cultural Heritage

No archeological sites and areas of cultural heritage were identified in the immediate vicinity of the proposed OHL route that would constitute a limiting factor in the implementation of the project.

During the construction works, the works contractor shall be obliged to develop and implement a “chance-find” procedure and to comply with national legislation on the protection of cultural heritage. Workers need to be trained in the use of these procedures.

If an archaeological site or items of archaeological significance are found during execution of construction works, the work contractor / investor is obliged to:

(i) inform immediately the competent public institution for protection of cultural heritage about the discovery

(ii) cease operations and to secure the site against eventual any damaging and against unauthorized access, and

(iii) maintain the discovered items in the location and in condition they were found.

8.10 Radio and TV Interference

Corona effect gives rise to radio noise which is a potential source of interference on the long wave (LW) and medium wave (MW) wavebands, but is of little or no significance to the VHF radio or television bands. Receivers located more than a few tens of meters from the proposed 400 kV overhead transmission line are unlikely to be affected.

Spark discharge can be an intermittent phenomenon and is usually associated with either a faulty electrical connection or faulty component. It is not considered a source of long-term annoyance as lines are built and maintained to high standards and any such sparking would be subject of remedial attention.

The proposed OHL route does not pass in vicinity of a radio or TV broadcast station. These facilities were considered during the routing exercise.

In general, domestic TV reception could be affected by the physical obstruction of the line of sight path from a domestic antenna receiving its signal from a broadcast TV tower, or reflections from a OHL tower into a domestic TV aerial where the unwanted signal may combine with the wanted signal to produce interference such as ‘ghost’ images on the screen.

In general, the operation of an overhead transmission line can generate electromagnetic fields over a wide range of frequencies, from power (50 Hz) to radio frequencies. It is possible for radio receivers in the immediate surroundings to be affected or interfered with by such electromagnetic fields.

The planned protection zone for the proposed single and double transmission lines is minimum 50-60 meters wide. No residential or other developments would be allowed within the OHL protection zone. The above, and the fact that the proposed OHL route does not pass in immediate vicinity to residential properties, lead to a conclusion that no interference on TV and radio reception is expected.

9 Characterisation of Impacts

The analysis of the impacts on the environment take into account any potential change on the biophysical and socio-economic environment (including health aspects of the population living and working in the project area) which may result from the proposed project. The level of change determines the significance of a change, which is assessed in terms of spatial extent, probability duration, and intensity. The overall assessment mainly addresses changes that are considered significant.

Criteria for impact assessment have been set according to their (i) scope, (ii) probability of occurrence, (iii) duration, (iv) intensity / magnitude and (v) reversibility and matrix to assess all impacts on different elements of the environment is prepared.

Scope / Extent	Limited (on SS location(s) / OHL route)	Area on, and around the construction and operational substations locations / route of the transmission line
	Local	In the range of municipality / neighboring municipalities
	Regional	Macedonia / neighbor countries
	Global	Continent and wider
Probability	No probability	Should not occur during normal operation and conditions
	Low probability	Possible, but unlikely
	Average probability	May happen sometimes
	High probability	Likely to occur during the project life cycle
	Reliable probability	Will certainly appear
Duration	Very short	Few minutes to few hours
	Short	Few hours to few weeks
	Average duration	Few weeks to few months
	Long	Few months to few years
	Very long	Decades / centuries
Intensity / Magnitude	A	Negligible. Weak change to environment.
	B	Low. Small detectable change to environment, but with proper planning does not cause damage to the environment.
	C	Moderate. Larger, but non-fundamental change to the environment that can be controlled by implementing the appropriate measures.
	D	High. Big, fundamental change to the environment.
	E	Impact that requires compensation measures.
Reversibility	Reversible (impact)	Reversible impact on the environment, i.e. impact upon which the environment will be able to return to the original state
	Irreversible (impact)	Irreversible impact on the environment, i.e. impact upon which the environment will not be able to return to its original state

Table 9-1 – Matrix for characterization of potential impacts

Evaluation of significance of potential impacts

The significance of a potential effect is a function of its characteristics (magnitude, duration, etc.) and the value of the resource being affected. It can be defined as the level at which the assessor considers the effect to be material to the environment. This is specific to each effect and will vary from effect to effect.

In general, effect could be categorised into following significance categories:

- None: no detectable change to the environment;
- Minor: a detectable but non-material change to the environment;
- Moderate: a material but non-fundamental change to the environment;
- Major: a fundamental change to the environment.

Parameter / indicator of environment	Description	Scope	Duration	Probability	Magnitude	Significance of the impact without mitigation	Reversibility
Electric and magnetic fields							
operation	Exposure of public or workers to electric and magnetic fields	Limited	Very short	Low probability	B	Minor	Irreversible (for the life of the project)
Air quality							
construction	Emission of dust and particulate matter	Limited	Very short	Reliable probability	C	Moderate	Reversible
	Emission from construction traffic	Limited	Very short		B	Minor	
Noise & vibrations							
construction	Noise from construction of access tracks	Limited	Short	Reliable probability	C	-Major (< 50 m) -Moderate (< 200 m) -Minor (< 400 m)	Reversible
	Noise from construction of tower foundations	Limited	Short		C		
	Noise from tower assembly and erection	Limited	Short		C		
	Noise from attachment of conductors	Limited	Short		C		
	Noise from construction of new substation	Limited	Long		C		
operation	Corona effect from OHL and substations	Limited	Very long	Reliable probability	B	Minor	Reversible
	Operational noise from substations: • transformer operational noise • transformer coolers / switchgear noise	Limited	Very long		B	Minor	
Hydrology							
construction	Construction of access road, earthworks: • increased suspended solids in waters • risk of impact to water supply facilities • changes in hydrological regimes	Limited	Very short to short	Average probability	A / B	Minor	Reversible
	Construction vehicle movements / operations: • disturbance of watercourses • increased suspended solids in waters • changes to sub-surface water levels • pollution risk from fuel and oil spillage • temporary habitat disturbance	Limited	Very short to short		A / B	Minor	Reversible
	Construction of OHL tower foundations: • risk of alkaline concrete spillage	Limited	Short		B	Minor	Reversible

Table 9-2 – Matrix of the main impacts

Parameter / indicator of environment	Description	Scope	Duration	Probability	Magnitude	Significance of the impact without mitigation	Reversibility
Hydrology (*continued*)							
operation / maintenance	Drainage of permanent access roads: • change in hydrological regime	Limited	Very long	Average probability	B	Minor	Irreversible (for the life of the project)
	Traffic to access transmission line route: • potential risk of pollution from fuel / oils • localized effects on hydrology from compaction	Limited	Very short		B	Minor	Reversible
	OHL tower foundations: • local effects on hydrological patterns and water levels (barrier effect on hydrology)	Limited	Very long		B	Minor	Irreversible (for the life of the project)
	Substations operation: • potential risk of pollution from oil spillage	Limited	Very short	Low probability	C	Moderate	Reversible
Geology and soil							
construction	Construction of access roads, earthworks and construction of towers: • loss of deposits / soils through excavation and removal for construction purposes • increased erosion of deposits / soils through removal of surface cover • compaction of soft ground leading to an alteration in the structure of the deposits / soils	Limited	Impact: Short Effect: Long	Average probability	B / C	Minor	Reversible
	Pollution risk from fuel and oil spillage	Limited	Very short		B	Minor	Reversible
operation / maintenance	Traffic to access transmission line route: • potential risk of pollution from fuel / oils • localized effects on soils from compaction	Limited	Very short	Average probability	B	Minor	Reversible

Table 8-2 - Matrix of the main impacts (*continued*)

Parameter / indicator of environment	Description	Scope	Duration	Probability	Magnitude	Significance of the impact without mitigation	Reversibility
Biological diversity							
Habitats & flora							
construction	Depletion and transformation of habitats	Limited	Average	Average probability	B	Minor	Reversible
	Degradation of vegetation related to erosion processes on inclined habitats (mountain slopes)	Limited	Average	Average probability	B	Minor	Reversible
	Destruction of forest habitats / forest cut	Local	Very long	Reliable probability	E	Major	Irreversible (for the life of the project)
	Fragmentation of forest habitats	Local	Very long	Reliable probability	B	Minor to moderate	
operation / maintenance	Fragmentation of forest habitats	Local	Very long	Reliable probability	B	Minor to moderate	Irreversible (for the life of the project)
	• Premature removal of vegetation and forest • Change in vegetation and forest, moving from large trees to small trees and shrubs	Local	Very long	Reliable probability	E	Moderate	Partly irreversible
Fauna							
construction	Disturbance of fauna species	Local	Short	Reliable probability	B	Minor	Reversible
	Loss of invertebrates and herpetofauna	Local	Short	High probability	B	Minor	Irreversible
	Poaching by the workers	Local	Short	Low probability	B	Minor	Irreversible
operation / maintenance	Potential collision of birds with the conductors / wires of the transmission line	Limited	Very long	Average probability	C	Moderate	Irreversible

Table 8-2 - Matrix of the main impacts (*continued*)

Parameter / indicator of environment	Description	Scope	Duration	Probability	Magnitude	Significance of the impact without mitigation	Reversibility
Visual effects / Impacts on landscape							
construction	Construction zones and access roads will draw changes in the aesthetics of the area.	Limited to local	Short	Reliable probability	A	Minor	Reversible
operation	Visibility of the transmission line on the landscape in the project region	Local	Very long	Reliable probability	B-C	Minor	Irreversible (for the life of the project)
Traffic and transport							
construction	Increase traffic flows on some roads, particularly the local road network and unclassified roads, where the levels of traffic are typically low.	Limited to local	Short to average	Reliable probability	B	Minor	Reversible
Waste							
construction	Different categories of waste: - Waste from forest cut (EU waste code 02) - Waste from packaging (EU w.code 15) - Wastes from electrical and electronic equipment (EU waste code 16) - Construction waste (EU waste code 17) - Municipal waste (EU waste code 20)	Limited	Short to average	Reliable probability	C	Moderate	Reversible
operation / maintenance	Different categories of waste: - Waste from forest cut (EU waste code 02) - Waste from use of coatings (paints) (EU waste code 08) - Waste from packaging (EU w. code 15) - Wastes from electrical and electronic equipment (EU waste code 16)	Limited	Very long, discontinued	Reliable probability	B	Minor	Reversible

Table 8-2 - Matrix of the main impacts (*continued*)

Parameter / indicator of environment	Description	Scope	Duration	Probability	Magnitude	Significance of the impact without mitigation	Reversibility
Cultural heritage							
construction	Case of accidental archeological discovery	Limited	Very short to short	Low probability	A	Minor	/
Radio and TV interference							
operation	Radio and TV receivers affected by the OHL	Limited	Very long	Low probability	A	Minor	Reversible

Table 8-2 - Matrix of the main impacts (*continued*)

10 Environmental and Socio-economic Mitigation Measures

10.1 Electric and Magnetic Fields

In absence of relevant national regulation on EMFs, MEPSO's policy in planning this proposed 400 kV OHL project is that it will comply with international standards and best international practice, mainly with the guidelines published in 1998 and 2010 by the International Commission on Non-Ionizing Radiation Protection.

Design stage

Likely impact of electric and magnetic fields on the human health was one of the key issues during the process for selection of the optimal corridor for the proposed overhead transmission line. In this context, the major issues of consideration were the populated areas of urban and sub-urban areas of the main centers along the alternative OHL routes – Bitola, Resen, Ohrid and Struga, as well as number of settlements within the project region.

As a result of the above approach, careful routing has sought to identify a line which bypasses the urban zones and other residential areas thus avoid any concern about causing exposure to EMF.

In order to avoid any EMF exposure above the limit values, further avoidance measures will include:

- Appropriate selection of the towers micro locations in relation to residential and other properties
- Compliance with technical specifications for minimum height of the OHL conductors.
- Monitoring of occupied houses and other buildings that are near the corridor if requested by the owner or occupant.

Operational stage

In a case there is a complaint by an owner or occupant of a building within 50 meters of the OHL, MEPSO will measure EM radiation levels and take appropriate action if needed to reduce or mitigate excess levels.

EMF will have no effect on agricultural workers who will not be exposed for long periods every day as well as on domestic animals that grazes under or near the proposed transmission line. Therefore no restriction of agricultural activities below or in vicinity of the OHL will be imposed.

10.2 Air Quality

The most effective way to manage and prevent dust and particulate emissions is through effective control of the potential sources. Specific mitigation measures designed to ensure that emissions from these sources are minimized are listed

below. These measures are specifically related at site preparation (tower installations and substations), access roads and machinery operations:

- Construction activity will be located away from sensitive land areas and receptors where possible, and ensure that activities are carried out when wind direction will direct material away from these receptors.
- Open excavation areas will be minimized.
- Stockpiling of soil and earthen material will be minimized by proper coordination of earthworks and excavation activities (excavation, grading, compacting, etc.)
- When there is visible dust being generated by vehicles and other activities, apply water sprinkling measures to reduce dust.
- Reduce speeds on unpaved roads and take other measures as needed to reduce emissions if intensive fugitive dust emission occurs, until water sprinkling or other mitigation measures are put in place.
- Design all earthworks to allow future successful re-vegetation. For stockpiles left for long periods, apply grass seed or other covers.
- All construction machinery and equipment will be maintained in good working order and not left running when not in use.
- There will be no burning of any material anywhere on or construction sites, or in areas where forests are cut, without permission from authorities and supervision by forestry officials
- Vehicle speeds will be restricted on construction sites and access roads.
- Vehicles carrying aggregate material and workings will be sheeted at all times.
- Observe dust levels and amount of dust settling on properties near (200 m) construction sites and take action to reduce dust generation if there is excessive dust on surfaces.

The measures listed above are good construction practice measures and are designed to ensure that the construction activities do not generate excessive dust or particulate material release. Implementation of such measures will ensure that no significant dust effects occur during project construction of the proposed transmission line. Further mitigation measures will be developed on a site-specific basis based on a review of the planned construction activities and their proximity to the receptors. The site specific mitigation measures will need to ensure that properties within 200 m of the locations where earthworks are to be carried out will not be subject to significant dust nuisance. These measures will be focused on the mitigation of dust from key activities including access roads construction and earthworks for substations and will be included in appropriate technical documents.

Detailed mitigation measures to control construction traffic would be discussed with the local authorities to establish the most suitable access routes for the site traffic. The most effective mitigation would be achieved by ensuring that construction traffic is routed along the most suitable roads and that vehicles are kept clean and sheeted when on public roads.

10.3 Noise

10.3.1 Construction Noise

Relevant regulations concerning the management of construction activities will be fully respected. Construction, transport activities, including materials and equipment near the settlements, which imply increased noise levels, will not be conducted during the holidays, during the night, or at the weekend.

All construction procedures will be properly planned to reduce the time of utilization of equipment that creates most intense harmful noise. Working hours and rules will be established based on the needs to reduce the noise causing nuisance and disturbance, especially by avoiding the cumulative effect of increased noise due to simultaneous operation of different kinds of construction machinery and equipment.

Several other measures of good construction practice will be overtaken to mitigate noise from construction works:

- Any compressors brought on to construction sites would be sound reduced models fitted with acoustic enclosures.
- All pneumatic tools would be fitted with silencers.
- Care would be taken when erecting towers or during other steelwork to avoid impact noise from banging steel.
- Care would be taken when unloading vehicles to minimize noise.
- All machinery items will be properly maintained and operated in order to avoid causing excessive noise.
- Restrictions on periods of operation and locations of specific construction activities will be agreed by the contractor with the relevant local authority.
- No holiday, night-time construction, or weekend operations will be allowed unless necessary to meet important schedules and work is authorized by local authorities and discussed with nearby residents.
- Concerned residents will be notified and informed before construction commencing when construction works are planned within 200 meters from properties.

In addition to the measures listed above, regular liaison with the local authorities to discuss activities and the progress of the project will be undertaken in order to minimize the potential for negative effects of the construction works.

10.3.2 Operational Noise

10.3.2.1 Overhead Transmission Line Audible Noise

During the OHL routing process, MEPSO has achieved to minimize, as far as it is possible, acoustic effects by routing the proposed transmission line away from residential areas.

The acoustic performance of an overhead transmission line can be adversely influenced by inappropriate methods or processes employed during the manu-

facture and/or the erection of conductors. Therefore, the contractor would be required to submit quality plans and procedures for MEPSO's examination and approval prior to commencement of work. Correct manufacturing and installation methods and procedures are an essential prerequisite measure that will allow reduction of eventual audible nuisance due to OHL operations. Particular attention should be paid to:

- Appropriate corona testing of conductor fittings in the line configuration.
- Manufacture of conductor consistent with technical specifications, particularly with respect to removal of drawing oils, application of appropriate type and quantity of grease on the inner layers of the conductor and any other factors which could affect the surface condition of the conductor.
- Requirements in contracts that contractor which would ensure that conductors will be stored, transported and handled with appropriate care so as to minimise surface damage and contamination.

In an event of any effects arising once the transmission line is operational, MEPSO will investigate these effects on a case by case approach and take appropriate action to mitigate any unforeseen effects.

10.3.2.2 Substation Audible Noise

Correct design, manufacturing and installation methods and procedures are an essential prerequisite measure that will reduce operational noise. Particular attention should be paid to appropriate design approach that will reduce sound power level from transformers:

- via specification that will ensure that noise level generated at source is bellow 60 dB(A), and
- by installation of rubber foundation elements that will achieve appropriate reduction of noise emission.

In a case that eventual compliant by affected party due to increased noise level arises, MEPSO will investigate these effects, and take appropriate action to reduce noise levels if needed. Examples of possible measures may include construction of protective walls or acoustic enclosures around transformers.

10.4 Hydrology

Water protection measures against transformer oil spill will be installed in the new substation. These will include oil / storm water tank, placed bellow energy transformer on a concrete foundation and with 1.1 times the capacity of the transformer unit. Regular inspection throughout substation operation period will be performed to ensure the containment is secure.

As a general approach, all construction zones along the proposed transmission line would be established at the appropriate distance from nearby surface waters. Unless it cannot be avoided, all vehicles and equipment will stay at least 10 metres from watercourses and any surface water.

The general measures for reduction of the potential impacts of discharges in the

surface waters, during construction phase of the proposed transmission line include procedures of good construction practice as needed to prevent impacts on water:

- Wherever possible, locate tower foundations in dry locations with well consolidated geology, and avoid wetland areas.
- Wherever possible, do not locate towers within 10 meters of watercourses or in floodplains.
- Minimize work on soft ground in wet weather, wherever possible.
- Do not discharge any water or other materials to watercourses.
- Prevent erosion and run-off of sediment from construction works, including roads, to watercourses.
- Do not store soil or other materials close to watercourses
- Provide spill cleanup equipment at all sites where fuel or other material is stored.
- Fuel tanker vehicles for servicing the construction plant and equipment will carry a suitable sized spill kit and drivers would be trained in spill cleanup.
- Provide portable toilets and have authorized authorized service company remove and properly disposef waste water from the toilets.
- Keep all engines in good working condition and repair any leaking equipment immediately.
- In areas where significant tree felling is necessary, establish buffer zones and drainage ditches during felling, particularly on sloping ground.
- No crossing of watercourses by vehicles and machinery during construction will be permitted.

10.5 Geology and Soils

The following mitigation measures will be implemented as needed to prevent, reduce, and where possible offset the potential effects of the project on geology and soils:

- Minimize excavation and removal of soils.
- Leave no ground with no vegetative cover unless the surrounding area does not support vegetation. As soon as construction is complete in any area, re-grade the land surface as needed to restore natural drainages and contours, and establish vegetation cover with native species – seeds or young plants -- and monitor growth.
- Temporarily store all excavated soil in secure location with run-off and erosion prevented. Any soil piles left at end of construction will be removed or spread out.
- Wherever possible, limit vehicle movements in off-road areas to reduce soil compaction, and in particular in areas with softer deposits / soils

and on steeper slopes, like valley sides. Avoid off-road driving in wet weather; repair all vehicle damage to soils (ruts) immediately.

- Earth cutting and access roads along steeper slopes will be avoided where possible to reduce the impact on slope stability and erosion. Where required, suitable engineering will be undertaken to ensure the stability of the slope is maintained, including in areas prone to slides.
- Installation and maintenance of control measures for erosion, run-off and sedimentation on steep slopes and in erosion prone areas.

It is expected that site specific mitigation measures for towers and access roads will be part of the final design and construction documents, and included in contracts with construction contractors.

10.6 Biological Diversity

Various mitigation measures will be necessary to prevent, reduce, or compensate for impacts to critical ecosystems and protected fauna.

Following actions will be undertaken prior to construction:

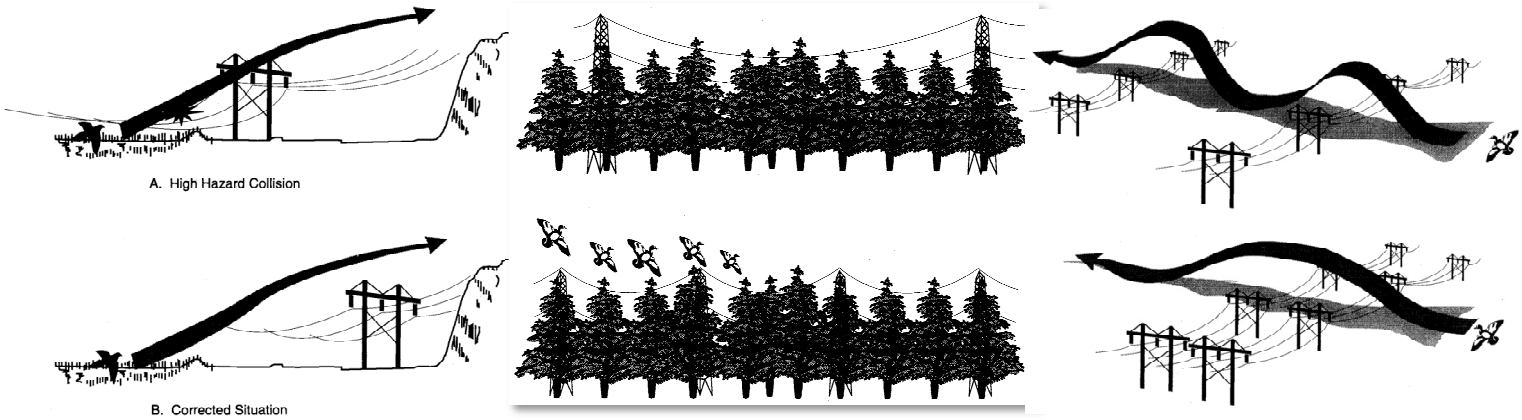
- Bio-survey by qualified experts prior to micro-siting tower and other locations, with the intent being to identify areas that must be avoided in order to prevent disturbances and significant fragmentation to sensitive habitats, including PBA Struga, and protected species. Based on bio-survey results, identify and mark areas that must not be disturbed, and mark or otherwise develop methods to prevent access by construction personnel.
- A bird survey by qualified ornithologists at an appropriate time of year and using relevant methods to allow sound micro-sitting of towers and access tracks and to identify eventual need of bird diverters on selected OHL sections, in particular Pelagonija (IPA Pelagonia) and Struga Field.
- Schedule construction so as to avoid disturbance to nesting birds of protected species and breeding animals of protected species.

10.6.1 Design Measures

Design measures to minimize impacts on avian fauna

Risk minimization of bird collision with an operational transmission line could be achieved by appropriate selection of tower location in relation to existing natural conditions along the proposed OHL corridor, mainly topography, vegetation / woodlands, etc. Topographical features can influence the visibility of power lines in certain situations and this can be used as an advantage during the OHL route detailed planning phase.Transmission lines that are at or below the height of nearby trees rarely present a problem because the small tree-dwelling birds have greater maneuverability and large birds will gain altitude to clear the highly visible tree-line, consequently avoiding the power line (Thompson 1978, Raevel and Tombal 1991) (Figure 9-1).

In addition, the collision hazard may be reduced by clustering (two or more lines sharing the same right-of-way) the proposed transmission line with the existing 110 kV OHL Bitola-Resen-Ohrid-Struga which passes along the corridor of the proposed 400 kV OHL. OHL configuration and "clustering" lines may be preferable, because the resulting network of wires is confined to a smaller area and is more visible. Birds have to make only a single ascent and descent to cross a series of lines in such arrangement (Figure 9-1).



Siting with respect to local topographic features

Siting with respect to forest

Reduction of bird collision hazard through clustering of power lines

Figure 10-1 – Design measures to minimize bird collision risk

10.6.2 Mitigation Measures during Construction

General measures

General measures are the measures that must be implemented on all construction sites at the substation sites and along the whole length of the transmission line corridor during the whole construction period in order to minimize impacts on biodiversity

- Use, as much as possible, existing access roads and minimize the construction of new access roads.
- Prohibit fires for any reason unless with the approval of local fire authorities. If fires are allowed in any place, ensure adequate fire-fighting equipment is available at all times.
- Limit workers to construction sites and prohibit their disturbance of local flora and fauna. Specifically, do not allow: (i) the collection of medicinal plants, mushrooms and fruits, (ii) collecting snails, (iii) disturbance and hunting of game, birds, etc., (iv) collection of eggs from birds, (v) disturbance of young animals and other; cutting plants or trees of any kind.
- Designate smoking areas for workers when constructing in forests or in dry periods.
- As soon as construction is complete, restore all construction sites and temporary tracks used for construction. If required, certain bio-technical activities would be implemented.

Mitigation measures for habitats' prevention

Besides the general mitigation measures that apply on the whole length of the proposed transmission line, certain measures are proposed for designated areas and high sensitive habitats:

- During construction in these areas, ensure that qualified biologist or environmental engineer is present at all times to ensure that all plans are followed and there is no unnecessary damage and fragmentation to habitat and other natural resources. Sensitive areas include Ohrid Lake near the village Radozda, Crn Drim upon its exit from Struga, Struga Field, the river Sateska near the village Volino, and Pelagonia area.
- Use, as much as possible, existing access roads and minimize the construction of new access roads through marshy vegetation (reedbeds), riparian habitats and meadows. Wherever possible, place new access roads in areas of low ecological sensitivity. As soon as construction is complete, restore all temporary tracks used for construction.
- No construction camps or machinery parks would be located within sensitive ecological areas, high sensitive habitats or on alluvial terrains (in the river and stream valleys) in order to avoid adverse impacts on valuable riparian habitats and surface and ground waters.
- Do not store any waste material (concrete, steelworks, soil, etc.) in sensitive areas.
- After trees are felled or other vegetation is cleared in the transmission line corridor or along new roads, re-establish vegetation by planting seeds or young plants of native species, and monitor until full vegetation cover is re-established.
- All sites that should serve as temporary deposits for various construction material have to be proposed by the designer and constructor in advance in order to be assessed for possible adverse impacts on the habitats.
- Compensate for forests' loss by planting adequate / corresponding area of bare forest land or other land that can serve for this purpose. The afforestation is to be carried out with autochthonous species, characteristic for the same area (Italian oak – *Quercus frainetto*, sessile oak – *Quercus petrea*, Turkey oak – *Quercus cerris*, beech – *Fagus moesiaca*, European hornbeam – *Carpinus betulus*, Pedunculate oak – *Quercus robur* and other species. Detailed design and locations for afforestation should be elaborated in cooperation with Public Enterprise "Makedonski sumi".

Mitigation measures for impacts on species

Plants

- Minimum clearing of vegetation and re-vegetation works to disturbed areas as soon as construction is completed.
- Restore vegetation cover with autochthon species, compatible with the OHL safety operation requirements.
- There will be no clearing of riparian zones and there will be a selective removal of tall growing trees.
- Cutting of pedunculate oak (*Quercus robur*) would be avoided. The route of the proposed transmission line and its towers would need to be located, as much as practicable, in the forest patches of the related habitat at the places where this species is not present.
- Unnecessary destruction of marsh vegetation will be avoided. Where this is unavoidable, it should be limited to the minimum. This measure applies to all humid meadows (humid meadows in Struga Field - along river Sateska and between villages Volino and Moroista).

Fauna

Birds

- Along the proposed transmission line, no construction would take place during the breeding bird season apart from where pre-construction bird survey has indicated that no birds are nesting.
- Where possible all access track construction and vegetation clearance for the towers would not be undertaken during the breeding bird season.
- All site staff would be briefed on procedures to be implemented if any nesting birds are found within the construction area.

Other animals

- Survey trees to be felled for potential bat activity. Mark and check potential bat roost trees. If any evidence of bats is identified, consult with competent authority to develop appropriate mitigation measures (e.g. micro-sitting of works to avoid trees, etc.) before felling the tree(s). If there is evidence of breeding bats or young bats (maternity colonies), postpone construction until bats have left the breeding trees.
- Direct destruction of habitats and populations of amphibians and reptiles can be avoided through application of some restrictions concerning construction period (spawning period should be avoided - spring) in the areas close to the water habitats, also avoiding to leave open pits for a longer period during the construction phase, due to the possibility of immigration of reptiles, mammals or insects.
- Limitation of construction areas with heavy construction machinery, to prevent impacts on wildlife.
- Prohibit and strict control of illegal hunting (poaching) by workers engaged.

10.6.3 Mitigation Measures during Operation and Maintenance

Plants

Forest, riparian and marshy habitats were assessed as the habitats affected by the operation of the proposed project due to regular clearing of the forest vegetation below the OHL wires. The main impact will be reflected on the forest habitats' fragmentation. In order to reduce the intensity of the impact, the land below the wires in the transmission line corridor of 30 m would be re-planted with native shrubs which will not affect the function of the proposed OHL and in the same time will enable safe movement of animals from paths to patch. Therefore, the implementation of an integrated vegetation management approach through the selective removal of tall growing tree species and the encouragement of low-growing grasses and shrubs will assist in minimizing any impacts from the operation of the project. Excessive vegetation maintenance may remove unnecessary amounts of vegetation resulting in the continual replacement of species and an increased likelihood of the establishment of invasive species.

Birds

- Design and install conductors and isolators to avoid any electrocution hazard[16)].
- Sections of the proposed transmission line assessed during the pre-construction survey to be associated with a potential risk of bird collision would be marked with suitable bird diverters. The marking of the OHL earth wire with bird diverters as anti-collision devices is a standard practice worldwide to mitigate eventual avian impacts. This measure has been proved to be reasonably successful in reducing collisions, with success rates of up to 60% reduction in mortality and even more documented (Ferrer and Janns, 1999). In addition, in the selected areas, the phase conductors would be fitted with fluorescent tubes (bird lights) to reduce the risk of nocturnal collisions.
- A post construction monitoring programme along particular sections of diverter-marked and unmarked transmission line would take place to assess the effectiveness of the bird diverters. This programme of bird mortality will be carried out during first three years of the OHL operation. The monitoring would be more intensive during breeding / fledging period and during migration period.

10.7 Visual Amenity and Landscape

The following general mitigation measures will be implemented to mitigate the effects of the proposed project on the landscape:

Overhead Transmission line:

- Include visibility of the towers among the factors considered during final tower positioning, including determining the proper balance between heights of towers and the number of towers. (In general, larger scale landscapes would be better able to accommodate taller towers and

16) In general this would be achieved by following best engineering practice and technical recommendations given in the (i) Recommendation of the Bern Convention no.110/2004, (ii) Resolution no 7.4 of the (Bonn) Convention on the protection of migratory species and (iii) recommendations of the working group Birdlife International for birds and transmission lines (2007).

the reduced disturbance to the landscape with fewer construction sites would also be of benefit.)

- Allow the maximum vegetation height in the OHL corridor while still maintaining the required clearance.
- Width of all access roads and tracks will be kept to the minimum necessary for their use during construction and operational.

New Substation in Ohrid area:

- To the extent possible, maximize the extent to which this facility 'fit' well into the surrounding landscape and are accepted by the community and are screened from view as much as possible.

10.8 Construction Traffic and Transport

A traffic management plan will be required to control movement of vehicles and equipment. This will include measures to:

- Consult with traffic authorities before construction in any location to determine the need for public notice, warning signs and flags, and other measures.
- Development of specific routes for traffic if needed to avoid schools or other sensitive areas.
- Training for all drivers and equipment operators.
- Minimize use of off-road areas and maximize use of existing roads and tracks.
- Strict speed limits for all different locations and conditions.
- Marking of routes acceptable for vehicles and equipment in off-road areas (to minimize disturbance to off-road areas).

An important measure will be the implementation of information programme to introduce the local population the construction activities, with particular accent on the traffic on the unclassified roads to the locations of the project. Population would be informed in a timely manner of all potential necessary changes in the regime of the traffic. In consultation with MEPSO, the contractor will be required to disseminate construction traffic movement information to the public, particularly in advance of the busiest phases of activity or in advance of movements of special loads such as substation transformers.

10.9 Waste Management

Waste management plans will be developed and implemented to ensure all wastes are properly managed during construction and operation of the proposed transmission line. Wastes will include excess soil and rock excavated from substation locations and tower foundations, excess concrete and gravel, wood and vegetation waste from tree- and vegetation-cutting, spent fuel and solvents, excess paint, cleaned-up soil from spill sites, sanitary wastes from portable toilets, solid "household" waste from work sites, etc.

The plans will describe how each type of waste will be managed, and require the use of licensed and authorized companies to remove waste and dispose of it properly.

Construction stage

Waste generated during construction of the proposed transmission line would be minimized wherever practicable by reusing and recycling any materials. All wastes will be identified, classified, quantified and, where practicable, appropriately segregated. The hazardous waste types will also be appropriately segregated. All waste materials removed from site will be managed in accordance with relevant waste and environmental regulations. Waste will be transferred using a registered waste operator to a licensed waste disposal site or recycling centre.

Operational stage

Waste items and materials that will be created during the maintenance of the proposed transmission line (consumables, spare parts and obsolete equipment) will be removed outside of the project area.

The waste management system shall be established during the operational stage. This system will be in compliance with the legal waste management requirements and will consider possibilities for re-use of obsolete conductors and insulators. Other option includes a possibility that these elements are offered as recyclable waste streams to the authorized waste management companies.

10.10 Radio and TV Interference

Any effect of the proposed transmission line on broadcast radio or TV reception would be negligible in most or all areas. The areas where there could be an effect are only those areas where reception is already not satisfactory. In an event of complaints once the transmission line is operational, MEPSO would investigate these effects on a case by case approach and take appropriate action if needed to mitigate any effects.

10.11 Other Social Measures

10.11.1 Land and Property Acquisition

The land acquisition process shall be conducted in accordance with the relevant Macedonian legislation and EBRD requirements. All land purchases and temporary occupation of land including compensation and resettlement assistance will be guided by the development and implementation of a land acquisition and compensation plan.

10.11.2 Labour and Working Conditions

Prepare and implement OHS Plan(s). Detailed measures need to be outlined in terms of protection of employees during the construction and operation of the project.

10.11.3 Community Health, Safety and Working Conditions

- Ensure compliance to the international standards on public exposure (see Section 7.3) to the electric and magnetic fields.

- Consult with local farmers and agricultural companies in Pelagonija Field to ensure that the OHL design does not pose safety risk during irrigation activities that may include water cannons. Make necessary design adjustments (if required) to ensure that such risks are avoided.
- Establish and enforce rules for worker behavior during construction period when dealing with local residents and visitors in order to prevent disturbances and adverse impacts.
- Public notice of construction operations near areas open to the public.
- Develop and implement construction and operational procedures to protect public health and safety, to include (but not be limited to):
  - Security as needed to prevent unauthorized access to project locations.
  - Notice to local authorities and nearby residents before major activities and traffic.
  - Hazard notices/signs/barriers to prevent access to energized components.

11 Environmental and Social Management and Monitoring

11.1 Introduction

The project's Environment and Social Monitoring and Management Plan (ESMMP) consisting of the set of mitigation and monitoring measures, criteria for their successful implementation and institutional measures to be taken during project implementation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels has been developed as part of the ESIA process. It has been prepared to ensure that all relevant project stages are implemented in compliance with applicable Macedonian laws and regulations and EBRD's Environmental and Social Policy (2008) PRs as well as in accordance with the results of the stakeholder consultations.

The ESMMP has been formulated in such a way that it is easy to use. The following aspects are addressed within the plan:

- *Description of mitigation measures.* The ESMMP identifies feasible and cost effective measures to reduce impacts to acceptable levels. Each mitigation measure is briefly described with reference to the impact to which it relates and project phase under which it is required.
- *Description of monitoring program:* Environmental performance monitoring has been designed to ensure that mitigation measures are implemented and have the intended result. The monitoring program clearly indicates the linkages between impacts identified during the ESIA process, parameters to be measured, methods to be used, monitoring locations, frequency of measurements and timeline of the monitoring activities.
- *Institutional arrangements:* Responsibilities for mitigation and monitoring are defined. The ESMMP identifies arrangements for coordination between the various actors responsible for mitigation.

The ESMMP will be implemented during the pre-construction, construction and operation / maintenance of the proposed transmission line project.

11.2 Responsibilities

Pre-construction stage

Each requirement that will result from the process of obtaining specific project-related decisions by the respective municipalities and other competent bodies (ministries, agencies, etc.) during the pre-construction stage will have to be included in the final documentation for construction.

It will be task of the appointed contractors to further detail the issues addressed in this ESMMP, depending on the progress of the project planning, until construction (establishment of construction zones, temporary facilities for work force, details for storing the construction and other materials, the access roads for transport, waste management issues, etc).

Construction stage

All committed mitigation measures defined in the ESMMP for the proposed transmission overhead line and associated substations, the access roads and the associated works such as construction camps need to be included in the construction procedural documents, as well as in contracts for particular works with contractors.

The selected construction contractor will be required to provide the required plans and procedures to MEPSO for approval prior to construction commencing.

MEPSO is ultimately responsible for the implementation of the ESMMP, with the objective of ensuring effective implementation of the mitigation measures, stakeholder engagement and other project requirements. In that respect, MEPSO will appoint staff to undertake environmental supervision and monitoring during the construction phase. Key responsibilities of this staff will be to ensure that measures and control as defined in the works contract and issued permits and decisions are applied in an appropriate manner. This also includes coordination with Directorate for Environment Protection within the MEPP and the Cultural Heritage Protection Office (CHPO) within the Ministry of Culture.

Operational stage

Environmental and social management during the operational phase of the proposed transmission line will generally consist of monitoring the efficiency of measures incorporated during the design as well as monitoring the project's operational performance. The operational management and monitoring will be organized and conducted by MEPSO.

MEPSO will also be responsible for ensuring its contractors during maintenance period understand the requirements contained within the ESMMP and have contractual conditions in place to ensure applicable elements of the ESMMP are achieved.

11.3 Review and Amendment

MEPSO will regularly review the ESMMP to reflect any changes in the project implementation and organisation. Upon any amendment, the amended ESMMP will be communicated to all relevant parties and stakeholders.

11.4 Summary of Mitigation Measures

The overall aim of the mitigation measures is to mitigate the construction and operational effects of the proposed overhead transmission line and associated substations.

Careful routing has sought to identify a line which prevents impacts and mitigates impacts to people and the natural environment as far as practicable.

Where impacts cannot be avoided, the approach has been to reduce impacts to the minimum necessary for safe implementation of the project. Where significant effects cannot be avoided, consideration has been given to mitigation measures which seek to offset impacts through compensation. Any opportunities to deliver positive benefits from implementation of the project have also been considered and identified (enhancement measures). The measures that would be implemented to mitigate the effects of implementing the proposed project are presented in the table below.

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
Environmental Management and Community Liaison	- The chosen OHL contractor would be required to produce and implement an Environmental and Social Management System (ESMS), which meets the requirements of ISO 14001 for the construction period. - All construction staff would be given appropriate environmental training before starting work on site. - Compliance would form part of the contract between MEPSO and the contractor. Compliance with the requirements of the ESMS would be reviewed at regular intervals by MEPSO. - MEPSO would implement a communication strategy - as laid out within the Stakeholder Engagement Plan (SEP) - MEPSO and the contractor would be required to maintain close liaison with local community representatives, landowners and competent authorities throughout the construction period. - MEPSO and the contractor would be required to liaise with the relevant local authority and community to identify major events in the area and to plan the construction works to ensure that these did not disrupt the local road network.	√	√	√	√
Electric and magnetic fields	Avoidance measure(s): (i) Appropriate selection of the towers locations in relation to residential and other properties (ii) Compliance with technical specifications for minimum height of the OHL conductors.	√			
	Measurement of EMF in zone within 50 meters of the OHL upon request and appropriate reactions in case of high EMF levels.				√
Air Quality	Good construction practice to prevent dust and particulate emissions by effective control of the potential sources, including (at a minimum): (i) Applying water sprinkling measures in case of visible dust (ii) Design earthworks to allow future successful re-vegetation. (iii) Proper maintenance of construction machinery / equipment. (iv) Appropriate restriction of vehicle speeds on dust roads / tracks. (v) Cover loads as needed to prevent dust release.		√	√	

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
Noise	Noise 1: Construction noise Good construction practice to prevent noise emission level that would cause nuisance, including (at a minimum): (i) Any compressors brought on to construction sites would be sound reduced models fitted with acoustic enclosure. (ii) All pneumatic tools would be fitted with silencers. (iii) Care would be taken when erecting towers or during other steelwork to avoid impact noise from banging steel. (iv) Care would be taken when unloading vehicles to minimize noise. Delivery vehicles would be routed so as to minimize disturbance to local residents. Delivery vehicles would be prohibited from waiting within or close to the site with their engines running. (v) All machinery items will be properly maintained and operated in order to avoid causing excessive noise. (vi) Restrictions on periods of operation and locations of specific construction activities will be agreed by the contractor with the relevant local authority. (vii) Night-time construction operations only when necessary and after consultation with local residents. (viii) Concerned residents will be notified and informed before construction commencing when construction works are planned within 200 meters from properties.		√	√	
	Noise 2. Operational OHL audible noise				
	(i) Corona testing of conductor fittings in the line configuration.	√	√		√
	(ii) Manufacture of conductor consistent with technical specifications, particularly with respect to removal of drawing oils, application of appropriate type and quantity of grease on the inner layers of the conductor and any other factors which could affect the surface condition of the conductor.	√			
	(iii) Statements from the contractor which would ensure that conductors are stored, transported and handled with appropriate care so as to minimize surface damage and contamination.	√			

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	Noise 3. Operational substation audible noise				
	(i) Specification that will ensure that noise level generated at source is below 60 dB(A).	√			
	(ii) Installation of rubber foundation elements that will achieve appropriate reduction of noise emission.			√	
	(iii) Investigatecomlaints about noise, including cumulative noise levels, and take appropriate action to reduce noise levels as needed.				√
Geology & Soils	Good construction practice to prevent soil deterioration (at a mini-mum) and supplemented with commitments to site-specific mitiga-tion through future project development: (i) The removal and off-site disposal of soils will be avoided where soils are considered to have a value with regard to habitat and agricultural productivity, and where soils are to be used for restoration purposes. (ii) Where woodland / forest is removed for the construction of the proposed transmission line and associated access roads, suitable re-vegetation would be undertaken (in accordance with ecological constraints) to reduce the potential for erosion through the loss of the soil binding effect of surface cover. (iii) Temporary storage of excavated soil will be done in secure location with run-off and erosion prevented. Any soil piles left at end of construction will be removed or spread out. Excess concrete or stone will be removed. (iv) Activities for land restoration and re-vegetation will be overtaken immediately upon completion of works, including re-vegetation / seeding with native species. Monitoring until vegetation cover is self-sustaining will be performed. (v) Vehicle movements on untracked ground would be limited to reduce the impact of construction on surface cover loss and soil compaction and in particular in areas with softer deposits / soils and on steeper slopes, like valley sides. The contractor will be responsible for the planning of construction works to avoid access road construction during periods of highest		√	√	

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	rainfall. (vi) Earth cutting and access roads along steeper slopes will be avoided where possible to reduce the impact on slope stability. Where required, suitable engineering will be undertaken to ensure the stability of the slope is maintained, including in areas prone to slides. (vii) Installation and maintenance of control measures for erosion, run-off and sedimentation on steep slopes and in erosion prone areas. (viii) Provision of equipment for evacuation of leakages. (ix) Fuel tanker vehicles for servicing the construction plant and equipment will carry a suitable sized spill kit and the staff would be trained and regularly updated on their use. (x) Provision of portable toilets to prevent any sewage being discharged on site and contracting authorized service company for management and disposal of waste water from the toilets. (xi) Prior to any construction in geological sensitive areas, geotechnical investigations will be completed by the contractor to ensure that there is no likely risk associated with underground workings. (xii) Site specific mitigation measures for towers and access roads will be further developed prior to construction through appropriate technical documents.				
Hydrology	Good construction practice to prevent water pollution, including (at a minimum): (i) Avoid water protected / management zones (ii) All construction zones along the proposed OHL would be established at the appropriate distance from surface waters. (iii) Minimum distance from watercourse that must be kept by the construction & transport vehicles / machinery will be 10 m.. (iv) Tower foundations would be located and excavated wherever possible in the driest locations with well consolidated geology, and wetland areas would be avoided. Wherever		√	√	

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	possible, towers should not be located within 10 meters of watercourses. (v) Wherever possible, towers would be located outside of flood plains to reduce potential effects on flooding. (vi) Towers would be located to avoid water supply, springs and water extraction facilities in the vicinity of the proposed route. (vii) Work on soft ground in wet weather will be minimized, wherever possible. (viii) No water discharge directly to watercourses. (ix) Measures to prevent the run-off of sediment from areas of the works to watercourses. (x) Stockpiling out of the construction sites will be prohibited and areas close to watercourses will be avoided. (xi) Provision of equipment for evacuation of leakages. (xii) Fuel tanker vehicles for servicing the construction plant and equipment will carry a suitable sized spill kit and the staff would be trained and regularly updated on their use. (xiii) Regular maintenance of all machinery to prevent engine oil and fuel leaks. (xiv) Provision of portable toilets to prevent any sewage being discharged on site. (xv) No crossing of watercourses by vehicles and machinery.				
	Protection measures against transformer oil spill will be installed in the new substation. These will include oil / storm water tank, placed bellow energy transformers on a concrete foundation and with 1.1 times the capacity as the largest transformer unit. Regular inspection throughout substation operation period will be performed.			√	√
Biological diversity	Conduct pre-construction bio- survey prior to micro-siting tower and other locations to avoid disturbing sensitive habitats and protected species.		√		
	Schedule construction so as to avoid disturbance to nesting birds of protected species and breeding animals of protected species.	√	√		

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	General commitments – good construction practice				
	(i) Use, as much as possible, existing access roads and minimize the construction of new access roads.	√	√	√	
	(ii) Prohibit fires for any reason unless with the approval of local fire authorities. If fires are allowed in any place, ensure adequate fire-fighting equipment is available at all times.		√	√	
	(iii) Limit workers to construction sites and prohibit their disturbance of local flora and fauna. Specifically, do not allow: (i) the collection of medicinal plants, mushrooms and fruits, (ii) collecting snails, (iii) disturbance and hunting of game, birds, etc., (iv) collection of eggs from birds, (v) disturbance of young animals and other; cutting plants or trees of any kind.		√	√	
	(iv) Designate smoking areas for workers when constructing in forests or in dry periods.		√	√	
	(v) As soon as construction is complete, restore all construction sites and temporary tracks used for construction. If required, certain bio-technical activities would be implemented.			√	
	Habitats' protection				
	(i) Ensure that qualified biologist or environmental engineer is present at all times to ensure that all plans are followed and there is no unnecessary damage to habitat and other natural resources. Sensitive areas include Ohrid Lake near the village Radozda, Crn Drim upon its exit from Struga, the river Sateska near the village Volino, and Pelagonia area.		√	√	
	(ii) Use, as much as possible, existing access roads and minimize the construction of new access roads through marshy vegeta-tion (reedbeds), riparian habitats and meadows. Wherever possible, place new access roads in areas of low ecological sensitivity. As soon as construction is complete, restore all temporary tracks used for construction.	√	√	√	
	(iii) No construction camps or machinery parks would be located within sensitive ecological areas, high sensitive habitats or on		√	√	

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	alluvial terrains (in the river and stream valleys) in order to avoid adverse impacts on valuable riparian habitats and surface and ground waters.				
	(iv) Do not store any waste material (concrete, steelworks, soil, etc.) in sensitive areas.		√	√	
	(v) After trees are felled or other vegetation is cleared in the transmission line corridor or along new roads, re-establish vegetation by planting seeds or young plants of native species, and monitor until full vegetation cover is re-established.		√	√	
	(vi) All sites that should serve as temporary deposits for various construction material have to be proposed by the designer and constructor in advance in order to be assessed for possible adverse impacts on the habitats.		√	√	
	(vii) Compensate for forests' loss by planting adequate / corresponding area of bare forest land or other land that can serve for this purpose. The afforestation is to be carried out with autochthonous species, characteristic for the same area (Italian oak – *Quercus frainetto*, sessile oak – *Quercus petrea*, Turkey oak – *Quercus cerris*, beech – *Fagus moesiaca*, European hornbeam – *Carpinus betulus*, Pedunculate oak – *Quercus robur* and other species. Detailed design and locations for afforestation should be elaborated in cooperation with Public Enterprise "Makedonski sumi".			√	
	Plant species				
	(i) Minimum clearing of vegetation and re-vegetation works to disturbed areas as soon as construction is completed.			√	
	(ii) Restore vegetation cover with autochthon species, compatible with the OHL safety operation requirements.				
	(iii) No clearing of riparian zones and selective removal of tall growing trees.				
	(iv) Avoid cutting of pedunculate oak (*Quercus robur*).				
	(v) Avoid destruction of marsh vegetation. Where this is unavoidable, it should be limited to the minimum. This				

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	measure applies to all humid meadows (humid meadows in Struga Field - along river Sateska and between villages Volino and Moroista).				
Biological diversity (Birds)	Birds				
	(i) Design and install conductors and isolators to avoid any electrocution hazard.	√		√	
	(ii) Conduct a pre-construction bird survey to allow sound micro-sitting of towers and access tracks and to identify eventual need of bird diverters on particular OHL sections.		√		
	(iii) No construction would take place during the breeding bird season apart from where pre-construction survey has indicated that no birds are nesting.			√	
	(iv) Where possible all access track construction and vegetation clearance for the towers would not be undertaken during the breeding bird season.			√	
	(v) All site staff would be briefed on procedures to be implemented if any nesting birds are found within the construction area.Work would stop in the area until specialist advice is sought and implemented.			√	
	(vi) Sections of the proposed transmission line assessed during the pre-construction survey to be associated with a potential risk of bird collision would be marked with bird diverters.	√		√	√
	(vii) A three-year post-construction monitoring programme along particular sections of diverter-marked and unmarked transmission line would take place to assess the effectiveness of the bird diverters.				√
Biological diversity (other animal groups)	Other animal groups				
	(i) Survey trees to be felled for potential bat activity. Mark and check potential bat roost trees. If any evidence of bats are identified, consult with competent authority to develop appropriate mitigation measures before felling the tree(s). If there is evidence of breeding bats or young bats, postpone construction until bats have left the breeding trees.		√	√	

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
	(ii) Direct destruction of the populations of amphibians and reptiles can be avoided through application of certain restrictions during the construction period (avoiding spawning period - spring) in the areas close to the water habitats. A set of measures would need to be proposed at the final stage of design process when tower sites would be known.			√	
	(iii) Prohibit and strict control of illegal hunting (poaching) by workers.		√	√	
Visual and Landscape Effects	Transmission Line: (i) Include visibility of the towers among the factors considered during final tower positioning, including determining the proper balance between heights of towers and the number of towers. (ii) Allow the maximum vegetation height in corridors while still maintaining the required clearance. (iii) Width of all access roads and tracks will be kept to the minimum necessary for their use during construction and operational. New substation: (i) To the extent possible, maximize the extent to which these facilities 'fit' well into the surrounding landscape and are accepted by the community and are screened from view as much as possible.			√	√
Construction Traffic and Transport	• All construction work would be assessed for traffic management requirements, in accordance with the national legislation on roads and transport. Only contractors approved / licensed by the Macedonian road competent authorities would be selected to undertake construction traffic activities. • Develop and implement Transport (Traffic) Management Plan, that would, *inter alia*, include the following elements: – Transport management planning – Access road maintenance – Vehicle management and maintenance, and – Community liaison and safety.	√	√	√	

Indicator	Mitigation measure	Implementation			
		design	site preparation / pre-construction	construction	operation / maintenance
Waste management	Develop waste management plans to guide management of all waste types to be generated during construction and operation. The plan would include (at a minimum): – Waste selection options – Recycling / reuse options – Waste transport – Disposal options – Separation of hazardous waste	√		√	√
Radio and TV interference	No mitigation measures are necessary in relation to radio and TV interference. However, in an event of any effects arising once the transmission line is operational, MEPSO would investigate these effects on a case by case approach and take appropriate action to mitigate any unforeseen effects.				√
Cultural heritage	Develop and implement a chance find procedure and ensure all contractors and other relevant parties are trained in its use.	√		√	
Existing infra-structure	Further design process would ensure that safety height and safety distance as stipulated in the Macedonian standards (Regulation on the Technical Rules for Construction of Overhead Power Lines with Nominal Voltage of 1kV to 400 kV) are taken into considera-tion when the proposed transmission line crosses existing infra-structure (other transmission line, roads, pipelines, etc.)	√		√	

Table 11-1 – Summary of the mitigation measures at different project stages

11.5 Environmental and Social Monitoring

Project phase	Environmental indicator / parameter	Frequency	Way / type of monitoring	Responsibility	Phase	Reason
Construction	**Construction noise**					
	Implementation of regime of utilization of transport and construction equipment / machinery.	During intensive construction activities	Noise measuring equipment	Contractor / Investor	Construction	Maintenance of the level of environmental noise
	Biological diversity					
	Monitoring of measures for avoidance and mitigation of impacts.	In continuation	Visual / Expert advices	Contractor / Investor	Construction	Conservation of biological diversity
	Transport and traffic (Traffic Management Plan)					
	Monitoring of the compliance with the Plan for transport and traffic.	In continuation	Visual	Contractor / Investor	Construction	Provision of safety of the construction site
	Monitoring during construction activities in order to control whether access roads are maintained in adequately safe condition.	Weekly	Visual		Construction	Provision of safety of the construction site
	Air quality					
	Monitoring of the dust emission due to construction activities.	Daily	Visual	Contractor / Investor	Construction phase (dry and windy periods)	Maintenance of the quality of the air
	Hydrology / Soils					
	Inspection of control measures concerning erosion and sedimentation.	Weekly regular checks and after rainfalls	Visual	Contractor / Investor	Construction	Check of the effectiveness of measures
	Monitoring and sampling upon eventual leakages.	Incidental (after eventual leakages)	Visual / sampling and laboratory		Construction	Control of potential pollution
	Inspection of mobile toilets, in order to check if they are emptied regularly.	Weekly	Visual		Construction	Maintenance of the construction site

Table 11-2 – Environmental and social monitoring

Project phase	Environmental indicator / parameter	Frequency	Way / type of monitoring	Responsibility	Phase	Reason
Construction	**Waste management (Waste Management Plan)**					
	Inspection / control of the adequacy of excavated earth material for reuse.	As required	Visual	Contractor / Investor	Construction	Control of soil properties
	Inspection of the vessels for waste collection (regularity of emptying, etc.).	Weekly	Visual		Construction	Maintenance of the construction site
	Inspection of construction zones and scope (control over illegal waste dumping).	Weekly	Visual			
	Monitoring of procedures related to possible recycling and disposal systems.	Weekly	Visual			
	Cultural heritage					
	Protection of archeological heritage in case of incidental archeological discovery	As required	Visual	Investor / competent authorities on cultural heritage	Construction	Identification of archeological / cultural good

Table 10-2 – Environmental and social monitoring (*continued*)

Project phase	Environmental indicator / parameter	Frequency	Way / type of monitoring	Responsibility	Phase	Reason
Operation	**Operational Noise**					
	Monitoring of the operational noise from the OHL (corona effect) and the substations	On demand	Noise measuring equipment	MEPSO	Operation	Maintenance of the level of environmental noise
	Electro-magnetic fields (EMF)					
	Measurement of electric and magnetic fields	On demand	Equipment for measuring EMF	MEPSO / External consultancy	Operation	Protection of public from exposure to EMF
	Biological diversity					
	Monitoring of the mortality rate on avian fauna	In continuation (minimum 3 years once the OHL is operational)	Appropriate methodology and equipment	MEPSO / External consultancy	Operation	Conservation of biological diversity
	Transport and traffic					
	Monitoring of the condition of local roads in order to maintain them in adequately safe condition	In continuation	Visual	MEPSO (Maintenance team)	Operation	Provision of safety on the project location
	Radio and TV interferences					
	Monitoring of potential interferences	On demand	Appropriate methodology and equipment	MEPSO / External consultancy	Operation	Eventual electromagnetic interference with radio & TV services
	Water quality / Soils					
	• Communal order related to waste management • Eventual incidents of leakage of fuel or oil from the vehicles • Eventual incidents of leakage of transformer oil at substations	• Periodical • If required • If required	Visual / sampling and laboratory	MEPSO / (Maintenance team)	Operation	Maintenance of the quality of water and protection of soils
	Waste management (Waste Management Plan)					
	• Selection / recycling of packaging waste, waste OHL elements and materials • Separation of hazardous waste fractions and removal	In compliance with the Waste Management Plan	Visual	MEPSO (Maintenance team)	Operation	Maintenance of the project location

Table 10-2 – Environmental and social monitoring (*continued*)

12 Emergency Response Planning

12.1 Potential Hazards and Risks associated with the Project

Potential risks and hazards that may be associated with the project in the construction and operational phases are:

- natural risks
- risk from electric hazard
- risk of traffic accident
- risk of fires
- risk of hazardous substances spill
- risk of dust and noise
- injury of workers
- other

Natural hazards and geo-hazards

These may include:

- ice
- floods
- earthquake and other geological hazards
- soil erosion.

Traffic Accidents

Trucks and heavy machinery will be used during construction activity in project area. During their movement on public and access roads the following events may occur:

- Collision with vehicles, assets or animals of local population
- Collision with members of the local population
- Collision with other project machinery
- Collision with the members of the project workforce.

The construction of the proposed transmission line requires intensive transport operations, therefore, proper mitigation measures must be implemented to avoid accidents. The construction activity will involve large trucks and machinery. The use of driver training and skilled operational personnel will significantly reduce the risk of collision.

Fires

During the project life fires may arise due to:

- Clearing and cutting of tree and grass and its improper handling
- Sparks from construction or maintenance equipment

- Improper management of flammable matter (solvent, fuel, etc)
- Careless actions of worker at construction camps and work sites, such as throwing of burning cigarette, making fires at camps/work sites, etc.
- Thunder and electricity line failure.

Accidental Spills and Discharges (surface water or soil pollution)

Potential incidents and damage are associated with the following pollutants:

- Release of hazardous substances as diesel fuel, lubrication oils, hydraulic fluids used in construction vehicles and plants.
- Miscellaneous chemicals (e.g. cement and concrete, construction material compounds etc).
- Polluted runoff waters during construction.
- Leakage due to damage of sanitary facilities and discharges of none treated wastewater.

In the operation phase during maintenance of the OHL, incidental leakage of fuel and oils, as well as transformer oil at substations is estimated as potential hazard.

Dust and Noise

Dust and noise in construction phase arise from excavation, drilling, transport of material and waste disposal. In the operation phase they are negligible.

Worker Injury

Worker injury may be associated with:

- Incidents with heavy machinery / vehicle used for the project construction
- Operations at heights
- Pollution with used chemicals
- Expose of dust, noise and vibration from excavation, drilling, transport
- Electrocution when working near powered OHL towers / conductors or substation devices.

12.2 Emergency Management

An outline of the emergency management procedures will need to be provided for the range of situations identified in the risk assessment given above, where there is potential for hazards to create an emergency situation.

This should include an overview of the objectives and management principles to be adopted for the preparation of a detailed emergency response plan (including emergency response and recovery / cleanup procedures) in consultation with the relevant emergency services.

In particular, the following should be presented in the plan:

- contingency plans to deal with spills (e.g. diesel, lubricating oils) during construction, operation and maintenance of the project

- contingency plans to account for natural disasters during the construction and, operation phases
- emergency planning and response procedures that have been determined in consultation with state and local emergency service providers.

In the Emergency Response Plan, the persons who shall be designated and authorized in emergency cases and the method of delegation and authorization should be specified clearly. Designated first aid and emergency rescue facilities and equipment will be available during the construction and operation phases.

The Emergency Response Plan should include the following:

- roles and responsibilities of personnel during emergency situations
- notification listing or flowchart, identifying responsibility for notification, the order of notification and who is to be notified
- identification of emergency conditions which could endanger the integrity of the transmission line
- description of typical problems, problem characteristics and when/what to check for during inspections
- transmission line and substation operational procedures to follow in the event that such emergency conditions are identified.

13 Conclusion

Consideration of the key effects of the proposed project indicates that the careful routing of the new 400 kV transmission line together with the identification of a comprehensive set of mitigation measures, which when implemented, reduces the potential effects of the transmission line significantly.

The findings of this ESIA indicate that the project objective of identifying technically feasible and economically viable solutions which on balance causes the least disturbance to the environment and to the people who live and work in its surrounding has been met.

The construction and operation of the proposed transmission line and associated substations is considered as justified because:

- ✓ Environmental issues related to all stages of the life cycle of the proposed project are identified and taken into account.
- ✓ The assessment of the environmental and social impacts is based on best available information and consideration of cumulative impacts.
- ✓ The identified likely impacts can be prevented, reduced or compensated and, therefore, the proposed project is not a threat for adverse or irreversible damage to the natural and social environment in the project area.
- ✓ The proposed project will not cause significant impacts on biodiversity and ecological integrity of the area.

The environmental and social impacts associated with the proposed project are identified and addressed in this ESIA report according to the requirements of the relevant Macedonian regulation, the European Bank for Reconstruction and Development (EBRD) and best international practices.

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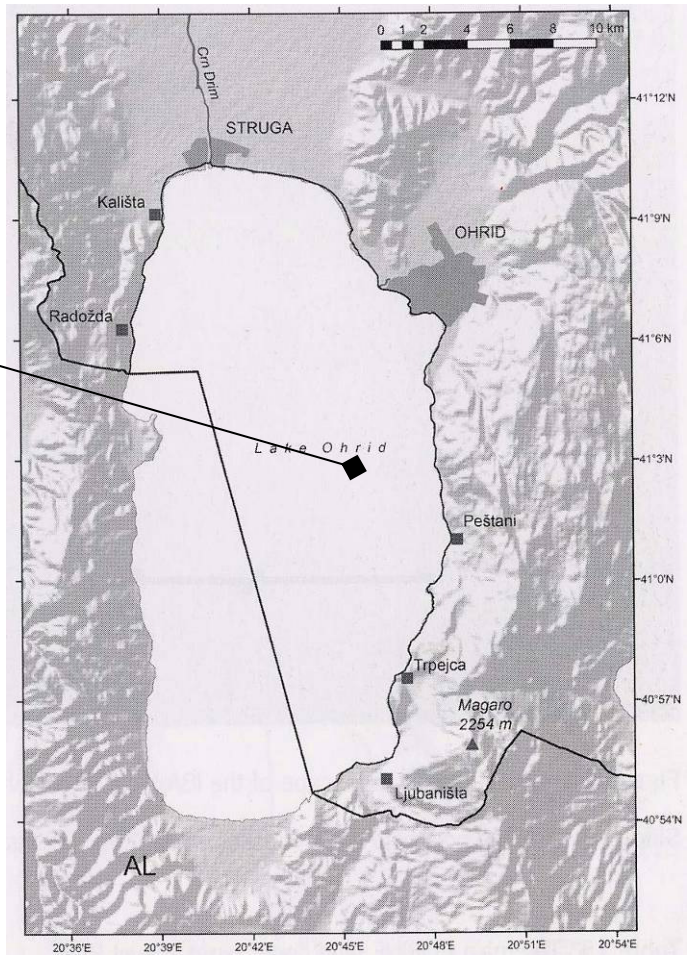
Appendix 1 – Project Maps

- Appendix 1.1 – Map of the Corridor of the Proposed Transmission Line (under separate cover)
- Appendix 1.2 – Map of Strategic Alternative Corridors (under separate cover)
- Appendix 1.3 – Geological Map (under separate cover)
- Appendix 1.4 – Land Use Map (under separate cover)
- Appendix 1.5 – Biodiversity Maps:
  - Appendix 1.5.1 – Birds and Butterflies Map (under separate cover)
  - Appendix 1.5.2 – Mammals Map (under separate cover)
- Appendix 1.6 – Map of Protected Areas (under separate cover)
- Appendix 1.7 – Administrative Map (under separate cover)
- Appendix 1.8 – Map of Newly Planned Infrastructure in Struga Region (Pan European Corridor 8) (under separate cover)

Appendix 2 – Sites of International Importance

Important Plant and Bird Area "Ohrid Lake"

Name in English: Lake Ohrid
Name in Macedonian: Ohridsko Ezero
Area: 24,736 ha



IBA mode: MK005
Criteria: A4iii, B1i, B2

(A) "A" criteria – Important Bird Areas of global importance

- A4 Congregations iii) The site is known or thought to hold, on a regular basis, ≥ 20,000 waterbirds or ≥ 10,000 pairs of seabirds of one or more species

(B) "B" criteria – Important Bird Areas of European importance

- B1 Congregations i) The site is known or thought to hold ≥ 1% of a flyway or other distinct population of a waterbird species
- B2 Species with an unfavourable conservation status in Europe, The site is one of the 'n' most important in the country for a species with an unfavourable conservation status in Europe and for which the site-protection approach is thought to be appropriate

List of triggering and other important bird species in the IBA "Ohrid Lake"

Species	Season	Year	Population	Acc.	Criteria
All waterbirds	W	1987-2002	20.000-79.000 ind.	A	A4iii
Podiceps nigricollis	W	1988-1991	2.600-3.600 ind.	A	B1i
Netta rufina	W	1987-2011	350-7.000 ind.	A	B1i
Fulica atra	W	1987-2011	13.000-60.000 ind.	A	B1i
Mergus merganser	B	2006	1-3	A	B1i
Phalacrocorax pygmeus	B	2000	50-100	C	B2
Podiceps cristatus	W	1991-2000	800-1.400 ind.	A	N
Podiceps cristatus	B	-2003	20-100	C	N
Phalacrocorax pygmeus	W	1989-2002	1.100-3.250 ind.	A	N
Aythya ferina	W	1987-2000	500-7.000 ind.	A	N
Aythya fuligula	W	1989-1999	240-6.500 ind.	A	N

Source: Important Bird Areas in Macedonia: Sites of Global and European Importance. [Acrocephalus 2010]

Species

89 waterbird species have been recorded taking into consideration winter census data for the periods 1987-1991, 1997-2000, 2002, 2010 and 2011 (MICEVSKI 1996, MICEVSKI 1998, FREMUTH et al. 2000, WETLANDS INTERNATIONAL in litt. MES unpubl.). The avifauna includes Dalmatian pelican *Pelecanus crispus* (VU), great white pelican *Pelecanus onocrotalus*, great cormorant *Phalacrocorax carbo sinensis*, pygmy cormorant *P. pygmeus*, European shag *P.aristotelis*, muste swan *Cygnus olor*, black-necked grebe *Podiceps nigricollis*, little grebe *Tachybaptus ruficollis*, red-crested pochard *Netta rufina*, common pochard *Aythya ferina*, ferruginous duck *A.nyroca*, tufted duck *A.fuligula* and corncrake *Crex crex*. Raptors include griffon vulture Gyps fulvus, lammergeyer *Gypaetus barbatus*, Eurasian black vulture *Aegypius monachus*, imperial eagle *Aquila heliacal* (VU), golden eagle *Aquila chrysaetus*, whitetailed eagle *Haliaeetus albicilla*, peregrine Falco *peregrines* and lesser kestrel *Falco naumanni* (VU). The population of Coot is the biggest (60,000 ind. in 1989, but only 7,500 in 2010), followed by the Pochard (500 – 7000 ind. but only 150 and 300 in 2010 and 2011, respectively), Red-crested Pochard (350-7000 ind.), Tufted Duck (240-6,500 ind., but only 20 in 2010) and Black necked Grebe (130-3600 ind.). Triggering species for the breeding period are the Pygmy Cormorant with some 50-100 pairs breeding in 2000 (MICEVSKI 2003) and the Goosander (SKORPIKOVA et al. 2006). The Great Grested Grebe is one of the most frequent breeding birds on the Lake (MICEVSKI 2003). The northern shallow part of the lake is of the highest importance for wintering waterbirds (MICEVSKI 1996), with the Coot and Red-crested Pochard being the most frequent.

There are two communities of plants and animals in Lake Ohrid, the near shore (littoral zone community) and the offshore (pelagic community).

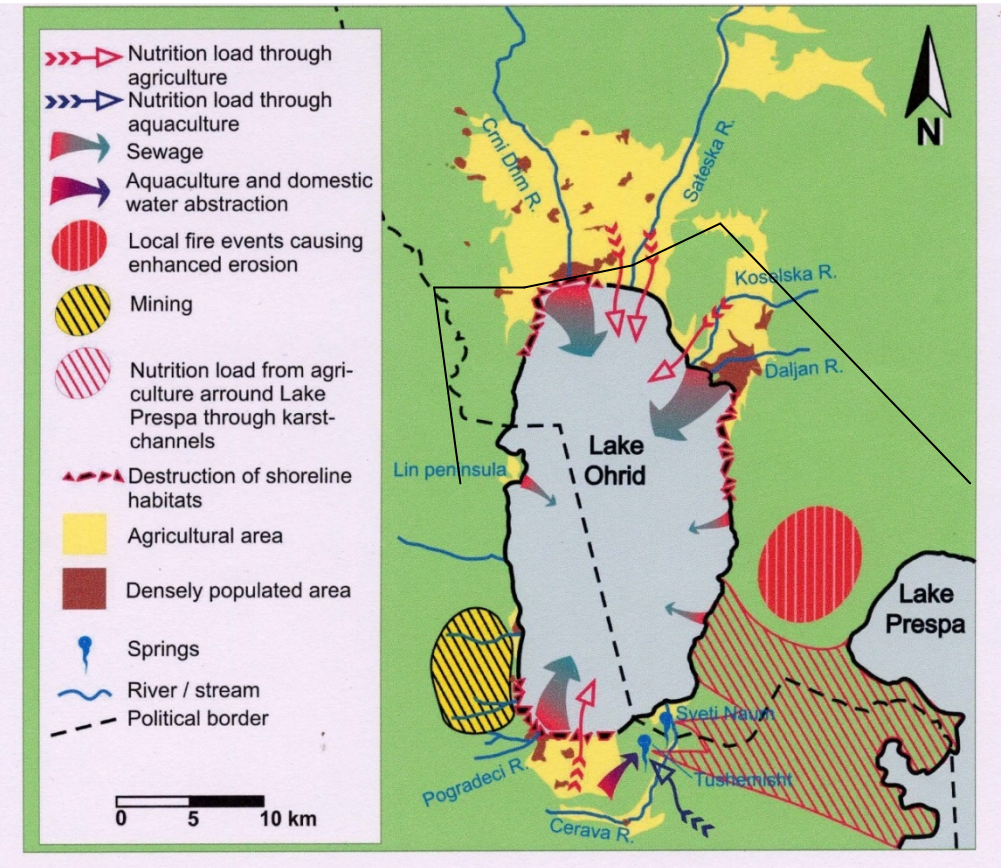
In the littoral zone, rooted plants grow up from muddy and sandy bottoms and algae grow on the surface of the rocks and other hard surfaces. In the deeper water (5-15m), algae and rooted aquatic plants can grow in large beds. Among the more common species are Potamogeton spp., Chara spp., Ceratophyllum spp., and Myriophyllum spp. Closer to shore, the reeds (Phragmites australis) appear and grow right up to the edge of the water. In many places, the colonial algae Cladophora spp. grows on most surfaces. In areas of the shoreline that receive river input, runoff from agricultural land, or sewerage, the littoral zone community can be thick with aquatic plants. Those species that thrive with higher concentrations of phosphorus are choking out the other plants. Cladophora in particular thrives when runoff carries phosphorus into the lake in the summertime.

Many of the bottom-dwelling animals in the Lake Ohrid are endemic. For example, Lake Ohrid is the only place where the rounded sponge Ochridospongia rotunda is found. Over the last 20-25 years, the community of small organisms has changed significantly in areas where human pollution has entered the lake.

In the pelagic community, the base of the food web is based on the plankton. Monitoring data collected over the last several years confirm that both the phytoplankton and zooplankton communities in Lake Ohrid are changing. New species that depend on nutrient enriched conditions have been discovered, and the species composition in locations close to river inputs and near the towns and villages is changing to one that is dominated by more eutrophic species. These changes reflect the changes in water quality in the lake, and underscore the need to control the pollution coming into the lake.

The shoreline and watershed of Lake Ohrid also provide critical habitat for a great variety of wildlife (frogs, turtles and birds).

Main threats

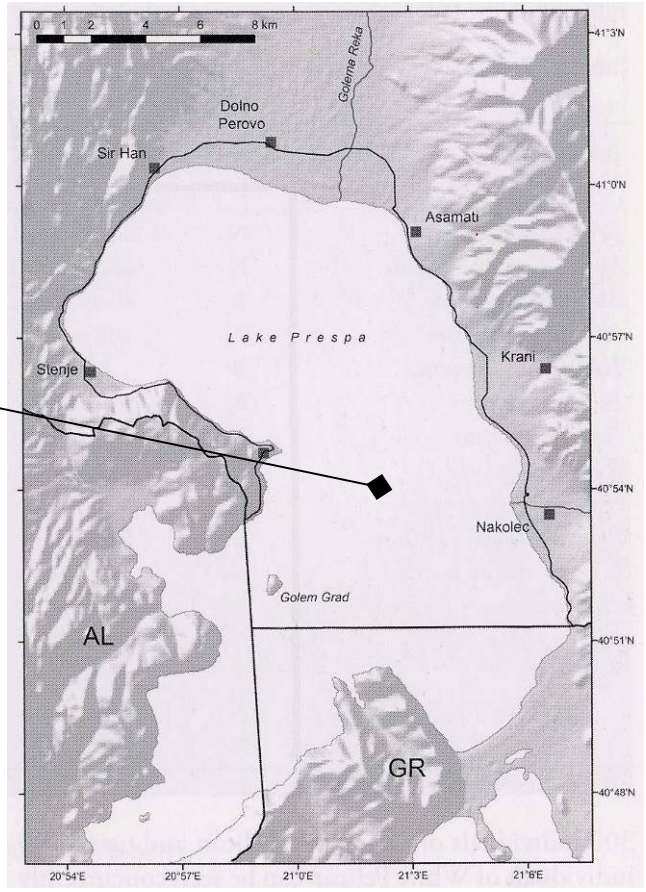


Map - Main threats to Ohrid Lake

Important Plant and Bird Area "Prespa Lake"

General Information
Name in English: Lake Prespa
Name in Macedonian: Prespansko Ezero
Area: 19,842 ha

IBA code: MK006



Criteria: A1, A4i, B1i, B2

(A) A criteria – Important Bird Areas of global importance

- A1 Species of global conservation concern, the site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern
- A4 Congregations i) The site is known or thought to hold, on a regular basis, ≥ 1% of a biogeographic population of a congregatory waterbird species

(B) B criteria – Important Bird Areas of European importance

- B1 Congregations i) The site is known or thought to hold ≥ 1% of a flyway or other distinct population of a waterbird species
- B2 Species with an unfavourable conservation status in Europe, The site is one of the 'n' most important in the country for a species with an unfavourable conservation status in Europe and for which the site-protection approach is thought to be appropriate

List of triggering and other important bird species in the IBA "Prespa Lake"

Species	Season	Year	Population	Acc.	Criteria
Pelecanus cripsus	N	2008-2010	300-1000 ind.	C	A1, A4i, B1i
Pelecanus onocrotalus	N	2008-2010	150-500 ind.	C	A4i,B1i
Mergus merganser	B	2008-2010	30-50	B	B1i,
Mergus Merganser	W	1987-2011	2-22 ind.	A	B1i
Ixobrychus minutus	B	2009	50-200	C	B2
Podiceps cristatus	W	2010-2011	2000-3400 ind.	A	N
Podiceps cristatus	B	1987-2010	100-600	C	N
Podiceps nigricollis	W	1989-2004	1400-5800 ind.	A	N
Phalacrocorax pygmeus	B	1993	10-20	C	N
Phalacrocorax carbo sinensis	B	2008-2010	2500-3000	B	N
Casmerodius albus	N	2010	60-150 ind.	B	N
Anas strepera	B	-1998	0-10	C	N
Aythya nyroca	B	1998-2008	3-10	B	N
Aythya ferina	W	1989-1999	1850-3200 ind.	A	N
Aythya fuligula	W	1988-1997	100-9000 ind	A	N
Fulica atra	W	1997-1998	9000-9750 ind	A	N
Pelecanus cripsus	N	2008-2010	300-1000 ind.	C	A1, A4i, B1i
Pelecanus onocrotalus	N	2008-2010	150-500 ind.	C	A4i,B1i

Source: Important Bird Areas in Macedonia: Sites of Global and European Importance. [Acrocephalus 2010]

Species

The bird fauna of Lake Prespa includes as recorded 103 waterbird species (MICEVSKI 1998) according to the winter censuses data for the periods/yeas 1987-1990, 1997-2002, 2004-2006 and 2009-2011 (MICEVSKI & SCHNEIDER 1997, FREMUTH et al. 2000, VASIC 2009A, WETLANDS INTERNATIONAL in litt., MES unpubl.). Coot is the most numerous (1,000 – 20,700 ind.) followed by Tufted Duck (between as few as 12 ind. in 2002 and 9,000 – 12500 ind. in 1988 – 1989), Black-necked Grebe (up to 5,800 in 2004, with decline in numbers thereupon, the exception being 2009 with 3900 ind.), Pochard (12,500 ind. in 1988, 9,000 ind. in 1989, but only 15 ind. in 2004), and Teal Anas crecca (up to 2,500 ind.). The total number of wintering waterbirds was more than 20,000 individuals only in 2009. The island Golem Grad hosts the largest Cormorant colony in the country (2,500-3,000 pairs, VASIC 2010) and the only colony (ca. 50 pairs) of the Yellow-legged Gull in Macedonia (VASIC 2009A). 30-50 pairs of Goosander breed along the lake shores (VASIC 2010), with some of them also wintering on the lake. The lake surface bears up to 300 individuals of Dalmatian Pelican and up to 100 individuals of White Pelican. An estimation of the number of non-breeding birds present in the Macedonian part of the Lake Prespa is at 300-1000 individuals of the Dalmatian Pelican and 150-500 individuals of the White Pelican, while the population of the Ferruginous Duck has been estimated at only 3-4 pairs breeding in 1995 (MICEVSKI 1998), and at 3-10 pairs by VASIC (2010). The breeding population of the Gadwall has also been estimated to 10 pairs (VASIC 2010). Some 20-50 breeding pairs of the Great Egret have been estimated to breed at Lake Prespa (VASIC 2010). MICEVSKI (1998) refers to minimum 30 breeding pairs of the Great Crested Grebe along the northern shore, while VASIC (2010) estimates 500-750 pairs for Galicica National Park (both Ohrid and Prespa shorelines included), which gives a high estimate of the breeding population at 100-600 pairs.

The entire lake is protected as a Nature Monument; since 1996, its northern shallow parts and shores have been protected as Strict Nature Reserve Ezerani (2,080 ha). It is a Ramsar Site of international importance, among other criteria due to the importance for waterbirds.

From the phytogeographical perspective, the Prespa region can be classified in the Balkan subzone of the Sub-Mediterranean vegetation zone. The regions with aquatic vegetation have special conservation importance. The plant formations of the land area exhibit a variety of forms. The successive zones from the lake shore to the basin line in the mountains are forest formations (lowland woodland vegetation, deciduous oak forests, deciduous beech forests, and mixed beech – fir tree stands), sub-alpine vegetation of dwarf shrubs and alpine meadows.

Considering the fauna, there have been recorded: 16 endemic species of invertebrates (Austropotamobius torrentium, Rosalia alpine, Lucanus cervus, Parnassius Apollo etc.), 11 amphibian species (two species and four subspecies are considered Balkan endemics - None of the amphibian species is directly threatened - Triturus carnifex macedonicus, Triturus (Lissotriton) vulgaris graecus, Bombina variegata scabra, Rana graeca etc.), 22 reptile species have been recorded (Elaphe longissima, Natrix tessellate, Algyroides nigropunctatus, Lacerta agilis etc.). The endangered mammals include the Brown bear (*Ursos arctos*), the Grey wolf (*Canis lupus*), Chamois (*Rupicapra rupicapra balcanica*) and European otter (*Lutra lutra*).

The following habitats of European importance are present in and around Prespa Lake: *22412 Frogbits rafts*, *22415 Salvinia covers*, *22416 Aldrovanda communities* and *44 Temperate riparian and swamp forest and brush*.

Ezerani is the most important ornithological reserve. There is a great number of birds nests, feeds and shelters in this area (Micevski, B., 1994). Present situation is: 96 species of birds are known to live in Prespa lake area (Micevski, 1999). The second important information is: 61 species (63,5%) from this number are on the List of strictly protected species (acc. to the Bern Convention, Annex II); 3 species (*Pelecanus crispus,Pelecanus onocrotalus* and *Haliaeetus albicilla*) are on the List of the most strictly protected species with international importance (Bonn Convention, Annex I), also 3 species (*P. crispus, H.albicilla* and *Phalacrocorax pygmaeus*) are on the European "Red List" of globally endangered animals and plants species; 17 species (35,4%) are under permanent protection by the national legislation.

Habitat types (Resolution No 4 / 1996) that are present are:

! 22.412 Frogbit rafts
! 22.416 Aldrovanda communities
! 44 Temperate riverine and swamp forests and brush

Species (Resolution No 6 / 1998) that are present are:

PLANTS: Aldrovanda vesiculosa L.

MAMMALS: Rhinolophus blasii, Rhinolophus euryale, Rhinolophus blasii, Rhinolophus euryale, Rhinolophus ferrumequinum, Myotis blythii, Canis lupus, Lutra lutra

BIRDS: Gavia arctica, Podiceps auritus, Phalacrocorax pygmaeus, Pelecanus crispus, Pelecanus onocrotalus, Ardea purpurea, Ardeola ralloides, Botaurus stellaris, Casmerodius albus (Egretta alba), Egretta garzetta, Ixobrychus minutes, Nycticorax nycticorax, Ciconia nigra, Ciconia cico-

nia, Plegadis falcinellus, Platalea leucorodia, Phoenicopterus ruber, Aythya nyroca, Mergus albellus, Circaetus gallicus, Circus aeruginosus, Circus cyaneus, Circus macrourus, Circus pygargus, Haliaeetus albicilla, Milvus migrans, Pandion haliaetus, Porzana pusilla, Philomachus pugnax, Tringa glareola, Himantopus himantopus, Recurvirostra avosetta, Glareola nordmanni, Chlidonias hybridus, Chlidonias leucopterus,Chlidonias niger, Gelochelidon nilotica, Larus melanocephalus, Sterna albifrons, Sterna hirundo, Sterna sandvicensis, Alcedo atthis, Acrocephalus melanopogon

REPTILES: Emys orbicularis

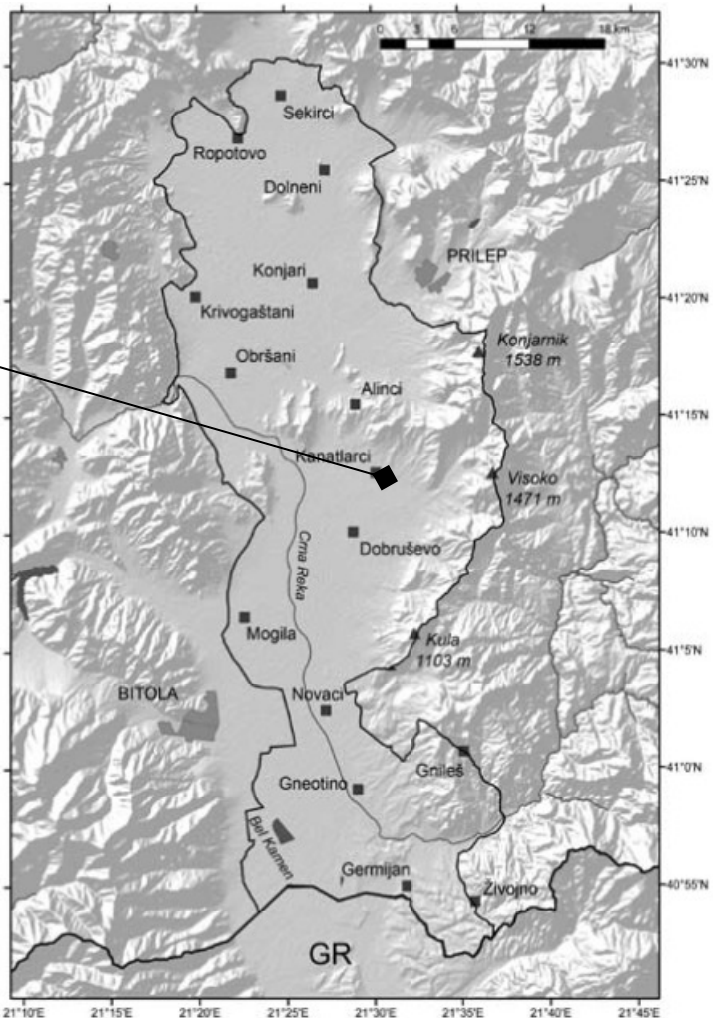
AMPHIBIANS: Triturus carnifex (Triturus cristatus carnifex), Bombina variegata

Important Bird Area "Pelagonija"

General Information

Name in English: Pelagonia
Name in Macedonian: Pelagonija

Area: 113,584 ha



IBA code: MK024

Criteria: A1, A4ii, B1iii, B2, B3

(C) "A" criteria – Important Bird Areas of global importance

- A1 Species of global conservation concern, the site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern
- A4 Congregations ii) The site is known or thought to hold, on a regular basis, $\geq$ 1% of the global population of a congregatory seabird or terrestrial species

(D) "B" criteria – Important Bird Areas of European importance

- B1 Congregations iii) The site is known or thought to hold $\geq$ 1% of a flyway or other distinct population of other congregatory species
- B2 Species with an unfavourable conservation status in Europe, The site is one of the 'n' most important in the country for a species with an unfavourable conservation status in Europe (SPEC 2 & 3) and for which the site-protection approach is thought to be appropriate
- B3 Species with a favourable conservation status in Europe, the site is one of the 'n' most important in the country for a species with a favourable conservation status in Europe but concentrated in Europe (non-SPEC^{E*}) and for which the site-protection approach is thought to be appropriate

List of triggering and other important bird species in the IBA Pelagonia

Species	Season	Year	Population	Acc.	Criteria
Falco naumanni	B	2002	760-850	A	A4ii, B1iii, B2
Coracias garrulus	B	2002	10-30	C	A1, B2
Ciconia ciconia	B	2002	220-230	A	B2
Aythya nyroca	B	2002	10-15	A	B2
Burbinus oedicnemus	B	2002	10-30	C	B2
Lanius minor	B	2002	30-100	C	B2
Circus pygargus	B	2002	60-80	A	B3
Falco vespertinus	P	2002	50-150 ind.	C	A1?
Pelecanus crispus	N	2007	10-30 ind.	C	N
Anas strepera	B	2002	2-5	C	N
Circaetus gallicus	B	2008	2-3	B	N
Buteo rufinus	R	2010	3-4	B	N
Falco biarmicus	B	2005	I	A	N

Source: Important Bird Areas in Macedonia: Sites of Global and European Importance. [Acrocephalus, 2010]

Species

No thorough information on the site's bird community has been published recently, although numerous data were collected during the Lesser Kestrel and White Stork censuses in 2002 (B. STUMBERGER & M. VELEVSKI unpublished). Ample information, however, is available from earlier periods (1940-1970) (e.g. MAKATSCH 1950, TERRASSE & TERRASSE 196IA & 196IB, GANSO 1962). The currently drained floodplain of the Crna Reka held numerous breeding colonial water birds in the 1930s, the most interesting being up to 100 breeding pairs of Dalmatian Pelican, 60+ pairs of Spoonbill *Platalea leucorodia*, tens of breeding Glossy Ibises *Plegadis falcinellus* and ca. 300 pairs of Black Tern Chlidonias niger (MAKATSCH 1950, THONEN 2006); none of these species breed in the territory of Macedonia at present.

In 2002, an important population (largest in the country) of White Stork was confirmed, breeding solitarily or in small colonies of up to 20 pairs (STUMBERGER & VELEVSKI 2002). Lesser Kestrel population was estimated at 760-850 pairs, entirely confined to villages and man-made structures in the central and northern parts of the plain, but using mountain slopes (especially those of Mt Selecka Planina) for foraging. At least two pairs of Long-legged Buzzards breed on cliffs of these slopes, and one more on a small hill in the plain. Several other species reach the threshold for populations of European importance, including the Montagu's Harrier with the largest breeding population in the country (60-80 pairs). The three fishponds (Bel Kamen and Bukri in the south and Belo Pole in the north) attract non-breeding Dalmatian Pelicans, and are important for the breeding Ferruginous Duck and few pairs of Gadwalls. Importance of the fishponds for migrating and wintering species is still insufficiently known, although it is presumably high.

Threats

Code	Threat	Threat / Impact	Most affected species
511	Transmission lines	High	- C. ciconia - F. naumanni - C. garrulous

Important Plant Area "Pelister"

The Pelister National Park is a part of the Baba Mountain located in the south-western part of the Republic of Macedonia. There are 37 species of woodlike plants, 31 species of bushes, 18 species of forest communities and 27 grassy communities located within this national park. Among plant communities, the largest surface area is covered by pine forests covering exclusively a surface area of 1.174 ha, and there are also pine-fir, pin-beech, pin-beech-fir, beech and oak-beech forests. Among flora elements, the presence is especially significant of the five-needle pine molica (Pinus peuce)- a unique species of tertiary age being present on only a few mountains in the Balkan Peninsula. As for the vertebrate fauna, there are 12 amphibian, 16 reptiles, 130 bird species and 37 mammal species, special attention deserved by the bear, the doe, the lynx, the wild goat, the deer, the wild boar, the stone partridge (Alcetoris graeca), the golden eagle (Aquila crhysaetos), the stone creeper (Tichodroma muraria) and the red-beak corax (Pyrrhocorax pyrrhocorax). Among the fish, the presence of the endemic Pelister trout is of special significance (Salmo peristerrious Karaman).

Habitat types (Resolution No 4 /1996) that are present are:

- ! 31.46 *Bruckenthalia* heaths,
- ! 41.1. Beech forests,
- ! 41.7 Thermophilous and supra-Mediterannean oak woods
- ! 42.7. High oro-mediterranean pine forests

Species (Resolution No 6 /1998) that are present are:

BIRDS: *Aquila chrysaetos*, *Gypaetus barbatus*, *Pernis apivorus*, *Falco biarmicus*, *Falco peregrinus, Bonasa bonasia, Dendrocopos medius, Dryocopus martius, Lullula arborea, Lanius collurio, Pyrrhocorax pyrrhocorax*

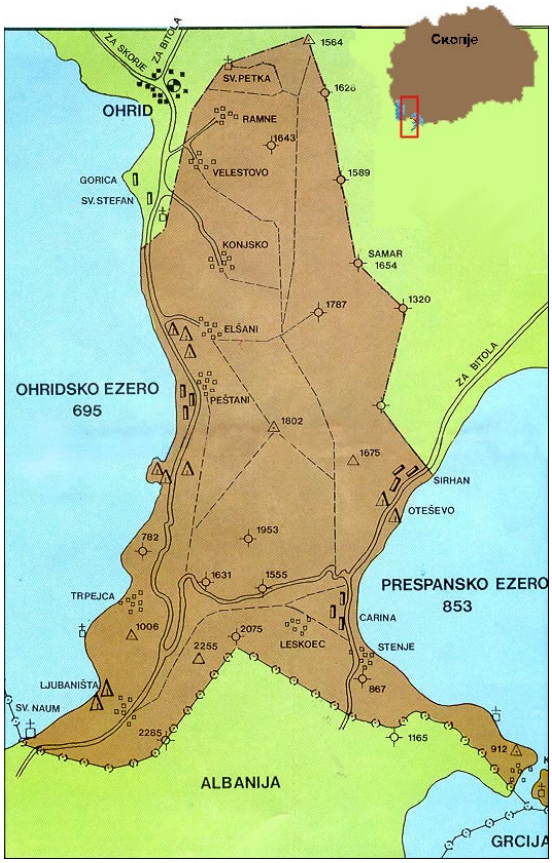
MAMMALS: *Rhinolophus blasii, Rhinolophus euryale, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Myotis blythii, Myotis capaccinii, Canis lupus, Ursus arctos, Lutra lutra, Lynx lynx, Rupicapra rupicapra balcanica*

AMPHIBIANS and REPTILES: *Triturus carnifex (Triturus cristatus carnifex)*, *Bombina variegate, Testudo hermanni*

INVERTEBRATES: *Lucanus cervus, Rosalia alpina*

Important Plant Area and Prime Butterfly Area "Galicica"

NP Galicica is located in the southwestern part of the Macedonia, between Ohrid Lake and Prespa Lake. It has a total surface area of 22,750 Ha. Within the Galicica, the present situation of flora is: 41 species of woodlike plants, 40 species of bushes, 16 forest communities and 16 grassy communities. Important characteristic of the NP Galicica is high incidence of relict and endemic plants. The fauna in this park also is determined. There are: 10 amphibian species, 17 reptile species, 124 bird species and 40 mammal species.



Habitat types (Resolution No 4 / 1996) that are present are:

!31.46 *Bruckenthalia* heaths
31.4 Alpine and boreal heaths
34 Steppes and dry calcareous grasslands
41.7 Thermophilous and supra-Mediterranean oak woods
!42.17 Balkano-Pontic fir forests
61.3 Western Mediterranean and thermophilous screes
22. Standing fresh water
24. Running water

Species (Resolution No 6 / 1998) that are present are:

MAMMALS: *Rhinolophus blasii, Rhinolophus euryale, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Myotis blythii, Canis lupus, Ursus arctos, Lynx lynx, Rupicapra rupicapra balcanica*

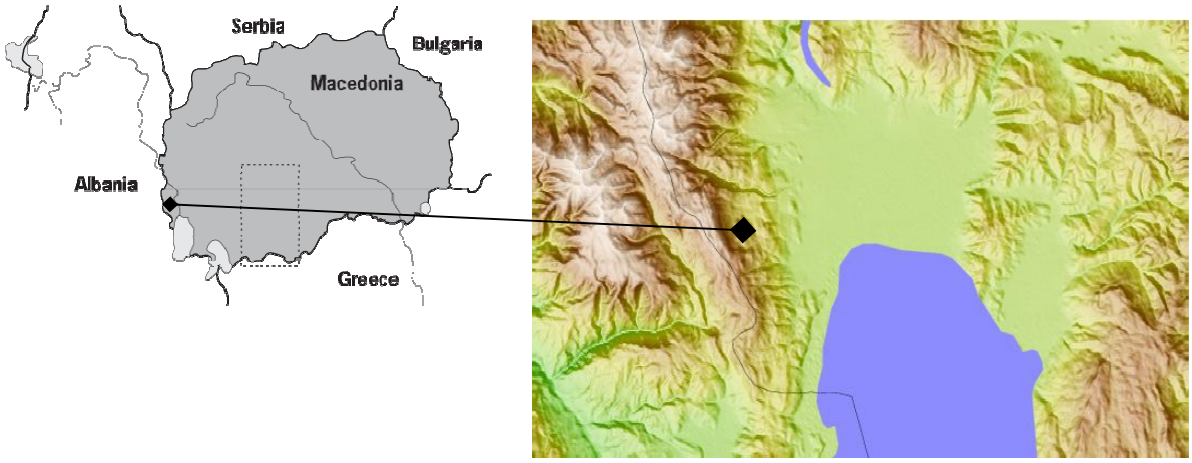
BIRDS: *Accipiter brevipes, Aegypius monachus, Aquila chrysaetos, Aquila heliaca, Aquila pomarina, Buteo rufinus, Circaetus gallicus, Gyps fulvus, Milvus milvus, Neophron percnopterus, Pernis apivorus, Falco columbarius, Falco naumanni, Falco peregrines, Falco vespertinus, Bonasa bonasia, Burhinus oedicnemus, Asio flammeus, Bubo bubo, Caprimulgus europaeus, Alcedo atthis, Coracias garrulus, Dendrocopos leucotos, Dendrocopos medius, Dendrocopos syriacus, Dryocopus martius, Picus canus, Lullula arborea, Anthus campestris, Lanius collurio, Lanius minor, Ficedula parva, Emberiza hortulana, Pyrrhocorax pyrrhocorax*

REPTILES: *Testudo hermanni, Elaphe quatuorlineata*

AMPHIBIANS: Triturus carnifex (Triturus cristatus carnifex), Bombina variegata

INSECTS AND BUTTERFLIES**:** *Lucanus cervus, Rosalia alpine, Erebia medusa, Hesperia comma, Lycaena dispar*

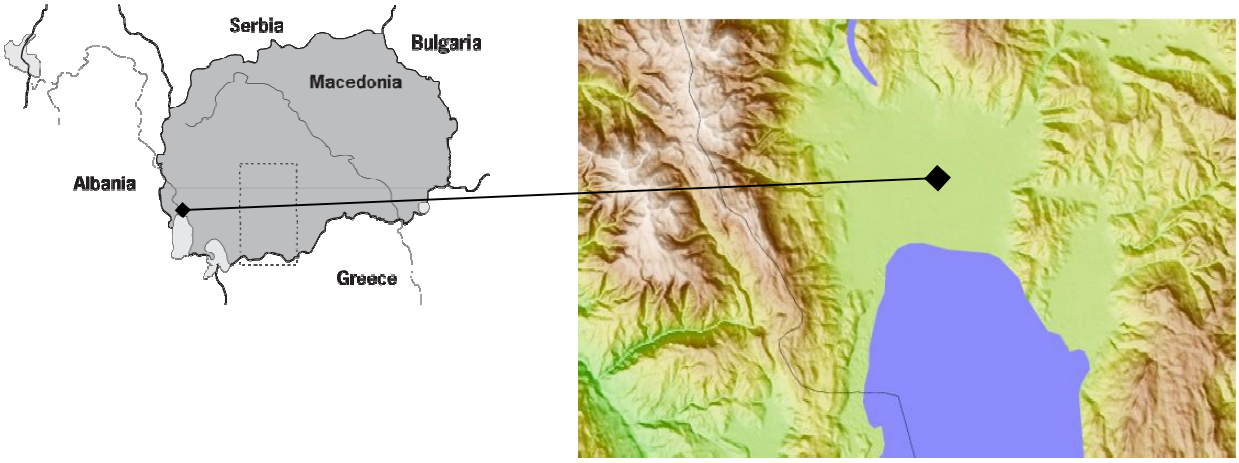
Important Plant Area "Jablanica" (newly proposed protected area)



The proposed OHL corridor passes through the peripheral south-east area of the proposed NP Jablanica[17] in an approx. 10 km long section avoiding the settlements spread out on the Jablanica Mountain. This particular area is not pristine one, as it includes number of human-caused intrusions: settlements, road lines, residential and commercial developments, etc. So far, this area has not been formally designated as natural heritage. It has not been subject of legally required exercise for assessment and valorization of its natural values, i.e. preparation of a Study for valorization, as an essential pre-requisite for official designation as protected area. According to the Law on Nature Protection and its associated by-laws, such study would need to include proposals and rationale for (i) the category of protection, (ii) the borders of the protected area and its zones and (iii) the main goals for future management and protection as a base for official designation and development of required spatial planning and management documents of the protected area.

[17] Project 00058373 - PIMS 3728 "Strengthening of ecological, institutional and financial sustainability of the system of protected areas in the Republic of Macedonia"; Report - Project Activity Ref. RFP 79/2009 "Development of representative protected areas network"; Macedonian Ecological Society, March 2011; supported by UNDP and the Macedonian Ministry of Environment and Physical Planning

Prime Butterfly Area "Struga"



The Struga region along with the mountain Jablanica represent a prime butterfly area due to its rich diversity and presence of three priority species: Euphydryas aurinia, Parnassius apollo (Vulnerable - Species at present in Appendix II of Bern Convention).and Phengaris arion. Special attention was given to the presence of the three priority species as well as the other important butterfly species. The research on daily butterflies (Rhopalocera) was performed during the summer period as part of the project: "Daily butterflies as biological indicators of the human impact on the environment in the Struga region". The materials were collected from 11 localities. A total of 47 species of daily butterflies were registered in the Struga region, from which 9 are noted for the first time for the region (Aphantopus hyperantus, Argynnis adippe, A. aglaja, Boloria dia, Cupido argiades, C. decoloratus, Plebejus agestis, P. belargus, Pontia edusa).

Phengaris arion was recorded in the vicinity of village Vevchani, while at the foothills of Jablanica Mt. (Melovski 2010) were recorded Papilio machaon (Red Data Book of butterflies of Serbia - Јакшић, 2003) and Lycaena dispar (Annex II and IV of Habitats Directive 92/43/EEC). Additionally lowlands of Jablanica Mountain are characterized by very small number of species (Pieris mannii), since butterflies have wide amplitude of altitude distribution: Anthocharis cardamines, Colias crocea, Gonepteryx rhamni, Polyommatus icarus, Vanessa atalanta, Aglais urticae, aniola jurtina, Pyrgus malvae etc.

Appendix 3 – An Overview of the Stakeholder Engagement

Meeting / Consultation	Stakeholders present	No. of people consulted	Key Issues discussed	Method
Consultations with relevant institutions				
(1) Name: Ministry of Environment and Physical Planning – Directorate for Environment Protection Place: Skopje Date: 25.09.2012 Time: 10.00-11.00h	* IPF Team * MEPSO * Ministry's representatives	(3)	• OHL corridor • Key environment issues • ESIA scope • UNESCO related aspects • ESIA procedure	Official meeting
(2) Name: Ministry of Culture - Cultural Heritage Protection Office Place: Skopje Date: 22.11.2012 Time: 10.00-11.00h	* IPF Team * MEPSO * Ministry's representatives	(1)	• OHL corridor • Cultural heritage in the project regtion • UNESCO related aspects	Official meeting
Consultations with affected municipalities				
(1) Name: Novaci Municipality Place: Novaci Date: 03.09.2012 Time: 14.00h-15.00h	* IPF Team * MEPSO * Municipality's representatives	(8)	• OHL corridor • Key environment issues • ESIA scope • Spatial and urban planning / documents vis a vis proposed OHL corridor • Construction transport through residential areas • Agriculture activities vis a vis operational OHL	Official meeting
(2) Name: Mogila Municipality Place: Mogila Date: 04.09.2012 Time: 11.00h-12.00h		(3)		Official meeting
(3) Name: Bitola Municipality Place: Bitola ate: 03.09.2012 Time: 11.00h-13.30h		(5)		Official meeting
(4) Name: Resen Municipality Place: Resen Date: 05.09.2012 Time: 11.00h-13.00h		(2)		Official meeting
(5) Name: Ohrid Municipality Place: Ohrid Date: 10.09.2012 Time: 12.00h-13.30h		(2)		Official meeting
(6) Name: Debrca Municipality Place: Debrca Date: 07.09.2012 Time: 11.00h-13.00h		(3)		Official meeting
(7) Name: Struga Municipality Place: Struga Date: 06.09.2012 Time: 10.00h-12.00h		(3)		Official meeting

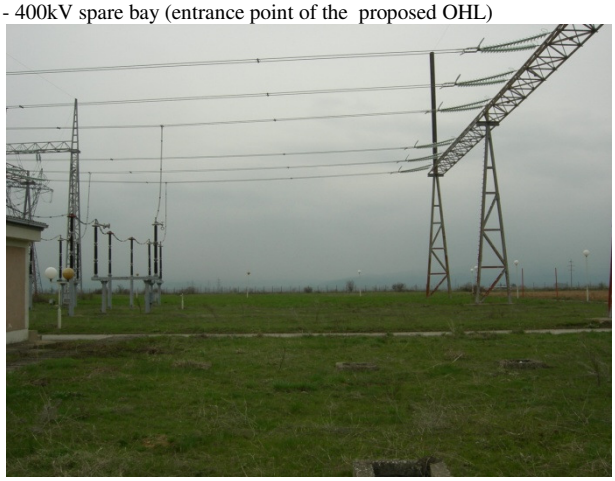
Consultations with settlements close to the OHL				
(1) Name: Dobromiri (Novaci) Place: Dobromiri Date: 03.09.2012 Time: 17.00h-18.00h	* IPF Team * MEPSO *Local residents	(5)	• OHL corridor • Proposals for routing details / changes • Key environment and social issues • Mitigation • Compensation • Construction transport through agricultural and residential areas • Agriculture / irigition activities vis a vis operational OHL (Pelagonija nad Struga Field) • Electricity supply • Further consultations	Interview
(2) Name: Mogila (Mogila) Place: Mogila Date: 03.09.2012 Time: 12.00h-13.00h		(5)		Interview
(3) Name: Trn, Bratin Dol, Capari, Kazani, Rotino, Gjavato (Bitola) Place: Bitola Date: 04.09.2012 Time: 17.30h-19.00h		(10)		Interview
(4) Name: Leva Reka (Resen) Place: Leva Reka Date: 05.09.2012 Time: 13.00h-14.30h		(3)		Interview
(5) Name: Kriveni (Resen) Place: Kriveni Date: 05.09.2012 Time: 14.30h-16.00h		(7)		Interview
(6) Name: Sopotsko (Resen) Place: Sopotsko Date: 05.09.2012 Time: 16.00h-17.30h		(2)		Interview
(7) Name: Mislesevo, Moroista, Radolista (Struga) Place: Struga Date: 06.09.2012 Time: 13.00h-14.00h		(4)		Interview
(8) Name: Volino (Debrca) Place: Volino Date: 07.09.2012 Time: 14.30h-16.00h		(3)		Interview
(9) Name: Svinista, Rasino, Vapila, Livoista (Ohrid) Place: Ohrid Date: 10.09.2012 Time: 14.00h-16.00h		(8)		Interview

Consultations with NGO				
(1) Name: Macedonian Ecological Society (MES) Place: Skopje Date: 17.05.2012 Time: 10.00h-11.00h	* IPF Team * NGO representatives	(3)	• OHL corridor alternatives • Key environment and social issues • ESIA scope • Visual effects • Impacts on forests • Bird protection • Mitigation • Further consultations	Meeting
(2) Name: Bioeco Place: Skopje Date: 06.07.2012 Time: 10.00h-11.30h	* IPF Team * NGO representatives	(2)		Meeting
(3) Birdprotection Place: Skopje Date: 27.09.2012 Time: 14.00h-15.00h	* IPF Team * NGO representatives	(2)		Meeting
(4) Name: NGO Pelagonija Place: Novaci Date: 03.09.2012 Time: 15.00h-15.30h	* IPF Team * MEPSO * NGO representatives	(1)		Meeting
(5) Name: NGO Mogilka Place: Mogila Date: 04.09.2012 Time: 13.00h-13.30h		(2)		Meeting
(6) Name: NGOs: Molika, Biosfera and Eko-zena Place: Bitola Date: 04.09.2012 Time: 16.00h-17.30h		(4)		Meeting
(7) NGO meeting, Skopje NGOs: Ecosvest; Birdprotection; Macedonian Enthomological Society. Place: Skopje Date: 27.09.2012 Time: 12.00h-14.00h		(3)	• OHL corridor • Key environment and social issues • ESIA scope • Further consultations	Meeting

Consultations with scientific institutions and individuals (bioidiversity)				
(1) Name: Prof. Ljupco Melovski Faculty on Natural Sciences, Biology Institute and President of MES Place: Skopje Date: 16.05.2012 Time: 12.00h	* IPF Team	(1)	• OHL corridor • Key biodiversity and landscape issues • Protected Areas • ESIA scope • Mitigation	Meeting
(2) Name: Prof. Vlado Matevski Faculty on Natural Sciences, Biology Institute and member of Macedonian Academy on Sciences and Arts Place: Skopje Date: 16.05.2012 Time: 14.30h	* IPF Team	(1)	• OHL corridor • Key flora nad vegetation issues • ESIA scope • Mitigation	Meeting
(3) Name: D-r Svetozar Petkovski Museum of Natural History Place: Skopje Date: 06.07.2012 Time: 13.00h	* IPF Team	(1)	• OHL corridor • Key biodiversity issues • ESIA scope • Mitigation	Meeting
(4) Name: Prof Branko Micevski, Orithologist Faculty on Natural Sciences, Place: Skopje Date: 27.09.2012 Time: 15.30h	* IPF Team	(1)	• OHL corridor • Key biodiversity issues • Impacts on avian fauna • ESIA scope • Mitigation	

Appendix 4 – Photo Log – Landscape and Land-use along the Proposed Transmission Line

Figure - SS Bitola 2 (OHL starting point)
- 400kV spare bay (entrance point of the proposed OHL)



- View toward the TPP REK Bitola

Figure – Wide open area of the proposed OHL corridor through Pelagonija Field (view from locality (church St.Ilija) above v.Krklino)

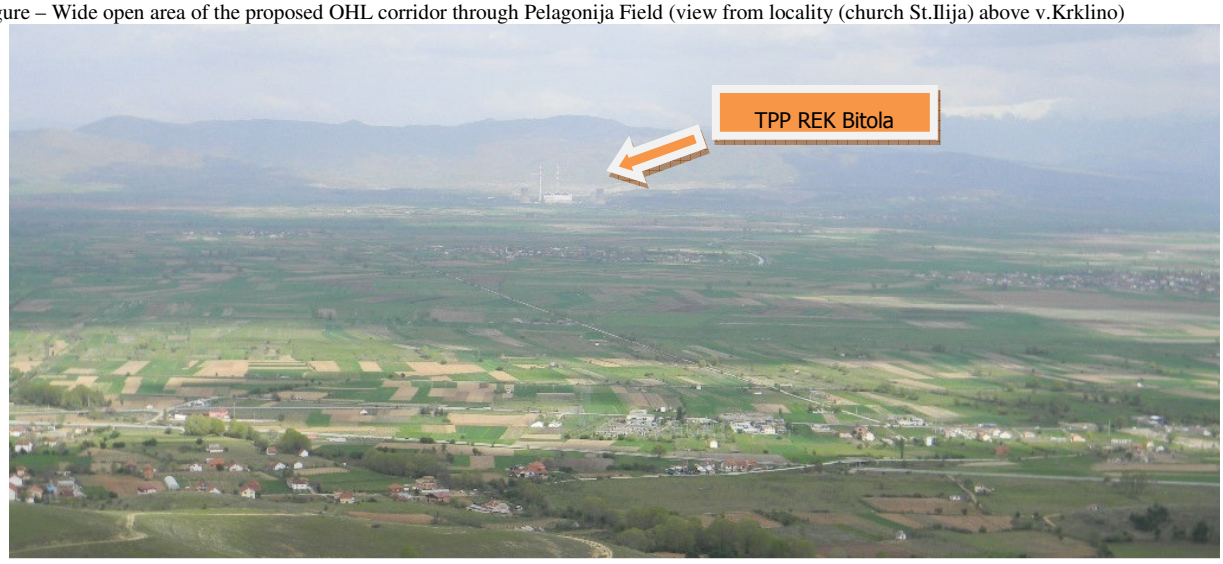


Figure – Hilly open area above the road Kicevo - Bitola- Ohrid (OHL corridor section between villages Krklino and Bratin Dol)

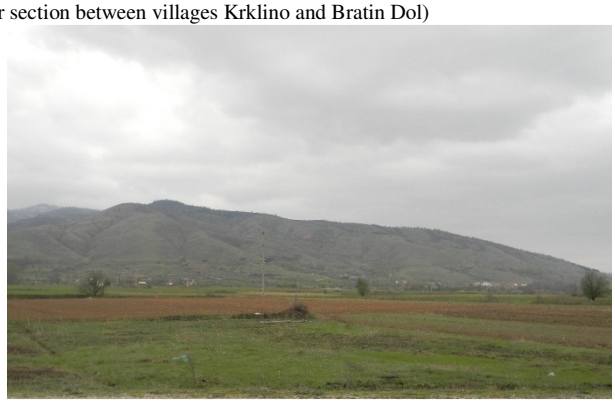
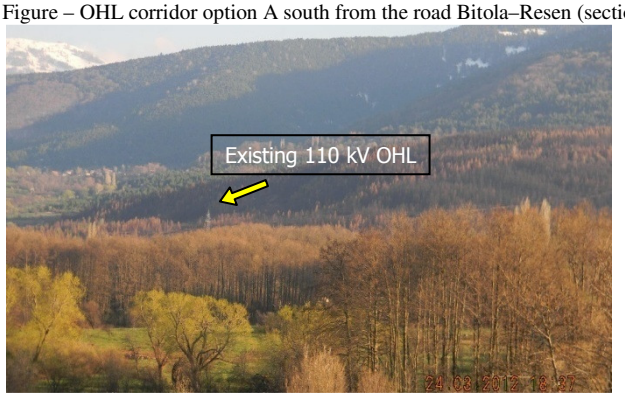


Figure – OHL corridor option A south from the road Bitola–Resen (section B.Dol-Rotino-Capari- Gjavato)



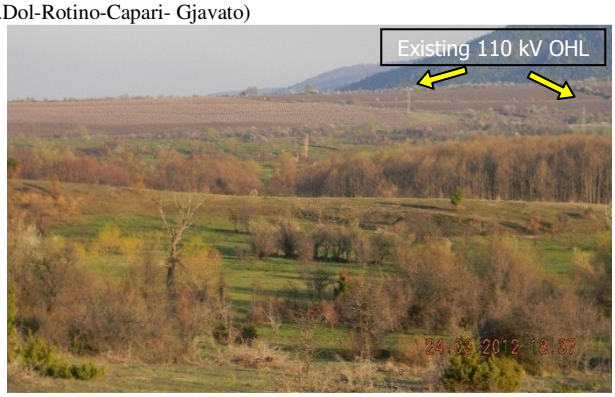
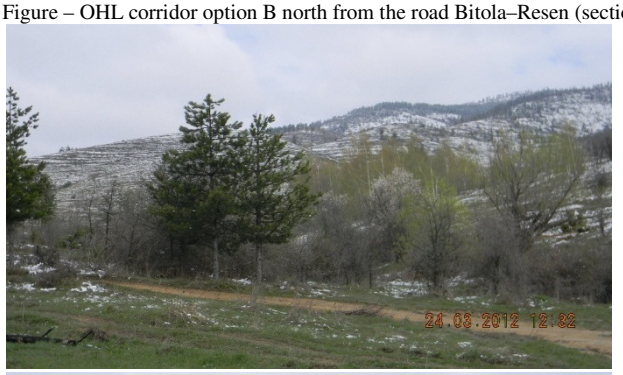


Figure – OHL corridor option B north from the road Bitola–Resen (section between localities Korija - Gjavato)

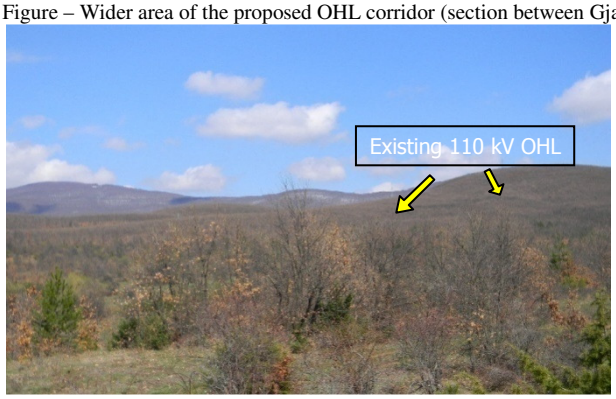


Locality Prevalec

Localities Kamici & Cvetkova Livada

Figure – Area of the proposed OHL corridor (section close to village Gjavato)

Figure – Wider area of the proposed OHL corridor (section between Gjavato and Sopotsko)



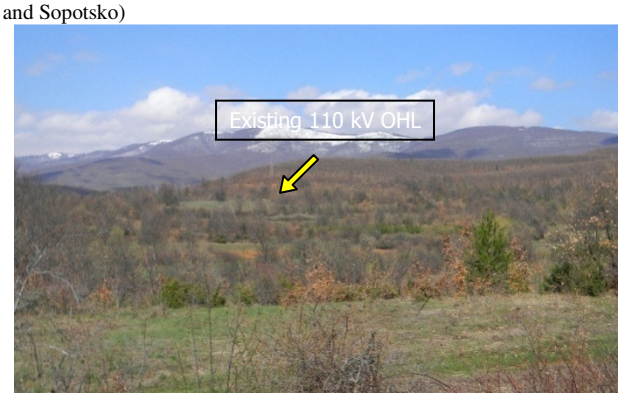


Figure – Area of the proposed OHL corridor in vicinity of the village Sopotsko (localities Martin Rid and Gorna Bakojca)

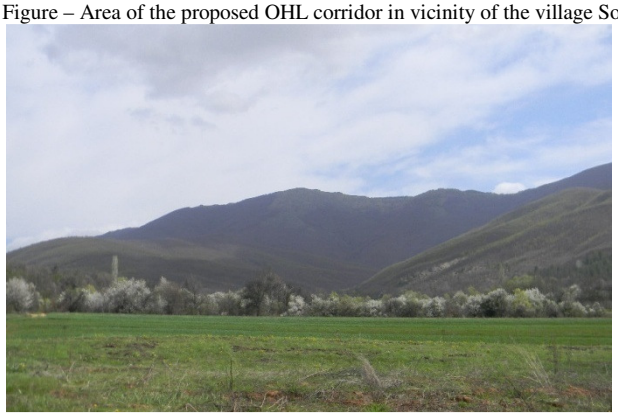


Figure – Area of the proposed OHL corridor in vicinity of the village Zlatari (locality Poroj)

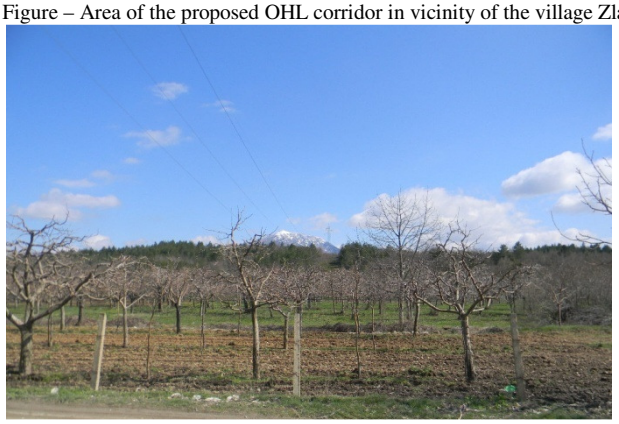


Figure – Area of the proposed OHL corridor in vicinity of the village Kriveni (crossing point with the local road Resen-Kriveni)

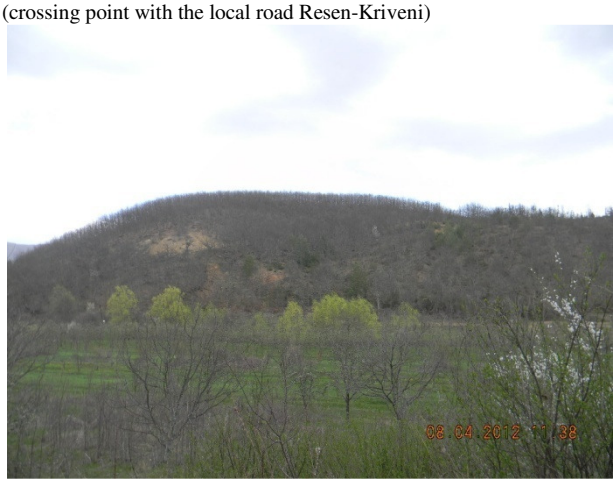


Figure – Area of the proposed OHL corridor above the village Leva Reka

Figure – Area of the proposed OHL corridor above the village Svinista

Figure – Locality Ceso Glava (knot point of the existing 110kV OHL)
- view toward east (proposed OHL corridor follows the existing 110kV)

- view toward west – Struga Field (proposed OHL corridor follows the existing 110kV)

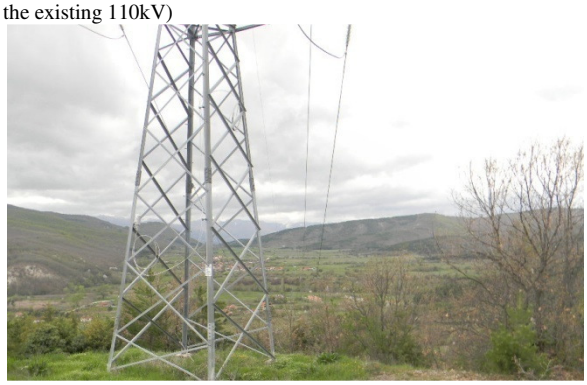
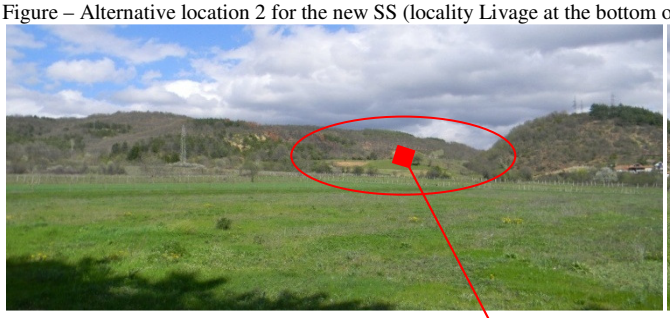


Figure – Alternative location1 for the new SS (immediate vicinity of the locality Ceso Glava)

Figure – Alternative location 2 for the new SS (locality Livage at the bottom of the hill Ceso Glava)



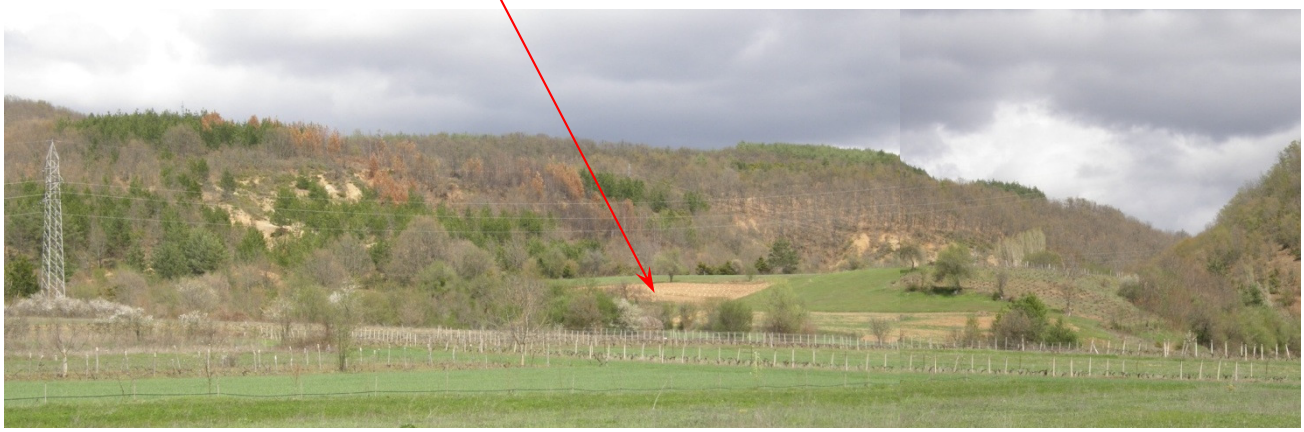
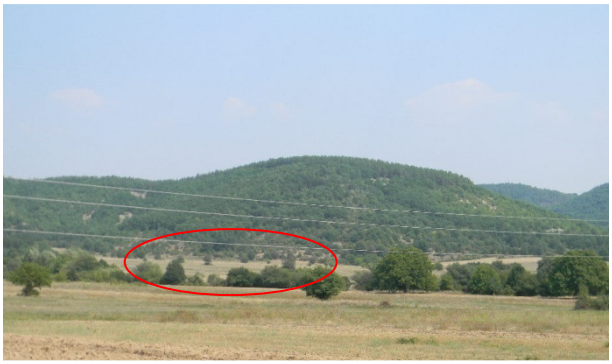
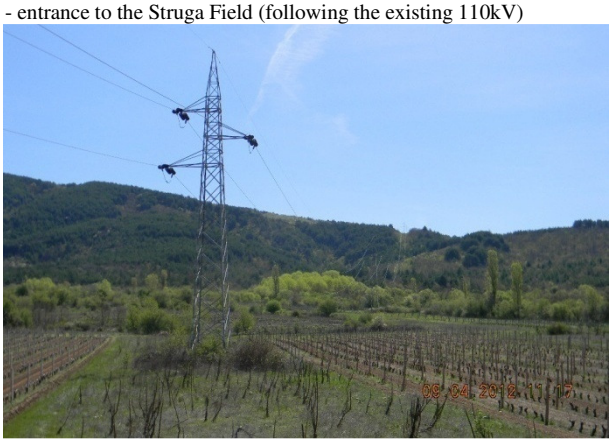


Figure – Alternative location 3 for the new SS (locality Staro Selo, north – west from village Livoista)
- view from the local road Livoista-Trebenista



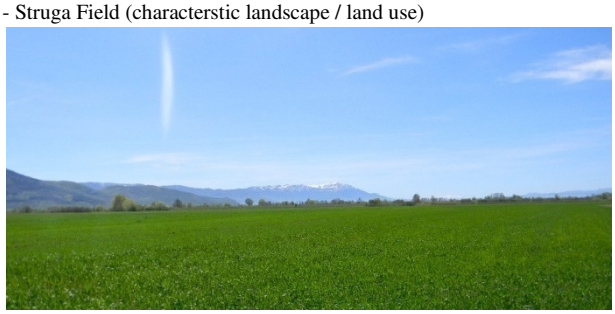
– view to the alternative location 3 for the new SS (locality Staro Selo)

Figure – Proposed OHL corridor - Struga Field
- entrance to the Struga Field (following the existing 110kV)



- Struga Field (characterstic landscape / land use)

- Struga Field (characterstic landscape / land use)



- Struga Field (crossing point with Crn Drim river)

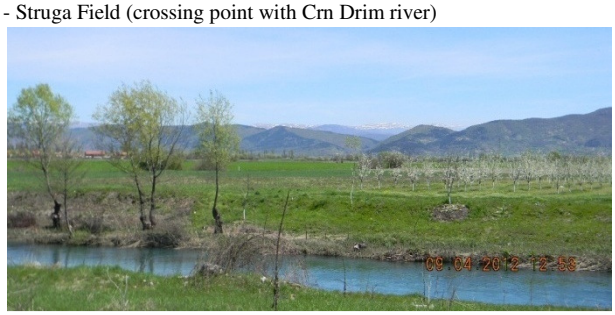


Figure – Wider area of the proposed OHL corridor - Struga Field and Jablanica Mountain

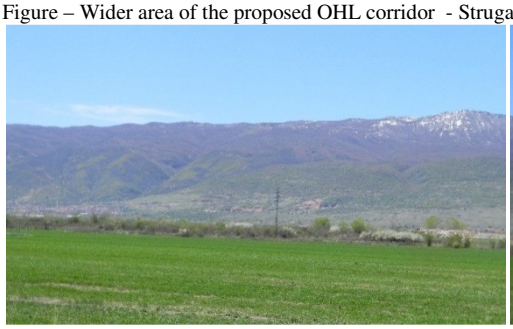


Figure – View to localities Spas and Belicka Krasta – bottom area of the Jablanica Mountain (OHL breaking point toward south – MK/AL border)

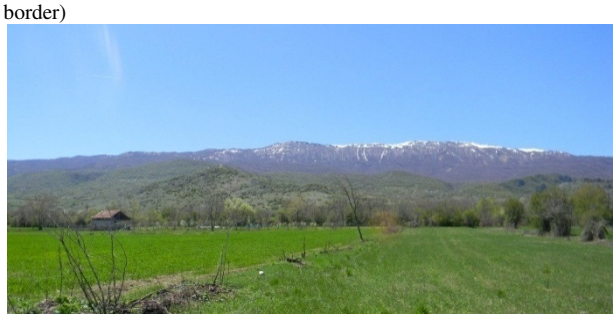


Figure – Proposed OHL corridor – bottom area of the Jablanica Mountain

Appendix 5 – Names of those Responsible for Preparing the Environmental and Social Impact Assessment

Responsible expert for preparing the Environmental and Social Impact Assessment:	
Name and surname:	Konstantin Siderovski
Position:	COWI Consultant for Environment
	phone: + 389 75 240 885
	e-mail: konstantin_siderovski@yahoo.com

Team of experts for preparing the Environmental and Social Impact Assessment:	
Expert	Position / Project component
Ilija Todorovski	COWI Expert on Social Impact Assessment
George Paraskevopoulos	COWI Expert on Nature and Biodiversity
Mitko Dimov	COWI Expert on Geology and Hydro-geology

Contribution for preparing the Environmental and Social Impact Assessment:	
Expert	Position
Heikki Lehtimaki	COWI Transmission Expert
Sinisa Stancevski	COWI Transmission Engineer
Nikola Nikolic	COWI Transmission Line Engineer
Evica Rumenova	COWI Substation Engineer

Appendix 6 – Decision on the Need for Environmental Impact Assessment issued by the Ministry of Environment and Physical Planning

(Note: To be included upon submission from the MEPP)