NON-TECHNICAL SUMMARY (NTS) FOR STIP WIND FARM PROJECT

(North Macedonia)

February, 2026

List of abbreviations

Acronym	Meaning
AEP	Alcazar Energy Partners
AoI	Area of Interest
CLO	Community Liaison Officer
CO_2	Carbon dioxide
EAAA	Ecologically Appropriate Area of Analysis
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
GWh	Gigawatt hour
ISO	International Organization for Standardization
kV	Kilovolt
km	Kilometre
m	Metre
MW	Megawatt
NTS	Non-Technical Summary
OHL	Overhead Line
SCADA	Supervisory Control and Data Acquisition
WTG	Wind Turbine Generator

Definition of terms

Term	Meaning and comments
Area of influence	The area likely to be affected by the project activities and facilities.
Baseline conditions	The environmental and social conditions before the Project begins.
Biodiversity	The variety of plants, animals and habitats in the project area.
Bird collision risk	Likelihood of birds striking turbines or overhead lines.
Blade	One of three long aerodynamic components of a wind turbine.
Carbon footprint	Emissions from fossil-fuel power that the Project helps reduce.
Community health and safety	Measures to protect residents during construction and operation.
Construction phase	The period when the wind farm infrastructure is built.
Cultural heritage	Archaeological and cultural sites that needs protection.
Decommissioning	End-of-life dismantling and land restoration activities.
Ecologically Appropriate Area of Analysis	Study boundary used for biodiversity assessment.
Effects / impacts	How significant a change is, based on scale and vulnerability.
Environmental and social management measures	Actions to minimise or manage project impacts.
Foundation	Reinforced concrete structure anchoring the wind turbine.
Grievance mechanism	Process for raising and resolving community concerns.
Hub height	Height of the wind turbine rotor centre above ground.
Land acquisition	Obtaining land rights.
Livelihood	The full range of means that individuals, families, and communities utilise to make a living, such as wage-based income, agriculture, fishing, foraging, other natural resource-based livelihoods, petty trade, and bartering. It encompasses subsistence (self-consumed) production, natural resource utilisation, non-cash-based transactions such as bartering, as well as cash-based and wage income.
Livelihood restoration	Support to households whose land-based activities are disrupted.
Meteorological mast	Masts measuring wind conditions.
Mitigation measures	Actions to reduce negative impacts.
Nacelle	Housing containing wind turbine machinery.
Noise	Sound generated during construction works or from wind turbines.
Operational phase	When the wind farm produces electricity.
Parcelisation	Subdivision of land plots.
Pollution prevention	Measures to avoid environmental contamination.
Project footprint	Area occupied by project infrastructure.
Shadow flicker	Moving shadows cast by rotating blades.
Substation	Facility collecting and transforming electricity.

Source: Mott MacDonald

1 Introduction and background

1.1 Introduction

This non-technical summary (NTS) provides an overview of the findings from the environmental and social impact assessment (ESIA) for the Stip Windfarm in North Macedonia (the Project). It describes the potential environmental and social effects of the windfarm during its development, construction, operation, and eventual decommissioning. It explains how these effects will be avoided, minimised, or managed. The ESIA has been prepared in line with the national legal framework as well as international standards to support the Project's access to international funding. For more information than what is provided in this NTS, please refer to the full ESIA study.

1.2 Who is developing the project?

The Project is being developed by a set of Special Purpose Vehicles (SPVs) incorporated in North Macedonia, fully owned by Alcazar Energy Partners II HoldCo Limited, referred to as 'AEP'. AEP will manage project development, construction and operation.

Mott MacDonald Limited, an independent consultant, has been appointed by AEP to undertake the ESIA and Livelihood Restoration Plan (LRP).

1.3 Project development history

The Project was originally developed in 2009 when an environmental impact assessment (EIA) aligned to national requirements was undertaken and granted an environmental consent which has been kept updated and is currently valid until February 2028. A Letter of Intent was submitted to the Ministry of Environment and Spatial Planning that determined that an Environmental Protection Elaborate[1] was required for the wind farm project to adequately consider the changes to the design and technology. The Environmental Protection Elaborate was developed and approved by the Ministry of Environment and Spatial Planning in December 2024. Similarly, a Letter of Intent was submitted to the Ministry of Environment and Spatial Planning with regards to the overhead line (OHL) and the substation that determined that an Environmental Protection Elaborate was also required. As soon as the design for the OHL and substation was completed, the Environmental Protection Elaborate was developed and approved in January 2026. An international ESIA which builds on the national EIA is being finalised in the first quarter of 2026 for the purposes of achieving international finance for the Project.

In 2010, the Ministry of Transport and Communications approved the state urban plan for the Project, formally designating the project area for construction and energy generation purposes. Based on recent technological improvements which were incorporated into the project design, a new urban plan was developed and approved in June 2025. As a result of this recently approved urban plan, the relevant land plots were reclassified from agricultural to construction use, providing the legal basis for the development of the wind farm and associated infrastructure and declaring the Project in the public interest. This reclassification enables the parcelisation of land and established the legal basis for subsequent land agreements, acquisition, and construction activities. The urban plan boundaries therefore underpin the project components by ensuring that the necessary land use changes and permissions are in place for the project's development.

[1] An Environmental Protection Elaborate is prepared for projects or their elements that do not require a full EIA, but still need to ensure that environmental and social standards are upheld

1.4 Consultation, participation and disclosure process

Engaging with local communities and other interested groups has been an important part of project development. Information has been shared openly, and people living in and around the Project area have had several opportunities to learn about the plans, to ask questions, and to express their views. Engagement has been guided by a plan so that information is provided in a clear and accessible way throughout construction, operation and closure of the Project.

Meaningful engagement with interested and affected parties began early in 2025 and will continue until the completion of the project. Meetings were held with municipalities, village representatives, community members and civil society organisations. During these consultations, people raised a wide range of questions and concerns about the Project. People wanted to understand both the positive and negative effects of wind turbines, their exact locations, and how far they would be from homes. Stakeholders asked about the length of underground cables needed for the Project. Questions were also raised regarding land acquisition, whether anyone would be displaced, and how compensation for affected landowners would work. Community health and safety was an important topic, including concerns about lighting, noise, and dust. A request for support with access to drinking water in Buchim was raised. There was strong interest in local employment opportunities and how residents could apply once construction begins. Biodiversity issues were also highlighted, particularly regarding black vultures in the area and the duration of bird monitoring. Stakeholders asked about project funding sources, and it was clarified that the Project is independently financed through international funding. Finally, while the grievance mechanism was appreciated, people requested more clarity on how complaints would be handled and tracked. These issues have been addressed in the ESIA in detail.

Additional engagement took place through focus group discussions and individual interviews with residents from several villages.

During the focus group discussions conducted for the ESIA, respondents were keenly interested in the project and asked questions about the following topics:

- Vicinity of wind turbine generators (WTGs) to their property and whether their property will be affected
- Compensation for the property losses
- Possibility for fencing of swathes of project land to inhibit access
- Fencing of construction sites for safety of children
- The project scope of works and turbine locations
- Whether there will be jobs for residents of the villages, and how local jobseekers can get hired when the project starts
- Road access and further degradation of the road surface by construction traffic
- Traffic safety and limiting the speed of project vehicles through the area
- Access to drinking water
- Noise and dust

A detailed socioeconomic census survey was also carried out with affected landowners to understand land use and livelihood resources in private land. The project proponent and land agents are conducting ongoing engagement with landowners who have expressed reluctance to participate in the process. To understand how public land is used, focus groups discussions were also carried out with different groups of land users such as farmers, livestock keepers, gatherers, seasonal users, small businesses and institutional stakeholders, as well as key informant interviews held with local representatives, public authorities, the Chamber of Commerce, the National Agricultural Network, various associations and training institutions.

Information has been shared both online and in person, including project brochures, posters, translated materials and through public disclosure of project documents. The Draft ESIA will be publicly disclosed, followed by community meetings to present the Project. During these meetings, the team will explain the main findings, potential impacts and risks, and the measures proposed to avoid, reduce, or compensate those impacts. The Livelihood Restoration Plan (LRP) will also be presented, including information on entitlements, the cut-off dates, and how people can take part in the livelihood restoration programmes. Everyone is encouraged to share their feedback on the Draft ESIA and all related appendices.

A community grievance mechanism is in place so that anyone can raise concerns or request information at any stage. It has been available since 2024 and can be accessed online in Macedonian, Turkish, Albanian, Serbian and English at <https://alcazar.integrityline.com>. For people who prefer to speak in person, a Community Liaison Officer (CLO) will make regular visits to villages, including to support women, vulnerable groups and others who may feel less comfortable submitting written complaints. Grievances can be raised verbally, anonymously, or through grievance boxes placed in public buildings, and all complaints are formally logged, followed up and responded to. The mechanism is designed to be accessible, confidential, free of charge and fair, ensuring that issues are addressed promptly and transparently.

Feedback gathered through meetings, interviews, surveys and the grievance mechanism has helped shape the assessment and guide measures to reduce potential adverse impacts. Engagement with communities will continue throughout all stages of the Project. Table 1.1 shows the contact details for the Project for the ESIA disclosure phase and the table will be updated for later phases of the Project when contact details are available.

Table 1.1: ESIA disclosure, construction and operations phase contact details

Company	Person	Contact Details	Phase
Project Proponent – main contact	Tanja Dimitrova Filkoska E&S specialist	+389 70 247 773 tfilkoska@alcazarenergy.com Blvd. 8th September, No. 16, 1000 Skopje, North Macedonia	All the Project phases
Community Liaison Officer	TBC	TBC	All the Project phases
Alcazar Energy Partners	Bilge Karakas Sn E&S specialist	+971 (0) 58 930 6506 bkarakas@alcazarenergy.com	All the Project phases

2 The Project

2.1 Why is the project needed?

North Macedonia currently uses more energy than it can produce, so it relies on electricity imported from neighbouring countries. A large share of the country's energy still comes from polluting fossil fuels such as coal (30%), oil (44%) and gas (12%), resulting in a high carbon footprint. Renewable energy and biofuels make up only a small portion of the national energy mix.

The Project provides a practical solution to reduce North Macedonia's dependence on carbon-intensive fuels such as coal and gas. It helps lower climate-related risks, strengthens energy security, and reduces the likelihood of future shortages. By adding up to 396 megawatts (MW) of new clean energy capacity and generating more than 1,340 gigawatt hours (GWh) annually, the Project will play a significant role in helping the country meet its 2030 climate and energy goals, providing clean energy to the equivalent of approximately 100,000 households.

2.2 Alternatives considered

Before deciding on the final design and location of the wind farm, several alternatives were considered to make sure the chosen option provides the best balance between energy production and causing the least harm to people and the environment. The assessment explored what would happen if the Project did not go ahead, different types of energy technologies, different possible locations and different routes for the roads and power lines.

The "no-project" option would mean leaving the area unchanged. However, this would also mean missing the chance to produce clean, renewable energy locally. North Macedonia would continue its heavy dependency on coal and imported energy, making it harder to meet its 2030 national climate and energy goals.

Different energy technologies (geothermal, gas and oil, solar, hydropower, and waste-to-energy) were compared. Each option has strengths but also may come with drawbacks such as greenhouse gas emissions, large land requirements, large construction impacts, or misalignment with the country's long-term strategy for cleaner power. Wind energy was found to be the most suitable technology for this Project because it is renewable, has low operational emissions, and matches national long-term strategy.

In terms of location, several sites across eastern North Macedonia were considered. The final site was chosen because it offers strong and consistent wind, it is mostly uninhabited, avoids important environmental areas, and is close to existing access roads as well as to a high-voltage transmission line. This helps reduce the need for new infrastructure and limits impacts on communities and the environment.

Biodiversity was an important factor too. The selected site is outside protected areas and key wildlife zones, and the layout avoids sensitive habitats and areas used by protected birds and bats. Turbine positions and infrastructure layouts were adjusted to reduce impact on nature, based on detailed environmental studies.

The Project design also went through several changes to reduce impacts on people. Turbine positions were shifted to respect safety distances from seasonal structures, reduce noise and shadow flicker near villages, and respond to concerns raised during consultations. Road routes were adjusted to follow existing cadastral and municipal paths wherever possible, reducing land take and disturbance. Where new road segments were necessary, their alignment was optimised to avoid homes, agricultural plots, cutting of trees, and other community or environmental features. Buried cables were planned mainly along existing roads to further reduce impacts.

Overall, the alternatives analysis shows that the chosen design and location minimise environmental and social impacts while enabling the generation of clean, renewable energy. The final layout represents a balanced solution that aligns with national energy goals and avoids unnecessary disturbance to people, land and nature.

2.3 What is the project?

The Project consists of the development, construction and operation of a wind farm, which will be built in a rural area in eastern North Macedonia, about 75 kilometres (km) south-east of Skopje, near the city of Stip. Most of the Project lies within the Stip and Radovish municipalities, with a smaller part extending into Karbinci. The terrain is hilly, ranging from 500 to 900 metres (m) in elevation. The wind farm borders the Plackovica mountain range to the east, the Kriva Lakavica River valley to the west, the Derven Gorge to the south and is open to the Ovce Polje plain to the north.

The Project area is approximately 335 hectares including a substation that will be built as part of the Project. The WTGs will be connected to the substation via approximately 80km of buried cables that will run along the internal roads and will be laid in trenches and covered with excavated subsoil and topsoil. An approximately 7km long 400kV overhead line (OHL) will be built as part of the Project to connect the Project substation to an existing 400kV transmission line. As part of the Project, approximately 68km of internal roads will be constructed or reconditioned. A very limited number of new roads will need to be built, and these will mainly comprise short lengths of secondary roads from the existing roads to the actual WTG locations.

In summary, the Project is comprised of the following main elements:

- Up to 54 WTGs of up to 6-8MW power each, for a total of up to 396MW
- A 35/400 kV substation
- Approximately 80km of buried cables connecting the WTGs to the substation
- Approximately 7km long 400kV OHL
- Approximately 68km of internal roads

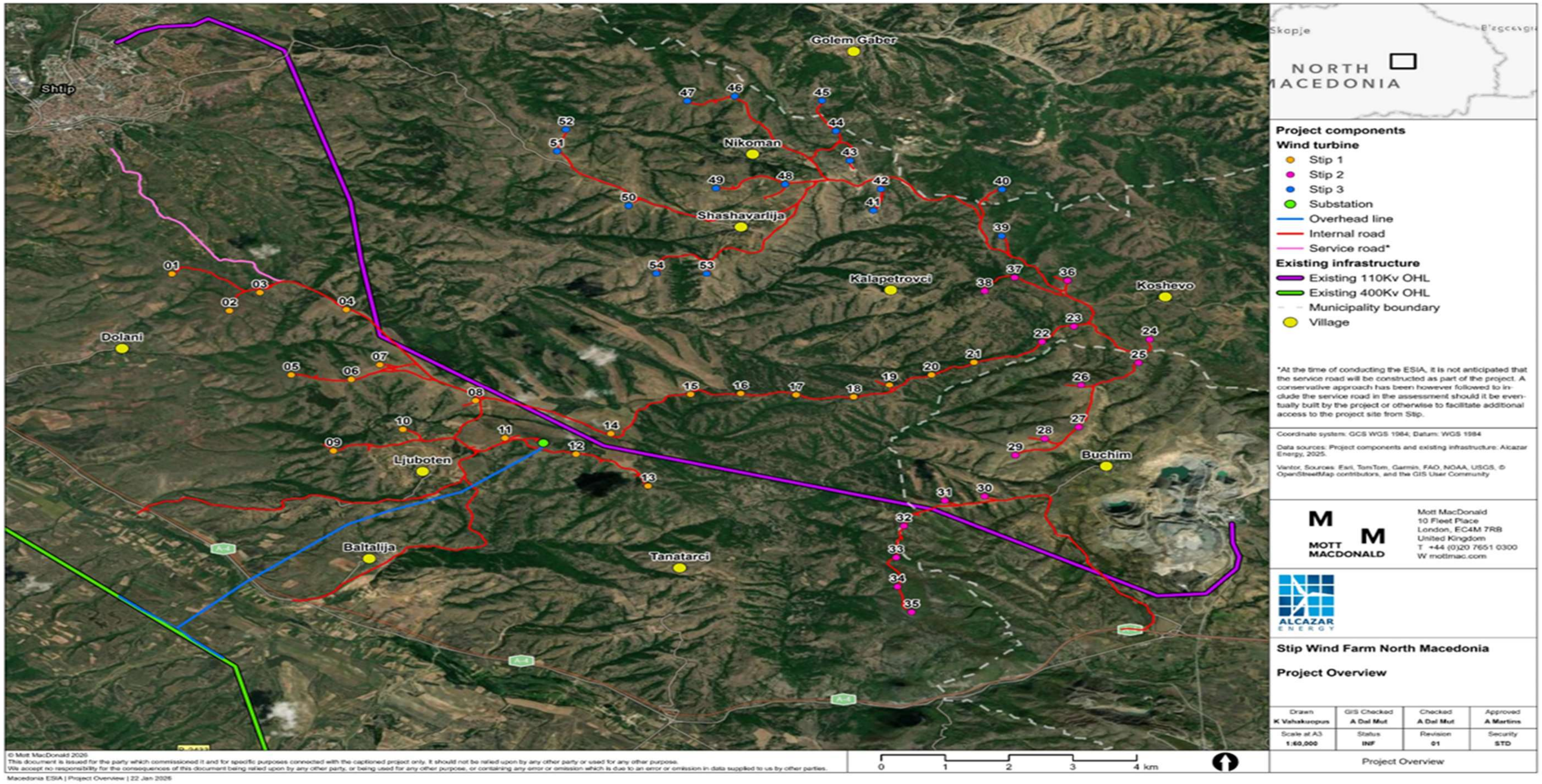
The Project does not involve associated facilities as defined[2] in IFC PS1 and EBRD ESR1.

Figure 2.1 below presents the layout of the main project components. The WTGs are identified by their numbers. Internal roads, service roads[3], the project OHL, the existing OHLs, and the substation location plus the most populated towns and villages around the project are also depicted.

[2] Facilities that are not funded/financed by the IFC or the EBRD as part of the project but without which the project would not be viable and would not have been constructed, expanded or carried out if the project did not exist.

[3] At the time of conducting the ESIA, it is not anticipated that the service road will be constructed as part of the project. A conservative approach has been however followed to include the service road in the assessment should it be eventually built by any party for the project or otherwise to facilitate additional access to the project site from Stip.

Figure 2.1: Project layout



Source: Prepared by Mott MacDonald based on information provided by the project proponent

2.4 Main project features

2.4.1 Wind turbine generators (WTG)

The planned WTGs to be installed for the Project are up to 6-8MW with approximately 120m hub height. See an example in Figure 2.2. The main components of the project's WTGs are:

- Blades: three blades made from high-strength composite materials like fiberglass or carbon fibre.
- Nacelle: houses the gearbox, generator, and control systems and other mechanical components necessary to convert mechanical energy into electrical energy.
- Gearbox/: designed to step up the rotational speed of the turbine's rotor.
- Generator: converts mechanical energy from the WTG rotor into electricity.
- Yaw and pitch mechanisms: optimise alignment with the wind direction and adjust blade angle for maximum efficiency.
- Tower: approximately 120m tall, made of steel, providing a high elevation for better wind capture.

Figure 2.2: Example of a WTG

Source: Project proponent

2.4.2 Substation, medium voltage collector system, control building and OHL

All the WTGs will send the electricity they produce to a new substation (see Figure 2.3), which will make sure the voltage is the right level and that the electrical system is protected and working safely. The turbines will be grouped together in small circuits of three to four turbines each and they will be linked to the substation through roughly 80km of 35kV underground cables.

Figure 2.3: Example of a substation

Source: Mott MacDonald

The substation will also include offices used for operation of the wind farm, using a remote monitoring system[4], which will provide real-time information of wind speed, how much energy is being produced, and whether any repairs or maintenance are needed.

The construction phase requires four temporary meteorological masts about 100 metres high across the Project area for measuring wind conditions. For the operational phase, the Project plans to install three new permanent masts about 120 metres high.

To connect the wind farm to the national electricity grid, a 7km-long 400kV overhead transmission line will be built from the Project's substation to the existing Stip–Negotino high-voltage line. See Figure 2.4.

Figure 2.4: Example of an overhead line

Source: Project Proponent

[4] Named SCADA for Supervisory Control and Data Acquisition

2.4.3 Access roads and internal roads

The wind farm will need about 68km of internal roads so that construction vehicles and turbine parts can reach all turbine locations. Most of these roads—around 50km—will be improvements to routes that already exist. The remaining 18km will be new roads, mainly short links that connect existing roads to each turbine's platform.

These roads must be wide and strong enough to carry very large turbine parts, including blades that can be up to 90m long, as well as heavy equipment like nacelles and transformers. To make this possible, some existing surfaces such as asphalt or gravel will need to be removed and rebuilt, and certain stretches will need to be widened. Once upgraded, the roads will generally be about 6.5m wide, including the side slopes. During the construction period wider areas along the roads—up to 10m in total—may be used to allow for the construction of the road or other activities.

The main access to the wind farm will be from the south, using the A4 highway and then local roads (including road R1204 and the road to Ljuboten). A temporary extra access route from the A4 is also being considered for reaching the turbines near the town of Butchim.

All turbine parts will arrive by road from the Port of Thessaloniki in Greece, approximately 180km south of the Project site. They will enter the site from the south-west, using the same main access near Ljuboten. There are no plans to create a new northern access road from Stip, so even the turbines located in the northern part of the site will be reached by driving equipment through the site from the south.

During the normal operation of the wind farm, large construction vehicles will not be needed. Only in rare cases—such as a major corrective maintenance requiring a gearbox or blade replacement—would heavy equipment like large cranes need to return to the site.

2.5 What is the planned project schedule?

The Project is planned to be developed in three phases:

- Stip 1 – STP WIND WF comprised of WTGs 1–21, OHL, substation, and the internal roads and buried cables that will connect the Stip 1 WTGs
- Stip 2 – KARB WIND WF comprised of WTGs 22–38 and the internal roads and buried cables that will connect the Stip 2 WTGs
- Stip 3 – RADO WIND WF comprised of WTG 39–54 and the internal roads and buried cables that will connect the Stip 3 WTGs

Construction of Stip 1 is planned to begin in the second quarter of 2026 and is expected to take around two years, with the wind farm becoming operational by mid-2028. The construction of Stip 2 and Stip 3 is expected to start partly alongside Stip 1 and partly afterwards, meaning that the three phases may overlap during parts of the construction period. Based on currently available information, the entire project is expected to be fully operational by 2029 and to remain in operation for 25 to 30 years.

2.6 What will happen at the end of the project?

A detailed decommissioning plan will be prepared closer to the end of the Project's operational life, in line with future regulations and good international practice. The plan will set out how infrastructure will be dismantled, how materials will be reused or recycled where possible and how the land will be restored.

2.7 What standards have been applied to the project?

The ESIA has been carried out in line with both North Macedonian legislation and the requirements of international finance institutions. The assessment follows internationally recognised standards and guidance, including the International Finance Corporation Performance Standards (IFC PSs), the

European Bank for Reconstruction and Development Requirements (EBRD ESRs), and the European Investment Bank Environmental and Social Standards (EIB ESSs). These frameworks set out how projects must identify impacts and risks, protect people and the environment, and manage impacts and risks throughout construction, operation and decommissioning.

The ESIA also applies topic-specific standards of good practice, for landscape and visual assessment, ISO 9613-2 and BS 528 for noise modelling and construction noise. The IFC General EHS Guidelines have been used in the management of waste and hazardous materials as well as for pollution prevention. Together, these standards mean that the Project is designed and managed to meet high levels of protection for communities, workers and the natural environment, and to align with international expectations for responsible renewable-energy development.

3 Managing environmental and social impacts

3.1 How was the project assessed?

The ESIA process entails understanding baseline conditions, identifying impacts and risks that are likely to change the baseline condition, then attributing significance to the impacts. Management measures including mitigation measures for adverse impacts, enhancement measures for beneficial impacts, and monitoring activities are then detailed. Baseline information was gathered through desktop review, field surveys and specific methods which depend on the aspect covered. Impacts were assessed by combining the sensitivity of each receptor with the magnitude of the predicted change, enabling identification of where impacts could be significant and where they would remain minor or negligible.

3.2 How will people and the environment be affected?

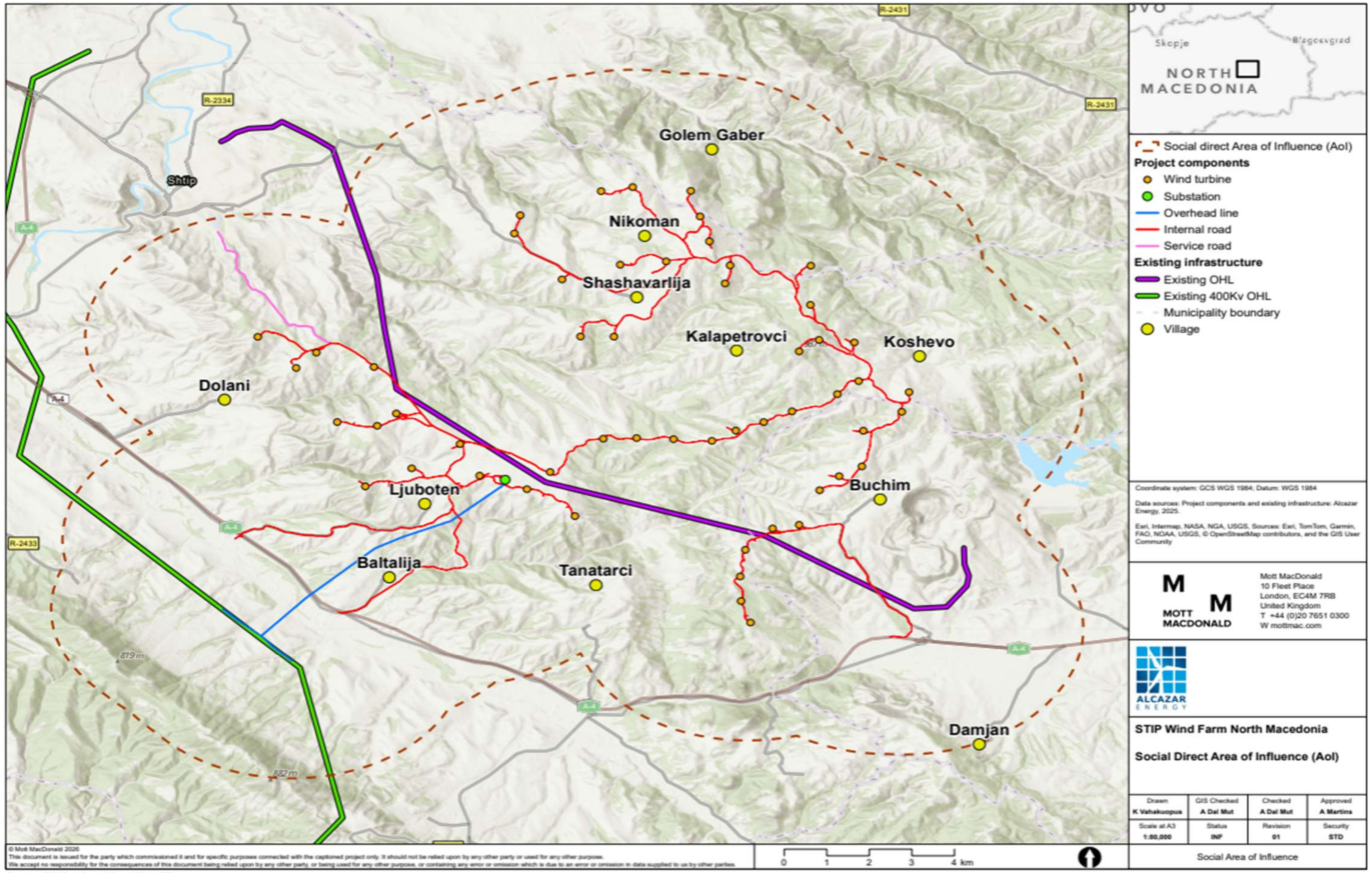
The next subsections describe the main impacts and risks that were identified through the ESIA process.

3.2.1 Effects on people

The direct area of influence (AoI) that has been used for the ESIA study includes the Project footprint and a 3km radius of all Project features, the villages where landowners and users predominantly live, and where the Project workers could potentially be housed. Eleven villages have been identified within 3km of the key Project components (WTGs, the meteorological mast towers, internal roads, substation and OHL), within the municipality of Stip – Baltalija, Nikoman, Shashavarlija, Dolani, Ljuboten, Kalapetrovci, Koshevo, Tanatarci; within the municipality of Karbinci - Golem Gaber; within the municipality of Radovic - Buchim and Damjan. Buchim and Damjan are the largest two villages with populations of 260 and 585 respectively. The closest villages to the Project components are Ljuboten, Shashavarlija, Buchim, Baltalija and Nikoman.

Figure 3.1 overleaf shows the layout of affected villages in reference to project features.

Figure 3.1: Map of the social direct Area of Influence and affected villages



Source: Mott MacDonald, using Free GIS Maps of North Macedonia - Resources | Simplemaps.com

The Project will bring a number of changes to the area, and the assessment looked at how these changes might affect people's daily routines, access to land, movement around villages, local traditions and general wellbeing. Many families use nearby land for farming, grazing, beekeeping or seasonal cultivation, and some of this land will be needed for turbines, internal roads or underground cables. Because of this, some plots—both private and state-owned—may be temporarily or permanently affected. This means that certain households may experience reduced access to the places they rely on for growing crops or keeping livestock. The Project intends to follow established procedures for acquiring land and for offering livelihood support where needed, which are covered in detail in the Livelihood Restoration Plan. AEP has committed to reduce land impacts as much as possible, maintain essential access routes and work constructively with people whose livelihood activities might be disrupted so they can continue earning their living.

Traffic is expected to increase during construction, particularly heavy trucks moving along narrow roads nearby villages. These are the same roads many residents use to reach fields, deliver milk or move livestock, so temporary congestion or disturbance is likely. While the Project plans to manage traffic (through scheduling road improvements or reinstatement after construction), residents may still notice slower movement and busier roads at certain times.

The Project will create some employment opportunities, it will prioritise local hiring where possible, and have procedures for fair working conditions. Some concerns were raised about the arrival of non-local workers. The Project does not expect a large number of such workers (i.e.: 100-300 workers during construction for civil works) and does not plan to establish worker camps. Even so, clear behaviour rules, supervision and a grievance mechanism will be in place so that any issues can be raised quickly by community members.

Community health and safety is planned with due care, but machinery, noise, dust and traffic bring potential risks. Construction areas will be secured, access to the construction campsite will be controlled, and workers will be trained to reduce risks to both themselves and the public.

Cultural and spiritual places were also considered in the assessment. A site near one WTG is used each May for a long-standing community celebration, and another nearby area contains old Muslim graves. These locations are important to local residents, and the Project has adjusted its design to avoid disturbing them. Additional measures (such as stopping the relevant turbine during the celebration and avoiding works near the graves) are intended so that residents can continue using these places in the same way as before.

The assessment looked at which people in the area may be more vulnerable to negative impacts and less able to cope with them. Vulnerability can arise for many reasons: age, disability, chronic illness, low income, limited access to services, or being in a household that depends heavily on land or livestock for survival. Some families have no formal papers for the land they have used for generations, which can increase uncertainty for them. Women in the area often face additional barriers, such as lower levels of formal education, limited mobility, and responsibility for most domestic duties, which can make it harder to adapt if something changes. Some ethnic minority groups also have fewer economic opportunities and may find it more difficult to secure formal employment or access public services. Because of these factors, even small disruptions—such as reduced land access or more difficult movement during construction—can affect some households more strongly than others. The Project therefore plans to offer tailored support to vulnerable households which have been identified in the ESIA as directly impacted. The project aims for clear communication and carefully plans access arrangements so that vulnerable groups do not bear a disproportionate share of the impact.

Human rights risks include unsafe working conditions, unfair treatment, misuse of personal data, or problems in international supply chains related to labour conditions. Measures are being put in place to manage these risks—such as clear contractor requirements, monitoring systems, protections for workers, and accessible grievance channels. With these measures applied, the risks are considered manageable.

Taken together, after the planned measures are considered, most impacts are expected to be minor or short-term. Some local households will still experience changes, particularly those whose land use is directly affected, but these impacts are expected to lessen as mitigation measures are applied and through ongoing engagement with residents. The overall intention is to support that people can maintain their way of life and traditions while also gaining some benefits from the Project's presence.

Cultural heritage

The municipalities of Radovic and Stip contain a range of historically and culturally significant landmarks, including churches, monasteries, archaeological sites, and traditional festivals that form an important part of community identity.

A cultural-heritage inventory was first prepared in 2009 during the original environmental consent process, and updated checks during the 2024 ESIA scoping phase identified 28 archaeological sites in the broader Area of Interest. Consultations with the Cultural Heritage Protection Office and the Institute for the Protection of Cultural Monuments and Museum of Stip confirmed two key sites near Project components:

- Gramada (Buchim) — an ancient burial site from the Iron Age located close to WTG 30 but outside the Project footprint.
- Star Bunar (Baltalija) — an early Christian basilica located near an access-road corridor.

Field inspections confirmed that the OHL corridor does not overlap with any registered cultural heritage, although access-road works near Baltalija require attention due to the presence of Star Bunar.

Community engagements revealed additional sites of local cultural significance, including a traditional gathering place near WTG 28 used for St George's Day celebrations, as well as an unmarked old Muslim graveyard near the planned road-widening area. Residents expressed concerns regarding continued access to these areas, and the Project is reviewing alignments to avoid disturbance.

Surveys with landowners documented several frequently visited churches and a mosque within nearby villages, used for annual religious ceremonies and community cohesion events. Village representatives also highlighted local festivity dates tied to long-standing cultural traditions.

Figure 3.2: Example of a church in Ljuboten village

Source: Maneko Solutions

The ESIA concluded that while several archaeological and culturally important locations exist in proximity to the Project, only two registered archaeological sites lie close to planned works, and none sit directly within the construction footprint. Through continued coordination with cultural heritage authorities, design adjustments, and implementation of appropriate management measures, the Project will protect these sites and maintain access for local communities.

Landscape and visual

The assessment considered how the wind farm will change the appearance of the landscape and how noticeable the turbines, overhead transmission lines, substation and internal access roads will be to people living or spending time in nearby villages.

During construction, the most visible changes will occur on the upland ridgelines, where the turbines and access roads are installed. These areas are open and exposed, which means construction machinery, crane operations and temporary works are easy to see from several nearby villages. The greatest visual change is expected from Buchim, Ljuboten and Shasavarlija, as well as on parts of the local walking routes that rise onto higher ground. In contrast, construction activity will be less noticeable in the Lipov Dol and Shashavarlija valleys, where trees and landform provide natural screening. Although construction effects are temporary, they will still alter the views and reduce the sense of tranquillity in places closest to the works.

Once the wind farm is operating, the turbines become long-term features that are part of the surrounding skylines. Their visibility depends mainly on elevation and orientation. In the upland areas, where views are more open, several turbines will be visible together, creating a noticeable change to the local character. For villages situated nearer to the ridgelines, such as Buchim, Ljuboten and Shasavarlija, the turbines are likely to be clearly seen. From Nikoman, located within the horseshoe-shaped layout, turbines will be seen from multiple directions, making them more prominent, though the small population means fewer people will experience this effect. In other settlements such as Koshevo and Kalapetrovci, views will be more filtered by terrain and vegetation, reducing the visual change. People in Stip, further away, will see the turbines at long distance with reduced visual effect.

Navigation lights required for aviation safety introduce additional points of light at night, although these will affect only the areas from which the turbine towers are already visible.

Across the wider area, the significance of effects varies. The upland landscapes will experience the greatest change because the turbines introduce large, permanent structures into an open setting. The enclosed valleys will experience smaller changes because their topography naturally limits visibility. Importantly, no nationally designated viewpoints or sensitive scenic areas fall within the area affected by the project, and no cumulative effects are expected from other wind farms due to distance. In summary, while the turbines will be visible from several nearby villages and routes, the effects remain localised and do not impact any protected or regionally valued landscapes.

Noise and vibrations

Noise and vibration from the Stip Wind Farm were carefully assessed to understand how they might affect nearby villages and other places where people live or spend time. The study examined both the construction phase and the long-term operation of the wind turbines.

The area on which the project will be constructed is generally very quiet. Measurements taken over several weeks in five nearby locations showed that the sound environment is currently dominated by natural sources such as wind moving through vegetation and birdsong. Traffic and industrial noise are minimal, and most villages experience consistently low noise levels, particularly at night.

During construction, noise will come from activities like preparing access roads, excavating foundations, building crane platforms, laying cables, and assembling the turbines. Because these activities move across the site, any one location will only experience construction noise for a short time. Forecasts show that even when construction equipment is working at the closest points to homes, the resulting noise levels remain below the accepted national daytime limit for construction work. Vibration from construction is also not expected to cause concern because all homes and other sensitive places are several hundred metres away from where heavier equipment will be used. Applying common good-practice measures, such as using modern equipment, avoiding unnecessary idling, and keeping noisier activities to daytime where feasible, will keep construction noise impacts low.

Once the wind farm is operating, the turbines will create steady noise generated both by their internal machinery and the movement of the blades through the air. The expected noise levels at nearby villages were predicted using detailed information about turbine locations, wind behaviour, and the sound characteristics of the machines. These predictions were compared with national and international limits that define acceptable levels during the day and at night. The results show that noise and vibration levels in all nearby villages are within the required limits during the day. At night however, prescribed limits are expected to be exceeded in five locations: Shashavarlija, Nikoman, Buchim, Chiflik, and Ljuboten. In four of these locations, the exceedance is small and classed as a minor impact while inChiflik, the exceedance is somewhat higher, but this location is largely unoccupied and consists mostly of abandoned or weekend-only houses.

The turbines can be operated in special reduced-noise modes that use quieter blade designs or lower power settings during certain wind conditions. Several combinations of these modes were tested. All of them reduce night-time noise levels. With the selected mitigation in place, exceedances at Shashavarlija, Buchim and Ljuboten are removed. At Chiflik, the remaining exceedance becomes small, and at Nikoman it remains minor and not considered significant. The Project has opted for quieter blade designs. With these measures in place, no significant noise effects are expected during operation.

Wind turbines in operation do not create vibration that can be felt at the distances where people live in the project area, and no vibration-related effects are expected during either construction or operation.

To verify that performance matches the predictions, noise monitoring will be carried out after the wind farm begins operating, and again if any concerns arise. The monitoring will use the same approach as the original baseline measurements so that results can be compared directly.

Overall, with the proposed noise-reduction measures in place, the wind farm is expected to operate within accepted noise levels and to avoid significant disturbance to nearby communities.

Shadow flicker

Shadow flicker is the effect created when the sun shines behind a wind turbine and its turning blades cast moving shadows. These shadows can briefly pass across nearby homes in the early morning or late afternoon when the sun is low in the sky. Because this movement can be distracting for some people, the project team studied whether homes around the Stip Wind Farm might be affected.

Thirteen nearby villages and individual houses were identified for the study because they are close enough to the turbines for shadow flicker to be possible. Using computer modelling, the team looked at when and where flicker might happen throughout the year. The study found that a handful of locations could experience more flicker than normally considered acceptable if nothing were done to prevent it.

To make sure shadow flicker impacts are prevented, the project includes a simple solution: during the short times of year when flicker could occur at certain homes, the nearest turbines will temporarily be paused. These pauses do not last long, so the impact on energy production is minor. This approach completely removes shadow flicker at all assessed homes.

3.2.2 Effects on the environment

Different AOIs are identified per type of environmental receptor considered. Even though the preliminary desktop study of biodiversity covers a range of 50km around to project, the potential adverse effects to the environment are mostly studied within the AOI which includes the project area to which a 500m buffer zone is added for habitats, flora, mammals, herpetofauna. The AOI considered for birds is 2km whilst the AOI considered for breeding raptors is 6km.

Water

Although the Project area does not contain major water bodies, it is situated within the wider Bregalnica River Basin and is characterised by small intermittent watercourses and generally limited local water availability. Construction works—such as excavation, soil stripping, road building and cable trenching—will disturb the ground and create exposed surfaces that can increase runoff, reduce natural water infiltration and raise the risk of soil being washed into nearby temporary water channels during heavy rainfall. Dust and loose sediment generated from construction activities and vehicle movements may also settle in these small surface water features, potentially affecting water quality used by nearby communities for purposes such as irrigation.

In addition, improper handling or accidental spills of fuels, oils, lubricants, chemicals or concrete wash water during construction could contaminate soil and, if not contained, infiltrate into groundwater. Hazardous and non-hazardous waste streams—such as oily materials, paints, batteries, and contaminated soil—pose similar risks if not managed using appropriate storage and disposal practices. Sewage and greywater from temporary construction facilities, if not properly managed, could also affect soil and groundwater quality.

To minimise these risks, the Project will apply a range of established protection measures, including storing fuels, oils and chemicals in bunded, impermeable areas; controlling and collecting concrete wash water; properly managing and stabilising excavated material to prevent runoff; and implementing drainage and erosion-control measures along upgraded and new internal roads. These measures, together with reinstatement of disturbed areas once construction is complete, are expected to keep any effects on surface water and groundwater very low.

Waste

The Project's approach to waste is focused on prevention, rather than just minimising impacts after waste has been created. During construction, the main sources of waste will come from excavation, concrete works, packaging, scrap metal, general domestic waste from workers, and a range of hazardous materials such as oils, lubricants, paints, batteries and medical waste. Raw material use during construction will primarily consist of concrete, steel, aggregates, and other materials required for turbine foundations, buildings, and road infrastructure, along with smaller quantities of fuels, oils, lubricants, paints, plastics, timber, and packaging. The project aims to minimise raw material consumption by re-using excavated spoil where possible, sourcing certified or local materials and applying procurement practices that avoid over-ordering and reduce waste generation.

Vegetation clearance, soil compaction, and new access roads will reduce natural infiltration and erosional stability, potentially increasing sedimentation in nearby waterbodies. Mitigation measures such as controlled waste handling, bunded storage, erosion management, and drainage control will minimise these risks.

The operational phase will generate far smaller volumes of waste. Most operational waste will come from routine maintenance of turbines and equipment, including lubricating oils, oily rags, packaging, occasional chemical containers, and small amounts of sanitary waste from staff. Waste produced during major maintenance activities would be exceptional and handled by the operator.

When the project eventually reaches the end of its life, all turbines, infrastructure and equipment will be dismantled and removed. A dedicated decommissioning plan will specify how each type of material will be reused, recycled or safely transported to the designated landfill.

Across all phases, the project will apply a clear hierarchy: prevent waste where possible, then reuse and recycle, and only dispose of waste as a last resort. Because regional landfill capacity is limited, the project will prioritise recycling through existing systems in Stip and surrounding municipalities. Several licensed waste collectors operate in the area, and new regional waste facilities are planned. The project will make use of these services so that waste is handled legally and responsibly.

Monitoring will take place throughout construction and operation to confirm that waste is being managed correctly. This includes regular checks of storage areas, record-keeping on waste quantities, audits of third-party waste contractors, and training for all staff involved in handling materials. With these measures in place, the project expects that waste-related impacts will be kept to a minimum.

Climate risk and vulnerability

The ESIA looked at how climate change could affect the Stip Wind Farm during its lifetime, and what can be done to keep the project safe and reliable as the climate continues to change. The wind farm is expected to operate for around 25 years, from 2028 to about 2053, so the study considered what the local climate may look like by the 2050s.

Temperatures in North Macedonia are expected to rise, especially in summer, while rainfall is likely to become more uneven wetter in winter but drier in summer and autumn. The ESIA examined how these changes could affect the wind farm's turbines, cables, substations, overhead line and access roads. In total, 60 potential climate-related risks were identified across anticipated climate change scenarios. The most significant risks include wildfires, extreme heat, landslides, heavy rainfall and flooding, and high wind events that could force turbines to shut down temporarily. Possible impacts range from damage to equipment and foundations to reduced efficiency or temporary outages during extreme events.

Fortunately, many of these risks can be managed through sensible design decisions and good operation and maintenance practices. Measures to be applied include using heat-resistant materials, improving drainage around turbines and substations, reinforcing slopes in areas prone to erosion, clearing vegetation to reduce fire risk, and making sure systems can be shut down safely during severe weather. The project already includes several design features that help reduce vulnerability, such as turbine cooling systems, sealed electrical equipment, buried cables and real-time monitoring. Additional actions—such as enhanced inspections after storms, better fire preparedness and continued vegetation management—will further strengthen resilience.

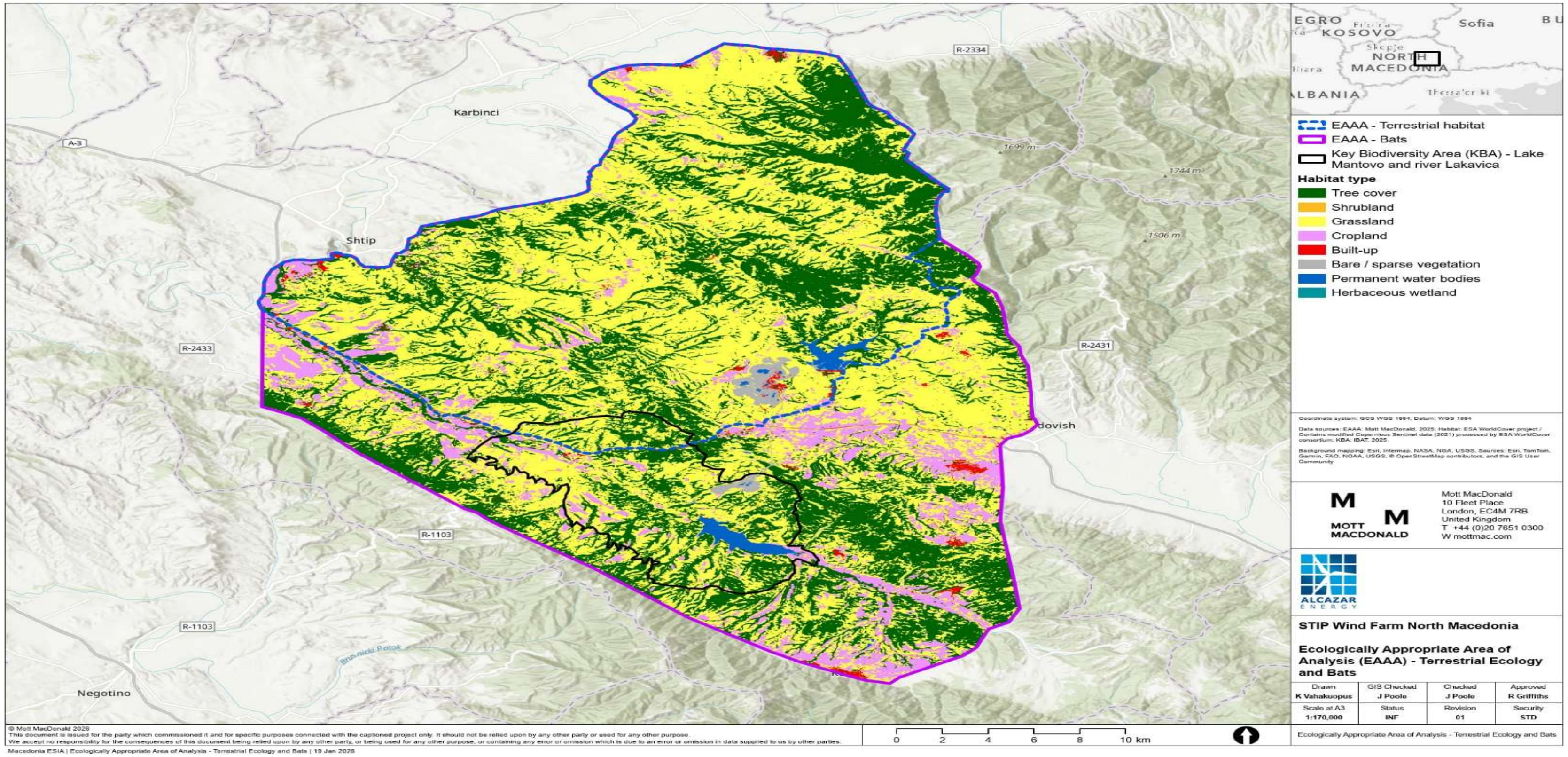
Beyond managing risks, the project will also bring major climate benefits. Based on the estimated 1,340GWh generation of clean electricity, the wind farm is expected to avoid around 980,000 tonnes of CO_2 per year compared with conventional electricity generation in North Macedonia. This contributes directly to the country's goals to cut emissions, expand renewable energy and reduce reliance on fossil fuels.

Local wildlife, habitats, and the natural environment

The area where the Stip Wind Farm will be built includes farmland, open grasslands, patches of oak woodland, and small seasonal water channels. While the project is not located inside any officially protected nature site, it is close to an area important for certain bird species, meaning some of them may pass through or use parts of the wider landscape. Surveys carried out over a full year showed that two types of habitats in the project area are considered particularly valuable: the local oak woodlands and the natural steppe grasslands. These habitats are declining in many places in the region, so the project needs to treat them with special care.

The Figure 2.1 shows the study area (Ecologically Appropriate Area of Analysis - EAAA) of terrestrial habitats, vegetation and animal species, birds and bats

Figure 3.3: Ecologically Appropriate Area of Analysis for Terrestrial habitats, flora and fauna, and Birds and Bats



Source: Mott MacDonald

The surveys also looked at plants and animals living in the area. A few uncommon plants were found, but many of the rarer species known from the wider region do not occur because the site does not have the conditions they need. Typical mammals like foxes and hares are present, while species that need wetlands or special conditions, such as otters or ground squirrels, are not expected. Some reptiles and amphibians, such as Hermann's tortoise, Greek tortoise and fire salamander, were recorded, and these can be sensitive to construction activities because they move slowly and live close to the ground.

Birds and bats received special attention in the ESIA studies. A large number of bird species were found to use the wider area, including some well-known birds of prey and several migratory species. However, detailed observations showed that only a small number fly regularly at the height where turbine blades turn, and no major flight paths cross the project site. Studies predicting possible collisions with turbines showed low risk for most species, with only kestrel and buzzard expected to be affected slightly more than others. Even in these cases, the numbers remain extremely small when compared with global populations. Surveys also found that bird activity along the proposed overhead line is low, meaning the risk of collisions there is also limited.

A broader review of nature in the area, covering more than a thousand species, confirmed that while the site contains some sensitive habitats and some species of concern, the project can avoid serious impacts to biodiversity if it follows strict protection and management measures. Some species, such as certain snakes, bats, tortoises and birds, are considered priorities, and the project must apply careful planning and monitoring so that their populations are not harmed.

The study also looked at the ways local people benefit from the landscape. These benefits include grazing land for animals, growing crops, collecting wild plants, hunting, as well as natural services like pollination, soil health, flood control, and recreational use of the hills and open spaces. Construction will require land currently presenting grassland, scrub and woodland. This may affect grazing and some crop-growing areas, and could temporarily disturb places that are used for gatherings or traditions. Once the wind farm is operating, the main long-term changes will be the presence of turbines in the landscape and small reductions in ecosystem services like pollination or natural pest control due to some bird and bat deaths. These effects are expected to be limited and mostly local.

To reduce impacts, the Project has been designed to avoid the most sensitive areas as much as possible. During construction, workers will follow strict rules, including checking for animals before clearing land, moving them if needed, avoiding work at sensitive times where feasible, such as breeding and migration periods of affected species, reducing dust, limiting lighting, and restoring vegetation afterwards. For the operation of the wind farm, measures include fitting bird-warning devices on power lines, and long-term monitoring of wildlife to detect any unexpected issues, and if necessary adjusting turbine operation further during certain bat activity periods. The project is also committed to restoring or improving important habitats, such as oak woodland, so that there is no long-term loss, and ideally a gain, of these natural features.

Overall, the biodiversity assessment showed that the wind farm will interact with nature and wildlife in several ways, but that these impacts can be effectively managed through careful design, responsible construction practices, and ongoing monitoring. With all measures in place, the project is expected to avoid significant long-term harm to wildlife and continue supporting the natural services that local communities benefit from, while also contributing to renewable energy and climate-change goals.

3.3 General Conclusions

The ESIA has shown that the Stip Wind Farm can be built and operated in a way that keeps impacts on people and the environment low, as long as the planned management measures are followed. The assessment looked at probable impacts and possible risks and then identified practical steps to reduce them. These steps range from careful technical design and strict construction rules to open communication with communities, fair land procedures, and measures to protect nature.

For people living in the area, most of the adverse effects relate to construction activities, nuisance items such as more traffic, noise, temporary disturbance and changes in access to certain places. With proper traffic planning, regular updates to villages, safe working practices, protection of sensitive cultural areas, and support for vulnerable groups, the ESIA concluded that long-term impacts on communities will be low. Studies on noise and shadow flicker also show that with the planned operating controls, homes will be exposed to accepted limits, leaving only small and manageable effects.

The Project will also create job opportunities and chances for local businesses to participate,. Risks linked to workers' rights and labour and working conditions have been identified, and clear measures are in place to keep them low.

Impacts to land, soil and materials are limited and can be handled through standard good practice. Waste will be sorted, stored and disposed of safely. Construction work will be temporary, and issues like dust, erosion or soil disturbance can be kept to a minimum through routine controls. The project has also been checked for climate-related risks, such as heat, heavy rain or wildfire, and the design already includes measures for the wind farm to cope with these conditions in the future.

Nature and wildlife impacts were studied in detail. The area contains typical regional habitats and some species that need extra care, such as certain birds, bats, tortoises and grassland plants. By carefully choosing turbine locations, adjusting operations during sensitive moments, restoring habitats after construction, and monitoring wildlife over time, the biodiversity assessment showed that impacts can be kept low. Predictions of bird and bat collisions remain within safe limits once these measures are applied. Activities such as grazing, beekeeping and use of natural resources can continue, with only minor adjustments needed during the construction period.

Across the ESIA chapters, cumulative effects were considered wherever other existing or planned activities could interact with the Stip Wind Farm. Overall, the assessment shows that while the project will generate some temporary or localised impacts during construction, there are no other major developments in the immediate area that would combine with this project in a way that meaningfully increases overall effects. Most impacts remain local, short-term or fully mitigable.

3.3.1 Summary of important impact facts:

- There will be no displacement of residents from their homes.
- Most changes and civil work activities will occur during construction, not operation.
- Access to fields, grazing areas, hunting, herb and mushroom gathering and cultural sites will be maintained with exception of Project footprint and construction areas which land has been secured by the Project.
- A grievance mechanism for feedback and complaints will be available at all times and a community liasion office will be established in Stip.
- The project will not cause any significant adverse effects to people or the environment

3.3.2 Summary of the main project benefits:

- Production of renewable energy from clean sources
- Associated climate benefits, preventing greenhouse gas emissions from conventional sources of energy generation
- Employment of local, national and international workforce and creation of business opportunities for local procurement of goods and services
- Improved local roads within the Project area

In summary, the ESIA has found that the Stip Wind Farm can be developed responsibly. The project avoids the most sensitive areas, does not require any homes to be relocated, and includes clear measures for managing environmental, social and cultural risks. With these measures in place, the remaining impacts are minor or negligible, and no meaningfully combined effects with other projects are expected. The project can therefore move forward with confidence that impacts have been properly identified and reduced, while contributing to long-term clean-energy and climate goals.