REPORT

Mirny (Kazakhstan) 1GW Wind Farm Project

ESBS Report Chapter 06 - Baseline conditions, Biological and Biodiversity Resources

Submitted to:

Aktas Energy LLP

Submitted by:

WSP ITALIA S.r.l.
Via Antonio Banfo 43, 10155, Torino Italia

+39 02 87 25 90 00

24685792-002-R-Rev 04

December 2025

Distribution List

Aktas Energy LLP

WSP Italia

Table of Contents

TABLES

FIGURES

APPENDICES

6.0 BASELINE CONDITIONS – BIOLOGICAL AND BIODIVERSITY RESOURCES

6.1 Definition of the Study Area

6.1.1 Initial survey areas

Two potential Project areas were considered at the screening stage, herein referred to as the 'northern Project area' and the 'southern Project area'. These Project areas can be seen on Figure 1. Complete biodiversity survey programmes for all species groups were carried out in 2023 on both Project areas. The location of the wind farm was then moved to the southern Project area, and the turbine layout was amended several times to avoid and minimise impacts to sensitive ecological features that became known during the course of the survey works to date. The wind turbine layout was finalised in January 2025, and the final site boundary herein referred to as "the Project site" according to the definition provided in Section 1 of this ESIA report, or simply "the Site". The Study Area for the biodiversity surveys described here includes the Area of Influence (AoI) for the Project and all associated infrastructure. The broad Site boundary can also be seen in the following figure.

Figure 1: The Site and Project areas: The Site – red line; Approximate southern Project area – green line; Approximate northern Project area – white line[1].

[1] The southern and northern Project area boundaries shown on the figure have been drawn by hand on Google Earth, rather than a shapefiles/kmz file provided.

6.1.2 Final study areas

As noted above, the surveys were initially undertaken within both the northern and southern Project areas of the initial layout, but the final Site has been moved to an area that largely overlaps with the southern Project area and has been chosen so that it avoids a range of biodiversity constraints identified in the initial surveys which are as it follows and shown in the figure further below:

- the presence of Regels tulip (*Tulipa regelii)*, which is globally endangered and also classified as rare and endangered in the Kazakhstan Red Data Book, in an extended area northwest of Site A and on its southern boundaries. This area has been excluded from the wind farm development footprint.
- the presence of the Argali (*Ovis ammon collium*), listed on the IUCN Red List as Near Threatened, because their populations are declining due to poaching and competition with livestock. This Argali zone where the sheep were mostly present has also been excluded from the wind farm footprint.
- the presence of a number of raptor territories with active nests, including five Golden Eagle (*Aquila chrysaetos*), two Saker Falcon (*Falco cherrug*) and two Steppe Eagle (*Aquila nipalensis),* all of which are Red Data Book species for Kazahkstan. All of these nests have been buffered by 2km.

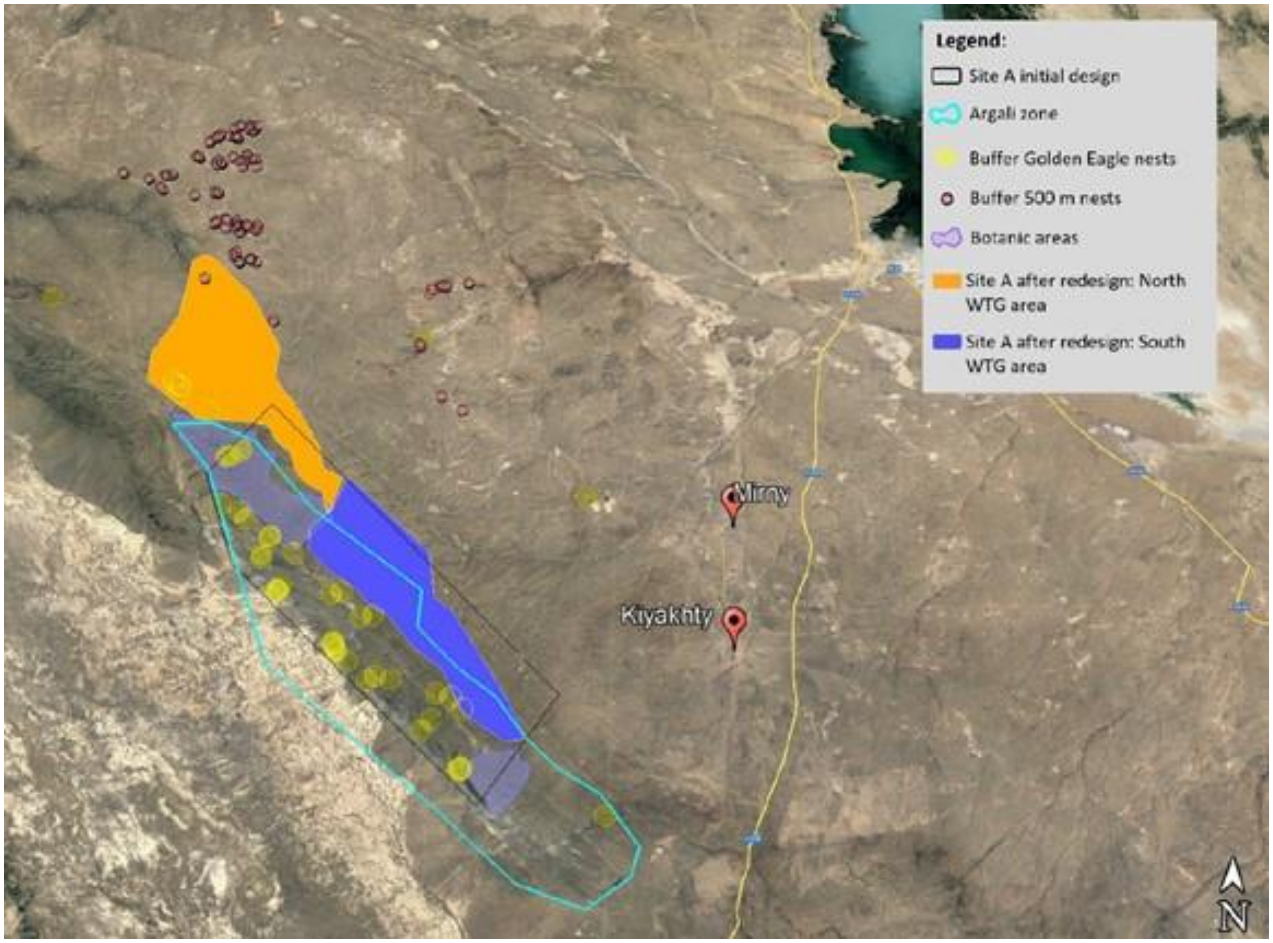


Figure 2: Final Project site for all species groups based on the identified biodiversity constraints identified in previous surveys.

The Study Area, for all terrestrial biodiversity species groups, is the area that may be relevant to the biodiversity assessment in order to fully understand and describe the baseline. It encompasses the AoI and may extend further based on the distribution of priority biodiversity features across the landscape. For this report, it is

necessary to apply several Study Areas of varying sizes depending on the ecological feature, in some cases, these will extend beyond the site itself.

Study Areas for the purpose of data collection are summarised in the following table and have been defined based on current best practice guidelines and current Proposed Scheme information. In some cases, the Study Area has been defined on a precautionary basis using professional judgement alongside this information. This approach ensures a sufficient geographical area has been considered and assessed to allow all reasonably foreseeable impacts to be taken into account. As the terrestrial biodiversity assessment progresses and further information becomes available, both in terms of survey results, Site details and design, and (where appropriate) in response to feedback from consultation, it is considered that one or more of the Study Areas may be subject to refinement later in the proposed scheme lifecycle.

Table 1: Study Areas.

Feature/Data	Coverage of data presented within this report (Study Area)
Protected Areas	50km of radius from the Project site
Species listed on IBAT report	50km from the Project site
Habitats	The Project site + 500m buffer
Flora	The Project site + 500m buffer (in 2023, southern Project area, and the northern Project area of the initial layout)
Birds	The Project site
Bats	The Project site (including the southern Project area, and/or the northern Project area in the initial layout)
Herpetofauna	The Project site
Freshwater species	Lower reaches of the Shu River, Karakol and Bolshiye Kamkale lakes, Akzhaikyn and Akkol lakes
Other mammals	The Project site (including the southern Project area as defined in the initial layout)
Invertebrates	The Project site (including the southern Project area and northern Project area as defined in the initial layout)

6.2 Methodology and Approach

6.2.1 Desktop Studies

The desk study is based upon a range of data and information collected specifically to inform this study, which is also presented in the following reports:

- Mott MacDonald (2023) Environment and Social Screening, wind farm: Mirny sites, Kazakhstan;
- ACBK Centre for Conservation Biology LLP (2024) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024. Final report for April 2023 – May 2024 (ACBK, 2024) (APPENDIX C);

- ACBC Centre for Conservation Biology LLP (2025) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during September 2024-August 2025. Final report for September 2024 – August 2025 (ACBK, 2025) (APPENDIX D);
- Ichtyofauna Shu river report, 2021 (APPENDIX F).

These reports used the following sources of data and information:

- Integrated Biodiversity Assessment Tool (https://ibat-alliance.org/) - data purchased in March 2023;
- Integrated Biodiversity Assessment Tool (https://ibat-alliance.org/) - data purchased in October 2025;
- International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org);
- World Flora Online (http://www.worldfloraonline.org/);
- Global Biodiversity Information Facility (http://www/gbif.org);
- Digital Observatory for Protected Areas (DOPA) Explorer (http://dopa-explorer.jrc.ec.europa.eu);
- The Red List of Republic of Kazakhstan **(https://redbookkz/en/index.html);**
- Local Ecological Footprint Tool (https://www.left.ox.ac.uk/);
- KeyBiodiversityAreas.org;
- One Earth;
- Fedosenko A.K., Kapitonov V.I. 1983. Argali – Ovis ammon. In: Mammals of Kazakhstan. Vol. 3, part 3. 144-208. (in Russian The Argali (Ovis a. ammon) of Kazakh tableland;
- Vinogradov B. S., Tugarinov A. Ya., Chernov S. A. (1948) Formation of the modern fauna of the zone deserts //Animal world of the USSR. – T. 2. – P. 321-331;
- Mityaev I. D., Kazenas V. L., and Kashcheev V. A. (2005) History, state and prospects of entomology in Kazakhstan //Proceedings of the Institute of Zoology of the Ministry of Education and Science of the Republic of Kazakhstan. Almaty. – T. 49. – P. 73;
- Materials for the Cadastre of the fauna of the Almaty region. Part 1 – Insects. (Tr.In-ta zool., vol. 53). – Almaty: Nur-Print, 2011. - 390 p.;
- Uvalieva K.K. (1990) Terrestrial mollusks of Kazakhstan and adjacent territories. Almaty, Science;
- Fedosenko A.K., Kapitonov V.I. (1983). Argali – Ovis ammon. In: Mammals of Kazakhstan. Vol. 3, part 3. 144-208. (in Russian).

This Chapter aims to present the methods and results for the desk studies and field surveys undertaken between April 2023 and August 2025. Where possible, information that is only relevant for the Site and/or the southern Project area has been included. The field survey locations and results for the southern Project area that now lie out with the Site boundary have been included for completeness, to provide additional contextual ecological information for the Site and its surroundings.

Given the changes to the Site boundary, a proportion of the data gathered prior to the final Site boundary overlaps with the current required survey boundaries for the final wind turbine layout. Therefore, the gaps in the baseline survey work for the relevant ecological features were closed with the field surveys conducted between September 2024 and August 2025.

6.2.2 Habitat Mapping

Prior to the start of field work, satellite images were prepared with the main contours of plant communities drawn in the Landsat program. These contours were then ground-truthed during the flora surveys (see Flora section below), and the main ecosystems present were mapped.

The determination of natural and modified habitats present in the Study Area was then performed on the basis of a literature review and analysis of the Sentinel-2 10-metre Land Use/Land Cover Time Series layer provided by Esri.

Surveys were designed and undertaken by ACBK Centre for Conservation Biology LLP, with the results presented in the following reports:

- ACBK Centre for Conservation Biology LLP (2024) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024. Final report for April 2023 – May 2024 (ACBK, 2024);
- ACBK Centre for Conservation Biology LLP (2025) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during September 2024-August 2025. Final report for September 2024 – August 2025 (ACBK, 2025).

6.2.3 Field Surveys

6.2.3.1 Flora

The field studies were conducted over the period from 12 to 18 June 2023, and subsequently from 12 to 18 June 2025.

In 2023, in accordance with best practice guidance (Alekhin and Syreyshchikov, 1926[2], Mirkin et al., 2001[3]), random study plots of 10m x 10m in size were set out within the southern Project area along transects, shown on Figure 3. Counts were made along the routes which were both walked and driven. Surveys were designed and undertaken by ACBK Centre for Conservation Biology LLP, and the results presented in ACBK (2024).

[2] Alekhin V.V., and Syreyshchikov D.P. (1926) Methods of field botanical research. Vologda.

[3] Mirkin B.M., Naumov L.G., Solomeshch A.I. (2001) Modern science of vegetation, Moscow.

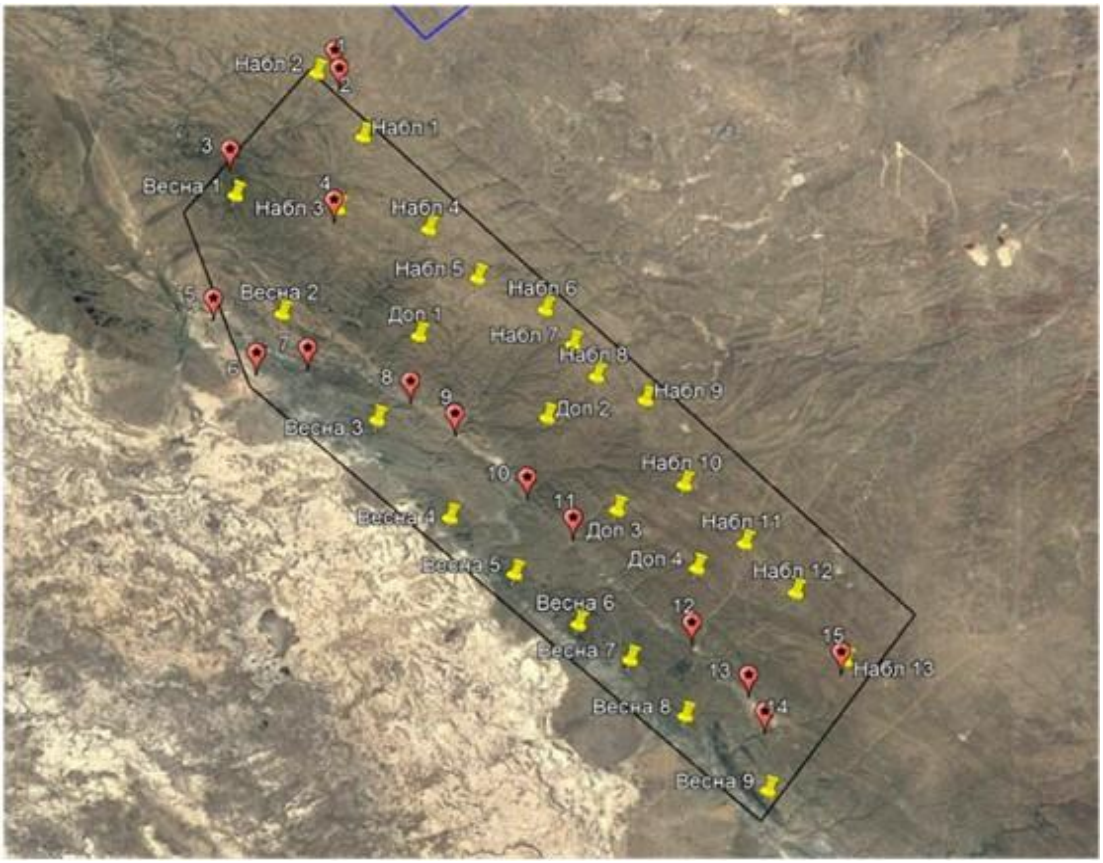


Figure 3: The location of the study plots within the southern Project area[4].

The yellow points in the figure above denote the main areas covered by the botanical surveys to get a broad coverage of the Study Area for flora.

The purpose of this field study was to determine the current state of vegetation within the southern Project site and to:

- Cover the maximum area of the territory to identify the main ecosystems and develop a map of ecosystems;
- Identify the habitats of rare and endangered plant species within the initial layout southern Project area.

Attributes recorded were the species composition of vegetation, the name of the community, the height of dominant species, the nature of the relief, the nature of the soil surface, the total projective cover, and the abundance of species. Abundance of plant species was classified according to the Drude scale, shown in the following table.

Table 2: Drude scale categories.

Number	Symbol according to Drude	Abundance characteristic
1	Socials (Soc.)	Plants that interlock with their above-ground parts, forming a common background

[4] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

Number	Symbol according to Drude	Abundance characteristic
2	Copiosae (Cop.)	Very plentiful, but does not give a background
	Cop.3	Abundant, there are many individuals of this species
	Cop.1	Abundantly
3	Sparsae (Sp.)	Plants are found occasionally, scattered, in small numbers
4	Solitariae (Sol.)	Plants are rare
5	Unicum (Un.)	The species is represented by a single specimen on the test site

Plants were identified by:

- Illustrated guide to plants of Kazakhstan (1969);
- Illustrated guide to families and genera. Flora of Kazakhstan. Volume 1 (1999);
- Key to plants of Central Asia (1968-1993);
- Online identification with www.plantarium.ru.

In Spring 2025, a comprehensive botanical survey of the final Project site was conducted. The field research encompassed a total distance of more than 200 km within the designated Project site, situated within the Zhambyl region. A site survey was conducted, in which the specified objects were meticulously examined by car along the designated route which included a walkover to delineate habitats present across the project site and a 500m buffer. The survey route was initiated at the northernmost point of the designated road and the 500 kV power line, extending towards the southernmost point, thereby encompassing the primary axes of the planned work. Stops were made along the route to inspect the site, describe the vegetation, and identify background landscape areas and areas with varying anthropogenic pressures on natural ecosystems. In instances where further investigation by car was not feasible, the area was instead surveyed on foot.

In the course of the botanical studies, a compendium of species growing in the designated area was compiled through detailed descriptions. To identify rare and endangered plant species, a systematic approach was employed, utilising a GPS device to ascertain the precise location of each species. The route survey also identified the main ecosystems within the specified lines.

During both surveys (2023 and 2025), plants were identified by using:

- Illustrated Guide to the Plants of Kazakhstan (1969) Vol. 1, Vol. 2;
- Illustrated Guide to the Families and Genera of the Flora of Kazakhstan. Volume 1 (1999);
- Identification Guide to the Plants of Central Asia (1968-1993);

- online identification guide http://www.plantarium.ru.

Full results are presented in ACBK (2025) report.

6.2.3.2 Birds

Bird surveys undertaken followed the recommendations of Jenkins et al. (2015)[5] and SNH (2017)[6] Jenkins *et al.* (2015) differs in some of the recommended survey types as it is more focused on arid environments. Surveys were initially designed and undertaken by ACBK Centre for Conservation Biology LLP, with the results presented in the following reports:

- ACBK Centre for Conservation Biology LLP (2024) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024. Final report for April 2023 – May 2024;
- ACBC Centre for Conservation Biology LLP (2025) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during September 2024-August 2025. Final report for September 2024 – August 2025 (ACBK, 2025).

From September 2024 the ornithology survey scope followed the recommendations of WSP (2024)[7].

Survey dates

Bird surveys were undertaken between April 2023 to August 2025. Specific dates can be seen in the following table.

Table 3: Bird survey dates.

Date	Survey objectives
23.04.2023 – 01.05.2023	1. Search for nests and/or evidence of breeding of rare and endangered species 2. Record the bird species observed at the vantage points to understand the species composition of the Site in spring.
02.05.2023 – 12.05.2023	
12.06.23 – 04.07.2023	1. Record the bird species observed at the vantage points to understand the species composition of the Project site in summer. 2. Record the number of birds of prey nesting in the Site in the summer. 3. Understand the number of passerines and other bird species (other than birds of prey) nesting in the Project site during the summer period.
26.07.2023 – 07.08.2023	

[5] A.R. Jenkins, C.S. van Rooyen, J.J. Smallie, J.A. Harrison, M. Diamond, H.A. Smit-Robinson and S. Ralston (2015) Birds and Wind-Energy Best-Practice Guidelines

[6] Scottish Natural Heritage (2017) Recommended bird survey methods to inform impact assessment of onshore wind farms, ver. 2.

[7] WSP (2024) Mirny Wind Power Plant: Ornithology Survey Scope 2024/5 Version 2.

Date	Survey objectives
10.09.2023 – 23.09.2023	1. To understand how the Project site is used by migrating birds over the autumn migration period.
30.09.2023 – 29.10.2023	
05.11.2023 – 16.11.2023	
20.12.2023 – 22.12.2023	1. Record the bird species observed along the transects to understand the species composition of the Project site in winter. 2. Collect information on wintering rare species.
23.01.2024 – 27.01.2024	
27.02.2024 – 01.03.2024	
15.03.2024 – 24.03.2024	1. To understand how the Project site is used by migrating birds over the spring migration period.
27.03.2024 – 11.04.2024	
13.04.2024 – 06.05.2024	
23.09.2024 – 10.10.2024	1. Determination of the species composition and census of birds (large predators) during the autumn migration period at the Wind Power Plant and Overhead Line Transmission (OHL). 2. Collection of data for modelling the probability of collisions of selected bird species with wind turbines proposed for installation. 3. Determination of the species composition and census of birds (background species) during the autumn migration period at the Wind Power Plant and OHL.
17.10.2024 – 24.10.2024	
08.11.2024 – 22.11.2024	
19.12.2024 - 22.12.2024	1. Determination of the species composition and census of birds (large predators) during the winter period at the Wind Power Plant and OHL. 2. Collection of data for modelling the probability of collisions of selected bird species with wind turbines proposed for installation. 3. Determination of the species composition and census of birds (background species) during the winter period at the Wind Power Plant and OHL.
10.02.2025 – 13.02.2025	
19.03.2025 – 12.03.2025	1. Determination of the species composition and census of birds (large predators) during the spring migration period at the Wind Power Plant and OHL. 2. Collection of data for modelling the probability of collisions of selected bird species with wind turbines proposed for installation. 3. Determination of the species composition and census of birds (background species)
23.03.2025 – 26.03.2025	
11.04.2025 – 22.04.2025	
04.05.2025 – 14.05.2025	

Date	Survey objectives
	during the spring migration period at the Wind Power Plant and OHL.
13.06.2025 – 23.06.2025 18.07.2025 – 26.07.2025 05.08.2025 – 10.08.2025	1. Determination of the species composition and census of birds (large predators) during the summer period at the Wind Power Plant and OHL. 2. Collection of data for modelling the probability of collisions of selected bird species with wind turbines proposed for installation. 3. Determination of the species composition and census of birds (background species) during the summer period at the Wind Power Plant and OHL.

Vantage point surveys (VP): wind power plant

VP surveys are designed to quantify the level of flight activity and its distribution over the survey area. The primary purpose of these surveys is to provide input data for the Collision Risk Model (Band et al. 2007[8]), which provides a prediction of annual mortality rates due to potential collision with turbines. Flight data can also be used to provide an overview of bird usage of the site, which may help to inform the potential for disturbance and displacement of birds. The viewshed from each VP will ideally be no more than the recommended 2 km as detectability of birds does decline beyond this distance but for some of the final VPs a viewshed of 2.5km was used to increase the coverage of turbines. Suitable VPs were chosen to take into account: accessibility, sufficient visibility, and the need to cover different and representative types of landscapes within the survey area and all viewsheds were analysed to ensure visibility. Given the large scale of the wind farm search area, the vantage point viewshed coverage was aimed to be approximately 75% of survey area as per Jenkins et al. (2015). Birds were recorded three height bands: 0-20m, 20-200m and more than 200m which cover the rotor swept areas of the two turbine models chosen for the Project.

Contextual bird survey data for the two scoping sites has been collected since spring 2023 and a proportion of these data overlaps the current required survey boundaries for the final wind turbine layout. Focussed data for the final layout has been collected since March 2024 and is required for a minimum of 12 continuous months and in some cases 24 months.

It has been assessed that 30 VPs are necessary to survey the rotor swept areas of all the turbines in the final layout. The recommended effort for bird surveys for wind farm power projects in SNH (2017) is two full years i.e. 24 continuous months. However, if representative data can be collected within one year, then this is acceptable with justification. This survey period is becoming more acceptable as the impacts of wind power plants on birds, and the effectiveness of mitigation solutions is better understood.

This survey period must include:

- a spring migration season (March to May). Data has currently been collected for a proportion of the final layout albeit the layout changed after these surveys had been completed;

[8] Band, W.,M., Madders, Whitfield, D.P (2007) Developing field and analytical methods to assess avian collision risk at wind farms.

- a full (uninterrupted) breeding season for resident birds (April to August);
- an autumn migration season (September to November); and
- a winter period. If access and weather conditions permit, then observations should be made monthly from November to March from each VP to assess winter flight activity.

The survey effort required is 72 hours of observations per VP location divided between seasons (36 hours breeding and 36 hours non-breeding) per year, as a standard. Where high levels of migration movements are considered likely, or are known, to occur, sampling within this period does need to be stratified to ensure adequate data collection across the spring and autumn periods. The survey effort generally works out at six hours observation time per VP per month with each survey no longer than three hours with a break in between.

Below is a chronology of the surveys conducted since spring 2023, which you can use to see how the situation has evolved over time.

Spring (April-May) 2023: Surveys at 26 VPs locations within the southern Project area were carried out. Surveys per VP were carried out during the daytime from 06.00 to 12.00 and then from 15.00 to 21.00. The period from 12:00 to 15:00 was avoided due to extremely low bird activity at that time of the day due to high temperatures. Each vantage point was surveyed for on average for 12 hours per month. See Figure 4 for VP locations and distribution

Summer (June-August) 2023: 20 VPs were utilised. The following six VPs were removed from the scope: S05, Add S01, S06, S08, Spring S06, Add S04. Due to the decrease in daylight hours in the autumn, surveys at VP in September were undertaken 06.30 to 12.30 and then from 13.30-19.30. October observations took place from 08.00 to 13.00 and then 14.00-18.00, on average for 9 hours. Surveys at the of October and November were carried out for 3-4 hours on average, approximately 12.00-16.00.

Spring (March-May) 2024: 32 VPs were utilised which can be seen Figure 5**.** These partially overlapped with the VPs in Spring 2023-Summer 2024. Of these, 20 VPs are within the southern Project area referred to the initial layout. Due to the gradual increase in daylight hours in the spring, March observations took place on average from 09.00-10.00 to 16.00-17.00; April observations from 07.00-08.00 to 17.00-18.00, May observations from 06.00-07.00 to 18.00-19.00. Route observations were carried out during movements between stationary observation points.

Autumn (September to November) 2024: 30 VPs were utilised with partial overlapping of the already existing points of the southern Project area referred to the initial layout. This was due to the change in the planned location of the wind turbines from the beginning of 2024. The location of the VPs are displayed in Figure 6. Due to the gradual decrease in daylight hours in the autumn period, September observations took place on average in the period from 08.00-10.00 to 17.00-18.00; October - from 08.00-10.00 to 16.30-17.30, November - from 08.30-09.00 to 16.30-17.00. Route observations were carried out during movements between the points of stationary observations.

Winter (December to February) 2024/2025: The methodology has been carried out as per the autumn 2024 VP surveys, albeit the survey timings are likely to be different due to the difference in daylight hours. The monitoring work in December was conducted over a period of three days, commencing at 9:00 a.m. and concluding at 5:00 p.m. Due to the presence of severe weather conditions, characterised by extreme temperatures and high wind speeds, 14 vantage points were identified within the designated site, with the objective of ensuring a balanced coverage of the Project site. The 14 vantage points selected for stationary observations were all covered, with the remaining territory being covered by route observations. The observation process was conducted over the course of one hour at each designated vantage point.

In the months of January and February, the work was executed in accordance with the same scheme, encompassing a total of 16 stationary VPs. Consequently, a substantial amount of information was gathered regarding the ornithofauna of the site during the winter months. This information encompassed quantitative indicators, as well as data concerning certain animals, including rare species.

Spring (March – May) 2025: field surveys of the Project site were conducted in several stages. All visits were subject to prior approval by representatives of Total Energies (D. Khitsenko). The initial field visit was conducted from 9th to 12th March 2025. The initial plan was to undertake the trip from 9-23 March 2025. However, due to the challenges posed by heavy snowmelt and precipitation, which made movement around the site extremely difficult and, in some places, impossible, the trip had to be shortened. The second field trip took place from 23rd to 26th March 2025. The purpose of the field trip in March was to clarify the conditions for effective work. Following a thorough investigation, it was determined that the majority of the moisture had been absorbed by the soil. However, the soil itself was still too wet to allow vehicles to travel on it. The third field trip (April 11 to April 22) and fourth field trip (May 4 to May 14) were transformed into full-fledged working trips in the spring of 2025. All assigned tasks have been completed.

Due to the change in the location of the planned wind turbines from the beginning of 2024, alternative stationary observation points were selected for the autumn work, with some overlap on existing points on the southern site. Accordingly, stationary observations were carried out in spring 2025 at 30 vantage points. Due to the gradual increase in daylight hours in the spring, observations were conducted, on average, between 8am and 10am, and between 5pm and 7pm in April. In May, observations were conducted from 7am to 10am, and from 6pm to 8pm.

Summer (June – August) 2025: stationary observations were carried out at 30 VPs. All summer observations took place on average between 06:00-10:00 and 14:00-18:00.

Figure 4: The location of the vantage points within the southern Project area in Spring 2023 to Summer 2023[9].

[9] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

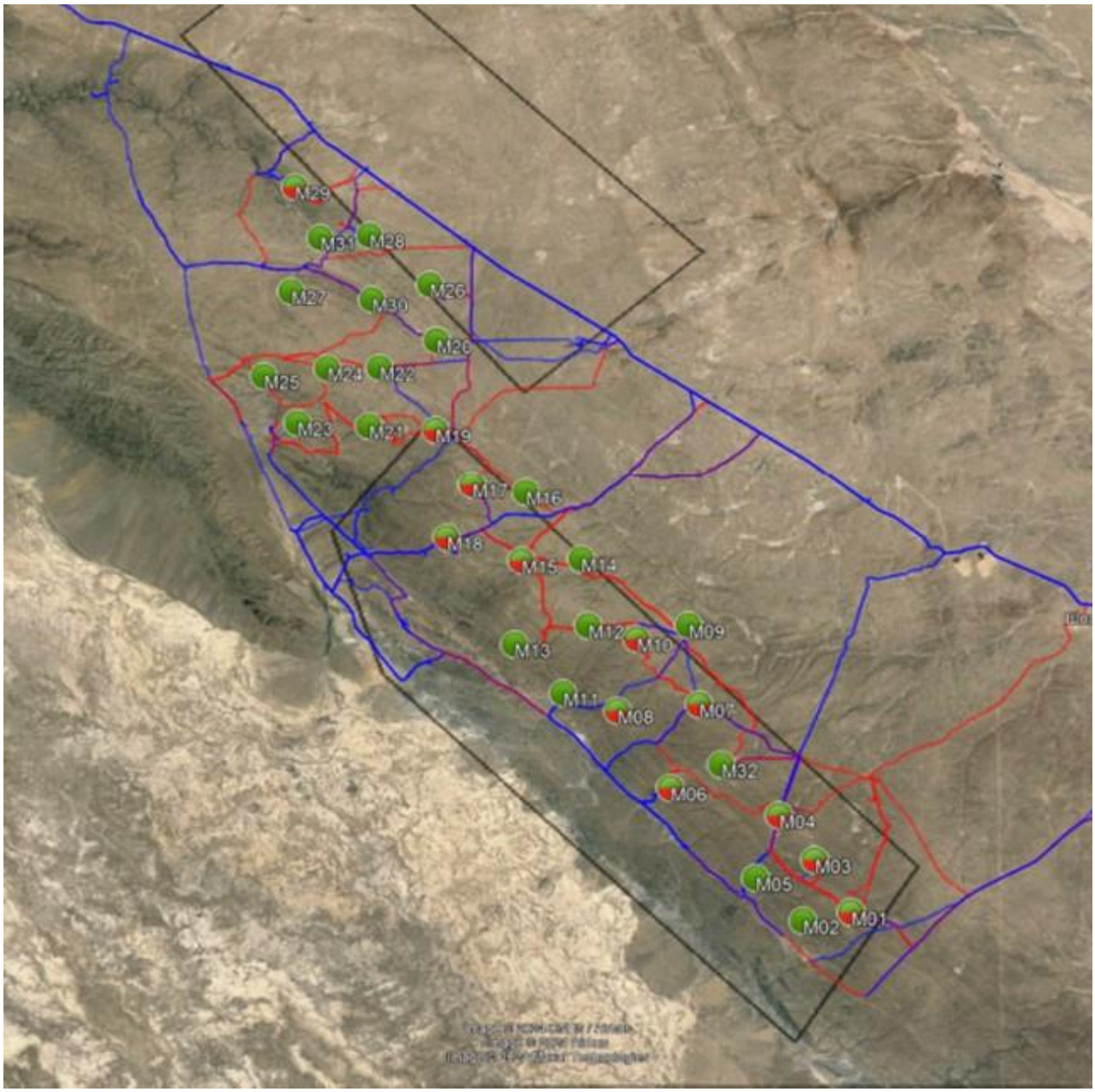


Figure 5: The location of the vantage points in Spring 2024[10].

The red and blue tracks shown in Figure 5 comprise the driven and walked transects for the breeding bird surveys.

[10] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

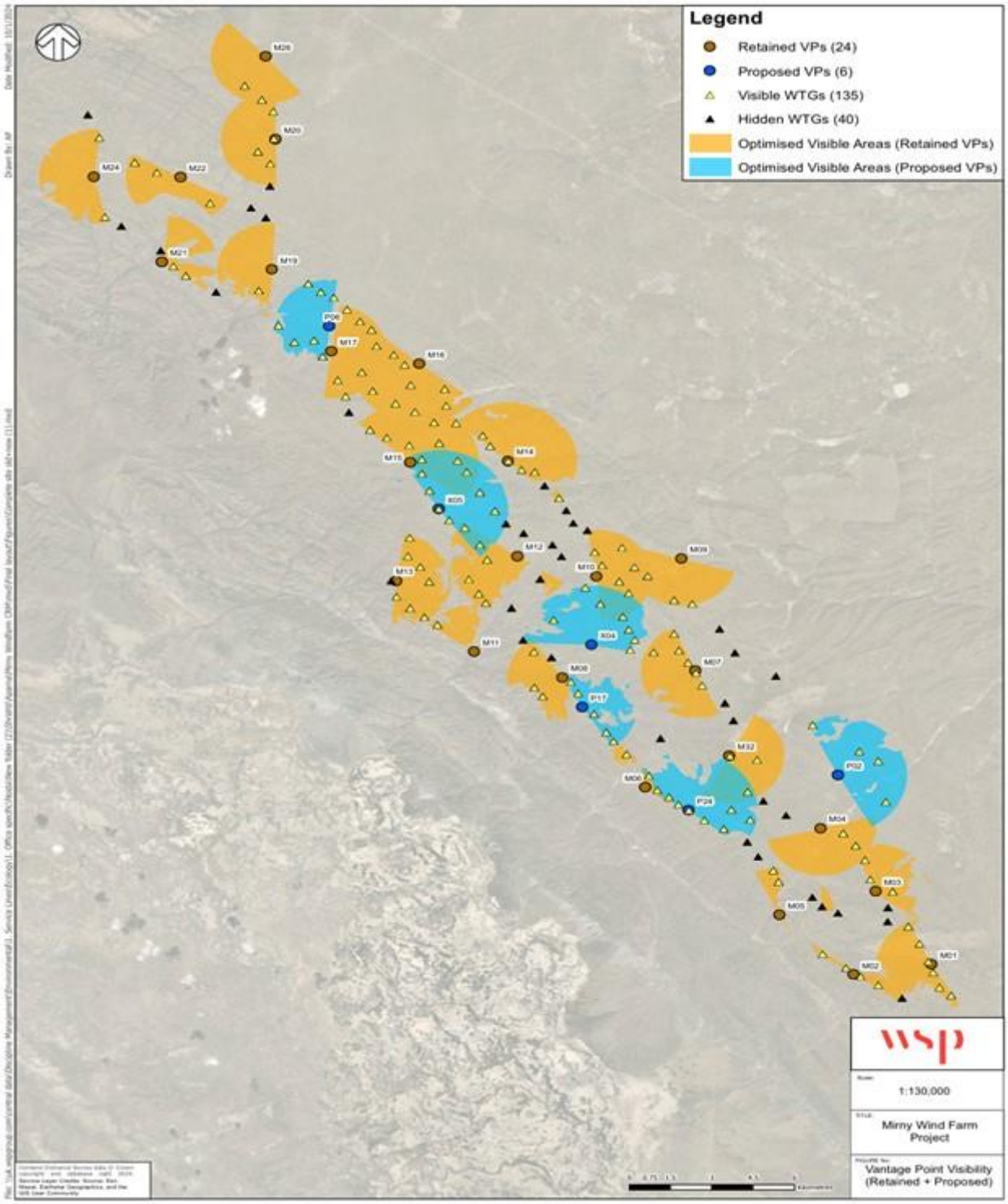


Figure 6: location of the vantage points and transects along the Wind Power Farm in autumn 2024, winter 2024/2025, spring and summer 2025.

Vantage point surveys (VP): overhead transmission line

The impacts of OHLs can be compounded if the line is placed in areas of 'high bird sensitivity', i.e migration bottlenecks, areas of suitable habitat for breeding or migratory birds or within or near designated sites, therefore, the survey effort and the assessment of possible impacts was designed to be in proportion to the scale of the proposed OHL and the potential bird activity along it. Based on the results of a desk study and an inspection of

habitat features along the route of the OHL seven vantage point locations were placed in areas of high expected bird activity.

Given that bird displacement effects are likely to be minimal (except during the construction and possibly maintenance phases) the main potential impact of the OHL is the risk of birds colliding with the cable arrays and specifically the much thinner and less visible earth wire where it is present.

The main purpose of migratory and breeding bird surveys, therefore, was to characterise the magnitude of flight activity in the key survey areas and to identify the range of species that may be potentially at risk from collision by monitoring flight heights and time spent in the proximity of the emerging preferred route corridors at risk height.

It is anticipated that electrocution from a large-scale transmission line e.g. 400 kV or 500 kV will not be an issue although attention should be paid to bird friendly design where possible, especially for low voltage distribution lines and at substations.

The appropriate survey corridor width at each VP is 500 m either side of the emerging preferred route. However, as the VP viewshed as per the guidance is a 2000 m arc it was extended 500 m either side of the survey corridor enabling data to be collected over a wider scale should the emerging preferred route be adjusted after the surveys have commenced.

As collision risk will not be assessed quantitatively (given the absence of a widely used collision risk model for OHLs), a qualitative approach will be taken by identifying hotspot areas where flight activity at collision risk height may require mitigation especially where vulnerable species are noted.

The production of flight line maps was not proposed for this method, instead a flight activity rate at risk height per VP sector was used as it will be more informative in identifying sensitive sections of the transmission line where mitigation may be required.

During each VP watch the 2000 m viewshed was scanned constantly using binoculars until a target or secondary species is detected in flight entering the survey corridor anywhere along the viewshed. Where the surveyors view of an individual bird was poor to the extent where identification of the species is challenging, perhaps due to poor light or where a bird is flying over the emerging preferred route at height, it was recorded to genus level.

Once detected, the individual bird or flock was followed until it landed in the survey corridor, passes across it or was lost from view if it flew along the corridor. The flight direction of the birds was coded on VP recording forms as follows:

- Flying left to right;
- Flying right to left;
- Random flight (e.g., a vulture spiralling within the corridor);
- Parallel north (birds flying along the survey corridor parallel to the proposed transmission line);
- Parallel south.

The time the bird or flock is first detected and duration of the flight whilst in view was also be recorded and a mean height estimated for flocks of birds. The bird's flight height was estimated from the time it enters the survey corridor and then at 15 second intervals until it leaves the survey corridor or becomes lost from view.

The flight heights recorded will be chosen to reflect the dimensions of the proposed pylons. Example height bands are as follows:

- <20 m (not at risk of collision);
- 21-50 m (potentially at risk of collision);
- >51 m (no collision risk potential).

It is assumed at this stage that the majority of pylon heights for the Mirny OHL are approximately 50m with the earth wire fixed at this height, but bird survey height bands can be adjusted at any time to suit the chosen dimensions.

Autumn (September to November) 2024: autumn stationary observations of 2024 on the projected OHL (north-south) were carried out at 7 VPs. VP locations can be seen on Figure 7. Due to the gradual decrease in daylight hours in the autumn, October observations took place on average from 08.00-10.00 - 16.30-17.30, November - from 08.30-09.00 - 16.30-17.00.

Migratory birds were counted for the purpose of recording the flight time in the allocated altitude zones (0-20 m, 20-50 m and >50 m) within the established counting corridor (500 m to the left and 500 m to the right of the observation point, 2 and 2.5 km in the direction of the designed power transmission line from the observation point).

Winter (December to February) 2024/2025: the methodology has been carried out as per the autumn 2024 VP surveys, albeit the survey timings are likely to be different due to the difference in daylight hours. The monitoring work in December was conducted over a period of three days, commencing at 9:00 a.m. and concluding at 5:00 p.m. Due to the presence of severe weather conditions, characterised by extreme temperatures and high wind speeds, four power line vantage points were identified, with the objective of ensuring a balanced coverage of the Project site. The 4 vantage points selected for stationary observations were all covered, with the remaining territory being covered by route observations. The observation process was conducted over the course of one hour at each designated vantage point.

In the months of January and February, the work was executed in accordance with the same scheme, encompassing a total of 4 VPs situated along power lines. Consequently, a substantial amount of information was gathered regarding the ornithofauna of the site during the winter months. This information encompassed quantitative indicators, as well as data concerning certain animals, including rare species.

Spring (March – May) 2025: stationary observations were carried out at 8 VPs. Due to the gradual increase in daylight hours in the spring, April observations were conducted on average between 08:00-10:00 and 17:00-18:00; May observations were conducted between 07:00-10:00 and 18:00-19:00.

Summer (June – August) 2025: a total of eight points were selected for summer stationary observations on the planned North-South power line. Additionally, two points on the South-bound power line were observed in June and August, replacing the previously observed points (OHL_VP_1, OHL-VP_3). All observations made during the summer months were conducted at regular intervals between 06:00 and 10:00, and between 14:00 and 18:00 on average. As part of the planned power line project between the north and south, three-hour observation sessions were carried out in the vicinity of the existing power line.

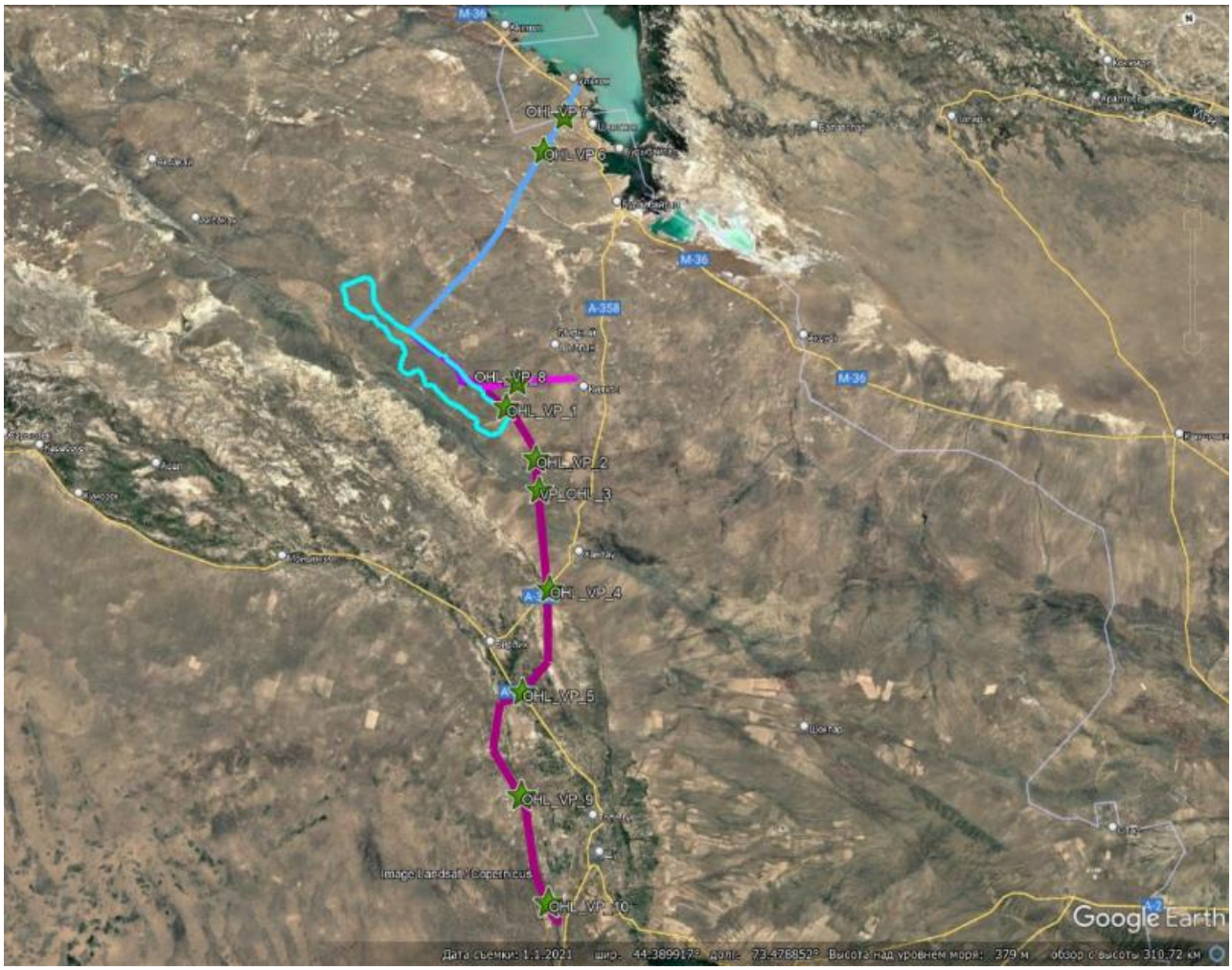


Figure 7: location of VPs and transects along the OHL routes (blue color – «North» line, pink color – «East line», purple color – «South» line) in autumn 2024, winter 2024/2025, spring and summer 2025[11].

Bird survey transects: wind power plant

Breeding bird surveys were focussed on pre-identified target species of conservation concern as per previous surveys and conducted in suitable habitats only. The target species were informed by the species included in the notified feature list for the State Protected Area.

For the open habitats such as those present at Mirny these surveys consisted of walked or driven transects and fixed-point counts as described in Jenkins *et al* (2015)[12].

The length, number, and distribution of these transects at the Project site varied according to habitat diversity, and the richness and relative significance of the small terrestrial avifauna. Transects were positioned at varying distances away from the proposed turbine array to maximize the value of the data.

[11] Figure taken from the brief report for Autumn 2025 (ACBK Centre for Conservation Biology LLP, 2025)

[12] A.R. Jenkins , C.S. van Rooyen , J.J. Smallie , J.A. Harrison , M. Diamond , H.A. Smit-Robinson and S. Ralston (2015) Birds and Wind-Energy Best-Practice Guidelines: Best-Practice Guidelines for assessing and monitoring the impact of windenergy facilities on birds in southern Africa.

Surveys will be continued in Spring/Summer 2025. As the Project site is very large the surveys will focus on areas where it is known that infrastructure will be developed e.g. the locations of turbine bases, access tracks, construction compounds, sub stations, quarries etc.

Winter (December-February) 2023/2024: Due to no bird migration and the reduced number of birds over winter, observations at VPs were not undertaken. Instead, walked transects were undertaken at 23 locations in December from 9.00 to 17.00 across the northern and southern Project areas. Transects took an average of 15 minutes, covering a distance of 400-600m. See Figure 8 for walked and driven transect locations in December.

An additional 17 walked transects (40 in total) were carried out in January, while a driven transect was undertaken for the southern Project area. Transects took an average of 15 minutes, covering a distance of 400-600m. See Figure 9 for walked and driven transect locations in January.

As a result of weather conditions, 27 walked transects were undertaken in February, taking an average of 10 minutes, covering a distance of 300-500m. The area of the driven transect was increased. See Figure 10 for walked and driven transect locations in February.

Summer (June – August) 2025: transect observations were carried out in July and August, within the designated observation areas and on nesting monitoring routes. These observations were conducted at regular intervals between 06:00 and 11:00. Route observations were carried out during the course of movements between designated stationary observation points (Figure 6 and Figure 12).

Breeding bird surveys were focused on pre-identified target species of conservation concern and conducted in suitable habitats only. Transects were positioned at varying distances away from the proposed turbine array to maximize the value of the data. As the Project site is very large the surveys were focus on areas where it is known that infrastructure will be developed e.g. the locations of turbine bases, access tracks, construction compounds, sub stations, quarries etc.

A short one or two hours survey were conducted in suitable habitats around the VP after each VP survey or at suitable areas of habitats via point counts and whilst travelling between VP. Walked transects surveys were undertaken across the Project site in accordance with Jenkins et al. (2015) and recording the bird species by sight and call and any evidence of breeding activity such as adults with young, adults carrying food, occupied nests etc. so that breeding status can be determined

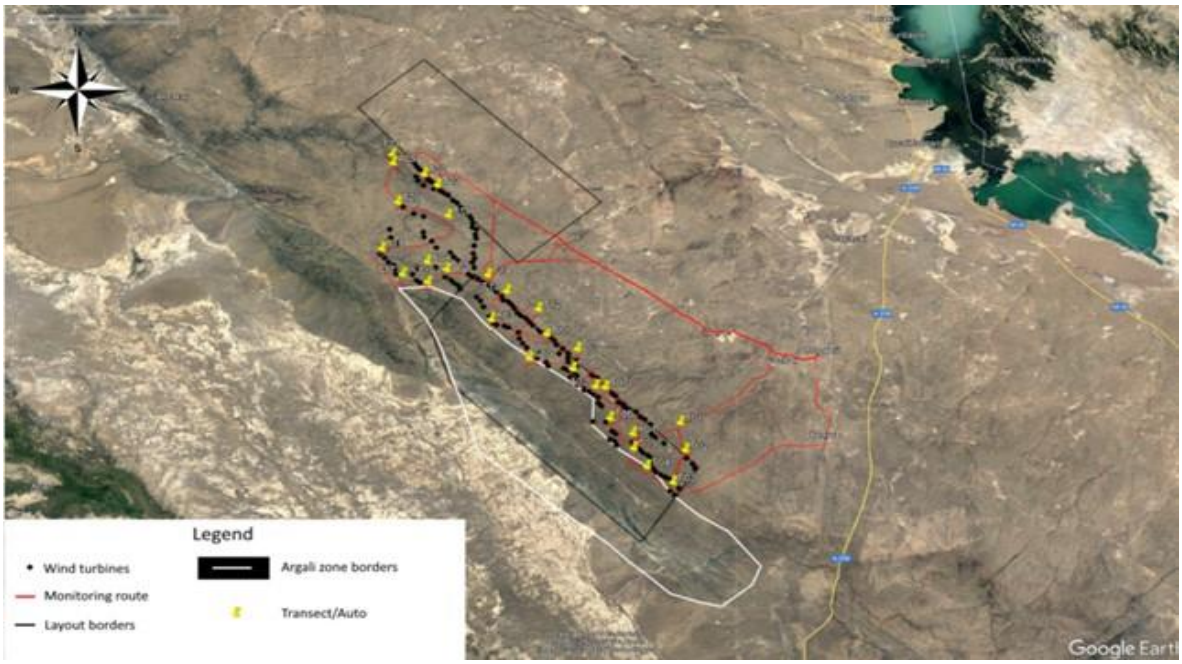
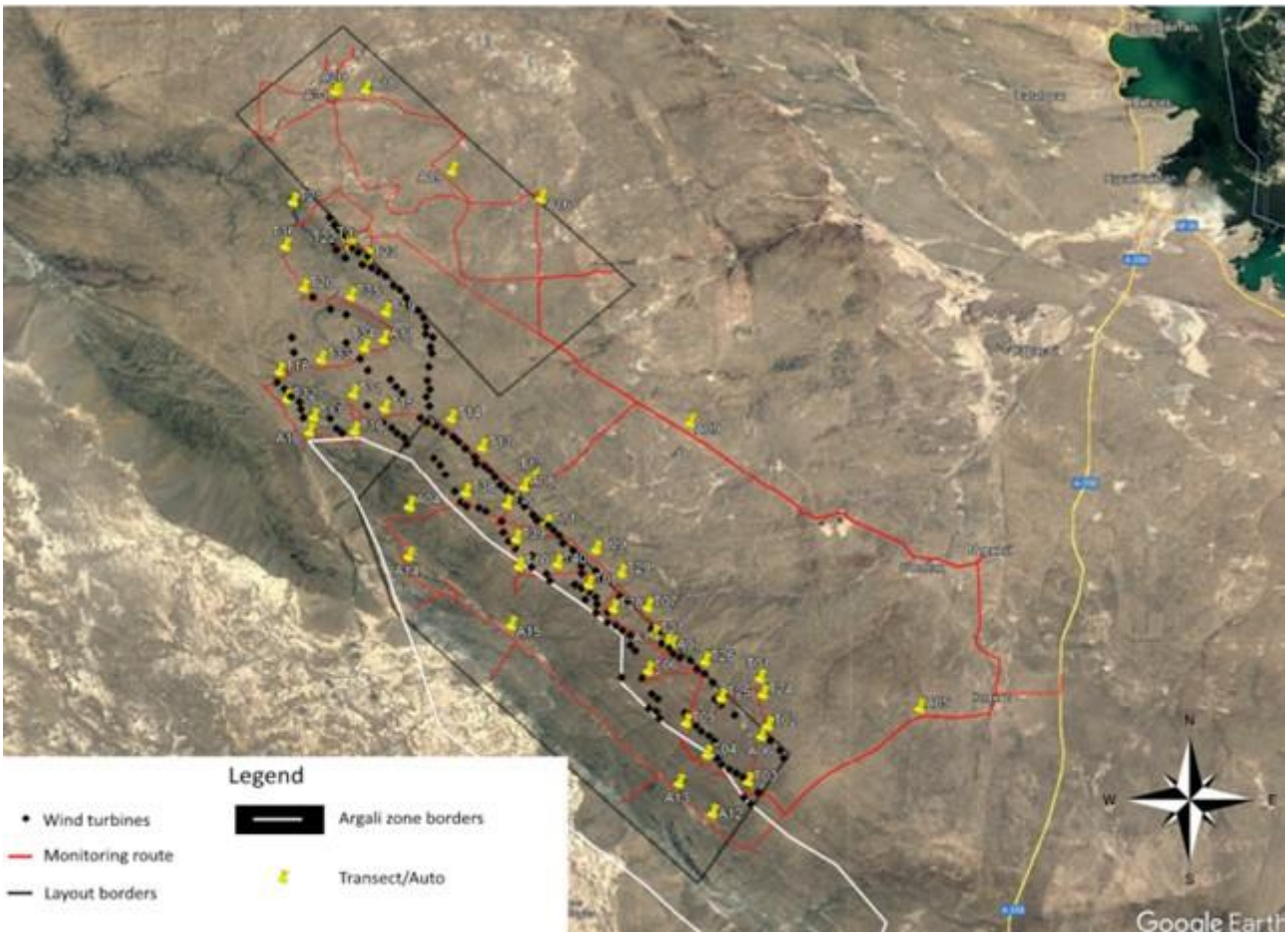


Figure 8: Location of monitoring routes in relation to the Site and northern/southern Project areas in December 2023[13] (terminology referred to the initial layout).



[13] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

Figure 9: Location of monitoring routes in relation to the Site and northern/southern Project areas in January 2024[14] (terminology referred to the initial layout).

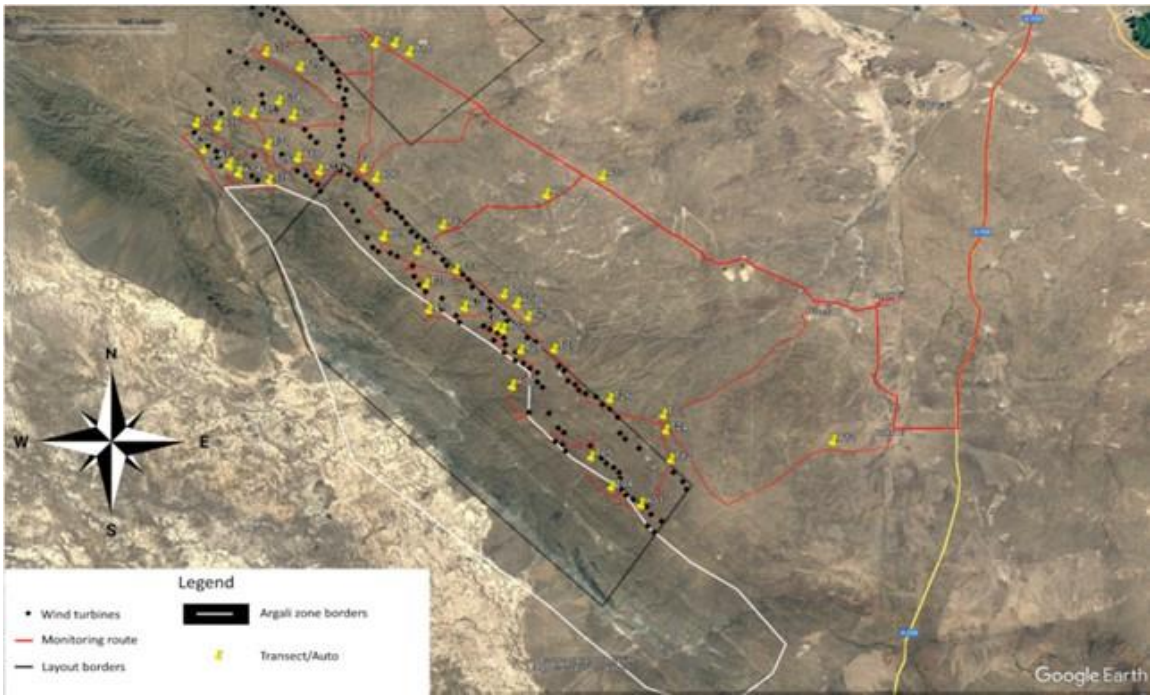
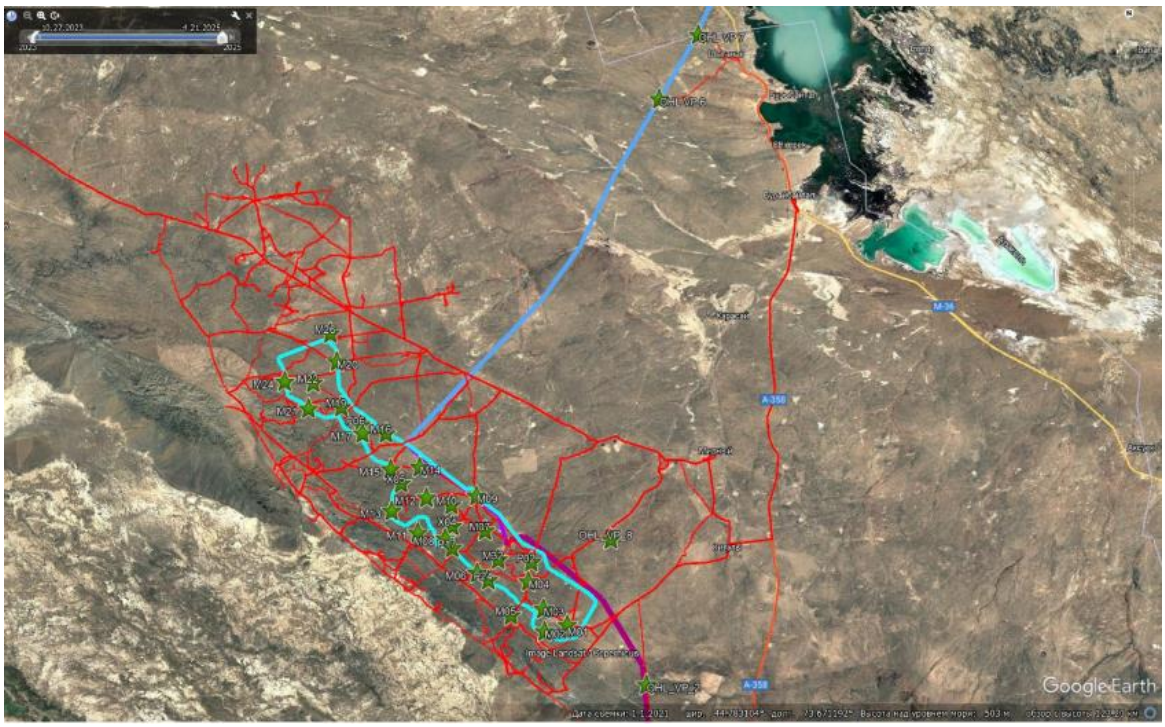


Figure 10: Location of monitoring routes in relation to the Project site in February 2024[15].



[14] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

[15] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

Figure 11: Location of monitoring routes in relation to the Project site in summer 2025 (movement tracks are highlighted in red)[16].

Breeding raptor surveys

Raptor nest surveys were undertaken during spring/summer in the Scoping site area and were repeated during the spring and summer of 2025 in the current layout area within the Project site.

Transect observations were carried out in July and August 2025, within the designated observation areas and on nesting monitoring routes. These observations were conducted at regular intervals between 06:00 and 11:00. Surveys were focused on areas where it is known that infrastructure will be developed e.g. the locations of turbine bases, access tracks, construction compounds, sub stations, quarries etc. (Figure 6 and Figure 11).

Breeding bird surveys were focused on pre-identified target species of conservation concern and conducted in suitable habitats only. Transects were positioned at varying distances away from the proposed turbine array to maximize the value of the data.

Transects: OHL

Autumn (September to November) 2024: on the proposed OHL (south), during breaks between three-hour observation sessions, walking transects were carried out near the existing power transmission line to search for facts of collisions and deaths of birds (for points OHL_VP_2, OHL_VP_3, OHL_VP_4 - 500m in the northern direction, 500m in the southern direction; OHL_VP_5 - 500m in the north-eastern direction, 500 m in the south-western direction). As a result of walking transects, facts of collisions of birds with the existing power transmission line and their deaths were not noted.

Winter (December to January) 2024/2025: walked and driven transects were undertaken along the existing 500-kv power lines in and near the Project site to search for dead birds that may have collided with the existing line.

Spring (March – May) 2025: on the planned power line (South), between three-hour observation sessions, walking transects were carried out near the existing power line (for points OHL_VP_1 and OHL_VP_8 –500 m in a south-easterly direction, OHL_VP_3 and OHL_VP_4 - 500 m in a northern direction, OHL_VP_2 - 500 m in a northern and southern direction; OHL_VP_5, OHL_VP_6 – 500 m in the northeast and southwest directions, OHL_VP_7 – 500 m in the northeast direction).

Summer (June – August) 2025: on the planned power line (North-South), between three-hour observation sessions, walking transects were carried out near the existing power line.

Incidental observations

Observations of birds from vehicles were made when moving across the Project site. Incidental data was also collected on mammals (especially ungulates) and reptiles to assess the breeding bird community.

Collision Risk Modelling (CRM)

The risk of birds colliding with turbine rotors has been assessed using a collision risk model based on NatureScot guidance released in 2024. The model requires input data based on species biometrics and flight characteristics, turbine specification and flights observed within the collision risk zone (CRZ). The amount of time that a species

[16] Figure taken from the species surveys final report for September 2024 – August 2025 (ACBK Centre for Conservation Biology LLP, 2025)

may be active within the CRZ in any given season is also required for the model and must therefore be estimated.

The complete methodology for CRM is provided in detail in within Appendix E: Bird Collision Risk Modelling Report (WSP, 2025)[17].

6.2.3.3 Bats

Bat surveys within the southern Project area commenced during the breeding period, identified in ACBK (2023a) as June to early July 2023. Surveys included remote recording of bats using broadband static detectors and the use of broadband mobile bat detectors along representatively spaced transects at night. Surveys of potential diurnal roosts of bats were also undertaken. The southern Project area is mountainous and roost sites were more likely to be found in cracks and fissures within outcrops of parent rocks. Surveys were designed and undertaken by ACBK Centre for Conservation Biology LLP, with the results presented in the following report:

- ACBK Centre for Conservation Biology LLP (2024) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024. Final report for April 2023 – May 2024.
- ACBC Centre for Conservation Biology LLP (2025) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during September 2024-August 2025. Final report for September 2024 – August 2025 (ACBK, 2025).

Driven transects

Four driven transects were undertaken, each of c. 13km long shown on Figure 12, utilisingmobile detectors at 27 recording points spaced every ~500m intervals along each transect. The mobile ultrasonic detector Echo Meter Touch 2 Pro was used for 3 minutes at each survey point, i.e. the total detector operating time per transect was 81 minutes, or 162 minutes per transect run twice on different days. Surveys began 40–80 minutes after sunset (c. 21:00 local time). The duration of the transect surveys was about 2.5-3 hours, and surveys on transects ended between midnight and 1 a.m. The total length of the survey transects was about 104 km (4 transects of 13 km repeated twice). To reduce survey bias the tracks were run in opposing directions on repeat.

Bat transect surveys at the southern Project area were undertaken June - July 2023 and were surveyed on the following dates:

- Transect ID Mountains-5 on the 22.06.23;
- Transect ID Mountains-4 on the 23.06.23;
- Transect ID Mountains-3 on the 24.06.23;
- Transect ID Mountains-2 on the 26.06.23;
- Transect ID Mountains-2 on the 28.06.23;
- Transect ID Mountains-3 on the 29.06.23;
- Transect ID Mountains-5 on the 30.06.23; and

[17] WSP (2025) Mirny 1GW Wind Power Project – Kazakhstan. Appendix E: Bird Collision Risk Modelling Report.

- Transect ID Mountains-4 on the 01.07.23.

Further Driven transects have been carried out in July 2025 between the 18th and 23rd of July. These additional surveys were commissioned to strengthen the overall bat baseline and to take account of changes to turbine positions from the locations known during the 2023-24 surveys. The records have not yet been analysed but will be analysed and utilised in the forming of the subsequent Biodiversity Management Plan (BMP).

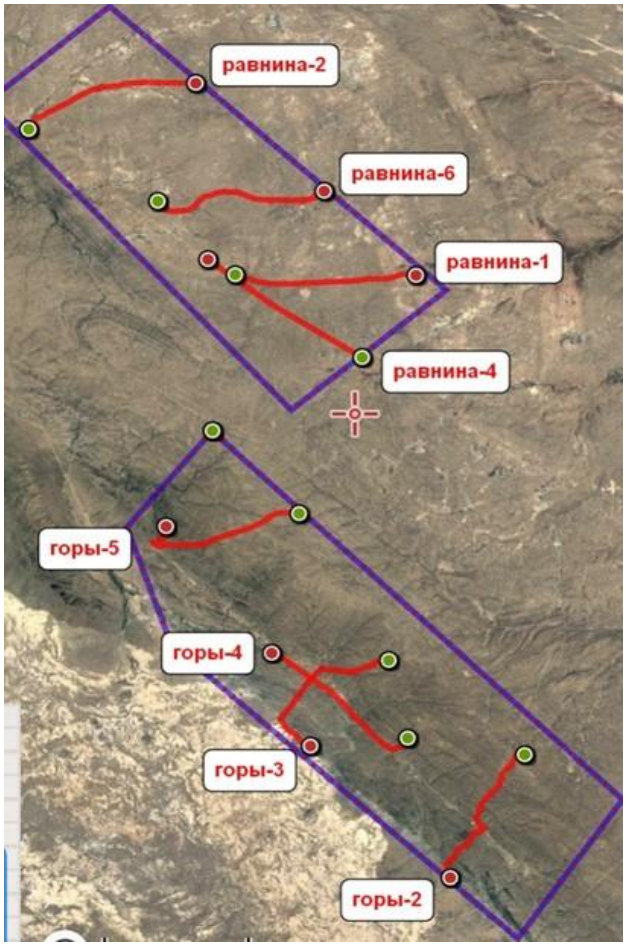


Figure 12: Location of transect monitoring routes in relation to the southern Project area[18] (terminology referred to the initial layout)

Stationary point counts

Nineteen, fixed point counts using static bat detectors - "Song Meter SM4BAT FS" were undertaken. The detector installation points were randomly distributed over the southern Project area using low trees or telescopic folding stands 2 to 5 m high. The point counts can be seen on Figure 13; six of the stationary point count locations are positioned within the Site. On mountain slopes, the microphone was fixed on stones, oriented away from smooth surfaces to reduce extraneous noise on the recordings, both from insects and reflected signals from large smooth surfaces. All stationary detectors were tuned to record ultrasonic signals with a frequency of up to 128 kHz from sunset to sunrise. The dates the detectors recorded at each location are provided in the table below.

[18] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

Table 4: Dates of audio recordings at stationary points within the southern Project area.

Date	Detector A01, № of point	Detector A02, № of point	Detector A03, № of point	Detector A04, № of point
22.06.2023	A01 2023-06-22	A01 2023-06-22	A01 2023-06-22	A01 2023-06-22
23.06.2023	A01 2023-06-23	A02 2023-06-23	A03 2023-06-23	A04 2023-06-23
24.06.2023	A01 2023-06-24			
25.06.2023	A01 2023-06-25			
28.06.2023	A01 2023-06-28	A02 2023-06-28	A03 2023-06-28	A04 2023-06-28
29.06.2023	A01 2023-06-29			
30.06.2023	A01 2023-06-30	A02 2023-06-30	A03 2023-06-30	
01.07.2023	A01 2023-07-01	-	Meteomast A11	Meteomast C11
02.07.23	-	-		

On 01/07/2023 detectors were installed on two meteorological at heights of about 50 m. These detectors were set to “sleep” mode until 10/08/2023 after which they were activated to monitor the activity of bats at the beginning of the autumn migration period. Stationary point count coordinates are provided in the table below.

Table 5: Coordinates of stationary bat counting points.

№ of point	Latitude	Longitude
A01 2023-06-22	44,71018	73,24838
A01 2023-06-23	44,57227	73,47664
A01 2023-06-24	44,56489	73,37744
A01 2023-06-25	44,47567	73,51141
A01 2023-06-28	44,55352	73,55370
A01 2023-06-29	44,61110	73,43246
A01 2023-06-30	44,70170	73,29027
A01 2023-07-01	44,65687	73,27481
A02 2023-06-22	44,69608	73,24238
A02 2023-06-23	44,50938	73,51986
A02 2023-06-28	44,52045	73,52918
A02 2023-06-30	44,70284	73,28700
A03 2023-06-22	44,70750	73,25072
A03 2023-06-23	44,52043	73,51179
A03 2023-06-28	44,51321	73,54851
A03 2023-06-30	44,70332	73,28279
A04 2023-06-22	44,70588	73,25252

№ of point	Latitude	Longitude
A04 2023-06-23	44,54771	73,47439
A04 2023-06-28	44,48172	73,58412
Meteomast A11	44,67373	73,37026
Meteomast "Southern"	44,55387	73,56215

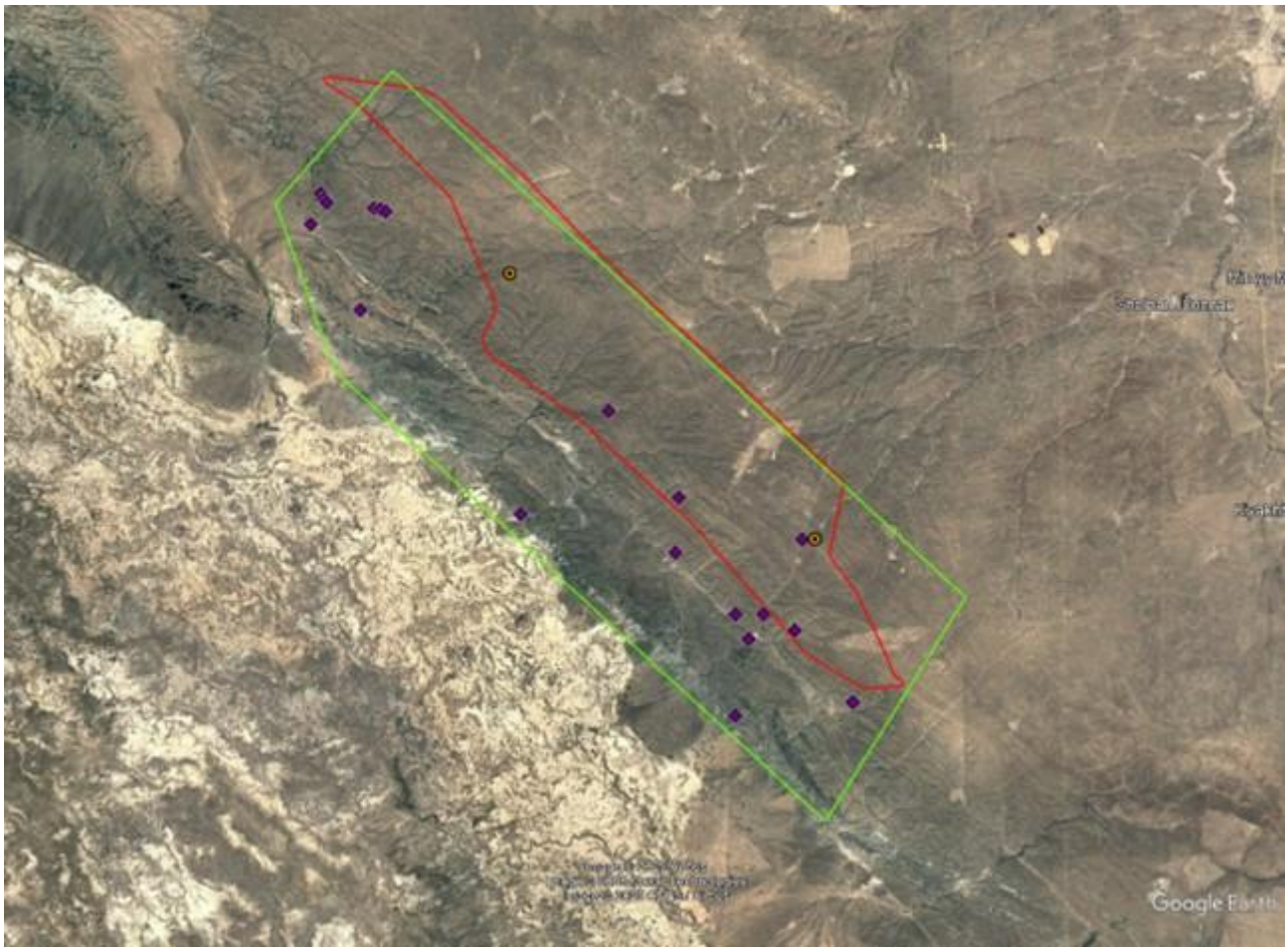


Figure 13: Location of stationary point counts in relation to the southern Project site.

6.2.3.4 Herpetofauna

Visual observation surveys of reptiles and amphibians were undertaken currently with the driven and walking surveys for mammals and birds. Audio evidence of amphibian species was also noted. Surveys were designed and undertaken by ACBK Centre for Conservation Biology LLP, with the results presented in the following reports:

- ACBK Centre for Conservation Biology LLP (2024) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024. Final report for April 2023 – May 2024 (ACBK, 2024);
- ACBC Centre for Conservation Biology LLP (2025) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could

result from the proposed Project and determine possible mitigation measures during September 2024-August 2025. Final report for September 2024 – August 2025 (ACBK, 2025).

6.2.3.5 Other mammals

Surveys were designed and undertaken by ACBK Centre for Conservation Biology LLP, with the results presented in the following report:

- ACBK Centre for Conservation Biology LLP (2024) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024. Final report for April 2023 – May 2024 (ACBK, 2024);
- ACBK Centre for Conservation Biology LLP (2024) Brief report - Field research of biodiversity within the framework of the Mirny Project (autumn 2024).
- ACBC Centre for Conservation Biology LLP (2025) Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during September 2024-August 2025. Final report for September 2024 – August 2025 (ACBK, 2025).

Camera traps

Nineteen Bushnell camera traps were installed at points within and surrounding the northern and southern Project areas, of which eight were within the southern Project area. These are shown on Figure 14**.** Four of the camera traps were in place for almost a full year - from May 2023 to the end of April - May 2024, two - from May to September 2023 and two - from September 2023 to May 2024.

Camera traps were installed at locations that were representative of the most characteristic and typical habitats for the northern and southern Project areas: (a) slopes and ridges of small hills with rock outcrops and rock ruins, bearing petrophyte-desert vegetation; (b) levelled, gently undulating watersheds covered by zonal black-fawn and grey-wormwood communities of northern deserts, usually with outcrops of flat granite slabs associated with the only available temporary watering holes (which is important for identifying mammals); (c) valley saxaul forests, within which both saxaul forests of the tugai type were examined along the beds of temporary watercourses, as well as open edges with a zonal desert lower layer (usually sulphur-teresken); (d) valley rock outcrops.

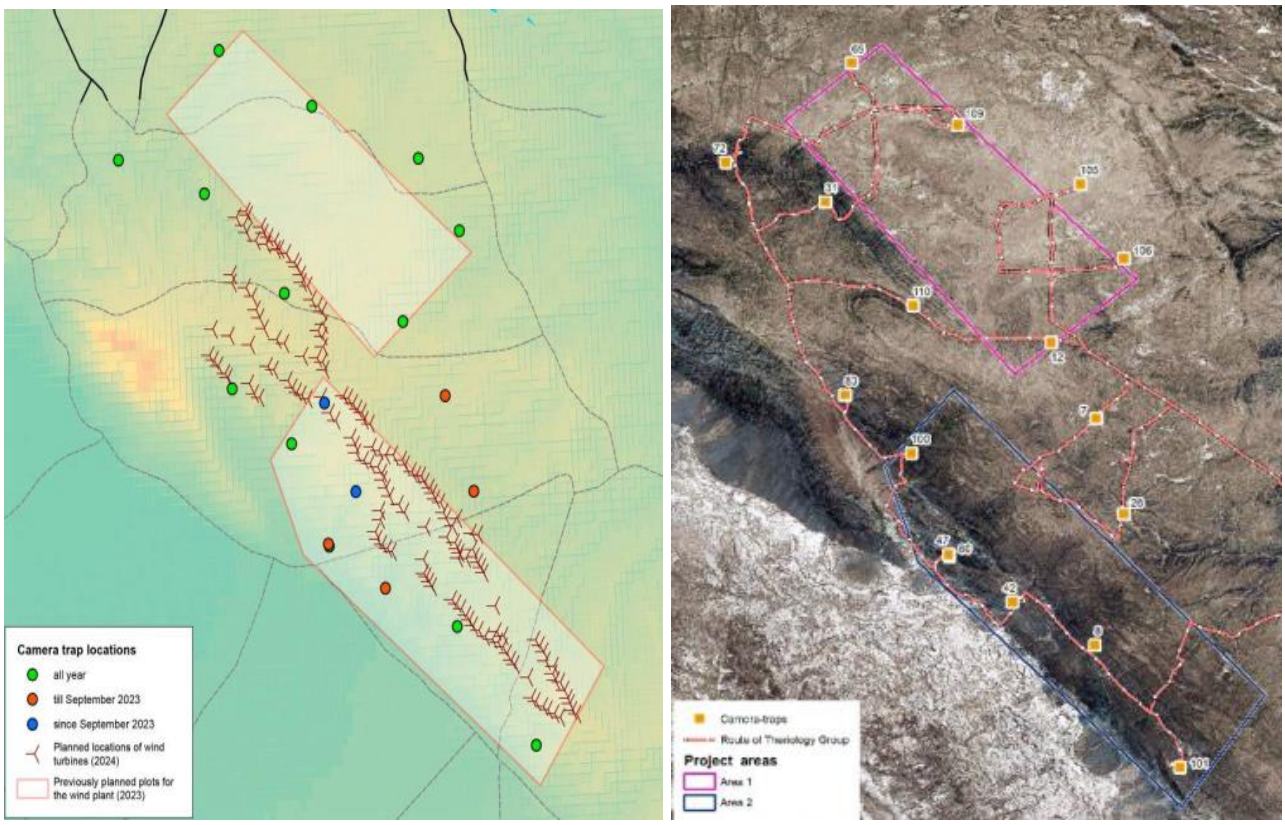


Figure 14: Location of camera traps and driven transect routes in relation to the northern and southern Project areas[19] (terminology referred to the initial layout).

Visual observations

In May, June, September 2023 and April-May 2024, day and night (first half of the night, after sunset) driven transect routes were carried out throughout the northern and southern Project areas. The work was carried out in a 4-WD UAZ-vehicle. The routes were carried out on dirt roads (occasionally also on roads with improved surfaces). The Project areas have a fairly dense network of such roads, which made it possible to cover it with vehicles routes more or less evenly, covering all the main types of habitats. The daily routes were combined with periodic stops for walking surveys, usually combined with the installation and checking of camera traps, the installation and removal of ultrasonic detectors for bat surveys, and other work. Night routes included regular stops every 500 m, during which animal voices were recorded (if available). Night routes were combined with bat surveys.

As part of the Project's ongoing bird migration monitoring programme, observations of mammals continued during the April-May period of 2025. All encounters with animals were meticulously documented. A particular focus was given to the great sand vole and other rodent species. During road-based transportation between designated bird monitoring points, the coordinates of the encountered burrows were recorded. Additionally, where feasible, the habitability of these burrows was assessed. All burrows were also recorded on foot routes. In large, diffuse settlements, the following data was determined:

- the density of burrows per 1 ha;
- the habitability of colonies; and

[19] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

- the number of animals per inhabited burrow.

These data were used to calculate the population per unit area. It was also noted that there were signs of other rodents on foot routes, indicating their presence. Live traps were strategically positioned to ascertain the species composition of the rodent population.

6.2.3.6 Invertebrates

No surveys have been undertaken for invertebrates in the period 2023-2024, but a detailed review was undertaken for the desk study. Invertebrate surveys focussing on the planned infrastructure locations have been undertaken from 18 July 2025 to 25 July 2025.

Visual recordings of large mobile arthropods (Arthropoda) were carried out on walking routes of at least 1.5 km, with the aim of covering all plant communities, relief features and biotopes. The finding locations were recorded using a camera, binoculars and GPS devices, in order to ensure the highest possible accuracy. A thorough examination of the soil and vegetation was also carried out to detect any relevant evidence. The stones were carefully turned over and any plant or organic remains were excavated. The collection of invertebrates was carried out manually, with consideration given to all major ecological groups. The substrate was sampled using tweezers, while shelters were also sampled, with particular attention paid to those with delicate and fragile coverings (accounting for coprobionts, campobionts, detritivores, cryptobionts). Mowing was conducted using nets (chortobionts, tamtobionts, phytophages), while entomological nets were used to collect aerobionts and pollinators in various microhabitats, including meadow vegetation, forest edges, shrubbery and forest litter. Particular attention was paid to representatives of the insect class (Insecta), including the orders Coleoptera, Hymenoptera, and Lepidoptera (at the imago stage), as well as other groups of terrestrial invertebrates. Further methods employed included the use of light sources to catch phototaxons, the setting of Barber traps (necrophages, geobionts, cryptobionts), and the counting of fossobionts by digging them up with an entomological shovel.

The euthanasia (preservation and fixation) of the captured specimens was carried out using a 10% ammonia solution (ammonium hydroxide). This was applied to cotton wool or paper towels in sealed containers (test tubes) or glass jars. The insects were placed inside for between 10 and 20 minutes until they were completely fixed. This method is guaranteed to swiftly immobilise the subject without causing any damage to its physical characteristics. Following pickling, the specimens were stored and initially processed in cotton wool pads in boxes or cuvettes. Materials on arachnids, isoptera, and parts of diptera insects, as well as larval stages, were fixed in 70% ethyl alcohol for morphological studies. Observations were systematically recorded in a field diary, and a selection of the material was fixed in a staining solution and transferred to entomological mattresses (arachnids collected in ethyl alcohol) for subsequent laboratory processing. The material was then examined under a binocular microscope and the taxonomic affiliation was determined.

6.2.3.7 Freshwater fishes

The material was collected in autumn 2021 in the lower reaches of the Shu River. Three large floodplain systems were selected for the study of the ichthyofauna of floodplain water bodies: Ulanbel, Kamkalinskaya and Akzhaikinskaya. In the Ulanbel and Kamkal floodplain systems, the two most full-flowing lakes at the time of the study, Karakol and Bolshiye Kamkale, were surveyed. At the end of the lowest system, two lakes, Akzhaikyn and Akkol, located about 40 km apart, were surveyed.bTo catch fish in the floodplain lakes, fixed gillnets with a mesh size of 24-90 mm were used. One net was set in each lake. The nets were set at night for at least 12

hours.bThe study of the species composition of the ichthyofauna, the collection and processing of ichthyological material was carried out according to generally accepted methods (Pravdin, 1966[20]).

The relative abundance was converted into the ratio of the number of specimens per net day (catch per 100 m of nets per 24 hours)[21]. A total of 255 fish specimens were caught and analysed.

6.2.4 Ecosystem services

The baseline on ecosystem services (ES) is derived from information collected during biodiversity and social field studies. The ecosystem services analysis commences with the identification of the potential ecosystem services provided by the natural habitat found in the Study Area during the biodiversity studies and confirmed during consultations with local communities in social field studies.

With regard to social field studies, data on ecosystem services was collected through secondary and primary sources of information. The primary sources of information are represented by a collection of raw data and evidence from first-hand accounts. Secondary sources of information are represented by documents and records that provide data and statistics on the socio-economic profile of the communities in the Study Area. Information on ES can be retrieved from data on land uses, cultural heritage sites, flora and fauna, and socio-economic characteristics in the Study Area.

6.3 Results

6.3.1 Protected areas

The following legally protected and internationally recognised areas have been identified within the Study Area:

- Zhusandala State Reserved Zone, located to the south of the WPP Footprint and partially overlaps with it;
- Andasay State Nature Preserve is located 1.5km to the west of the WPP Footprint;
- Pribalkash State Nature Santuary, situated approximately 20 km east to the Project site (Yukgres SS)
- Zhusandala Important Bird and Biodiversity Area (IBA) and Key Biodiversity Area (KBA), situated at a distance of more than 40 km east of the Project site;
- Topar Lake System KBA, located at a distance of more than 50 km east of the Project site;
- Ili River Delta KBA and Ili River Delta and South Lake Balkash Ramsar site, located at a distance of approximately 30 km north-east of the Project site.

Details of these internationally recognized and legally protected areas are presented below and are shown in the following figure.

[20] Pravdin I.F. Guide to the study of fish. Moscow: Food Industry, 1966. 306 p.

[21] On the approval of the Rules for the preparation of biological justification for the use of wildlife. Order of the Minister of Environment and Water Resources of the Republic of Kazakhstan No. 104-Ө of 4 April 2014.

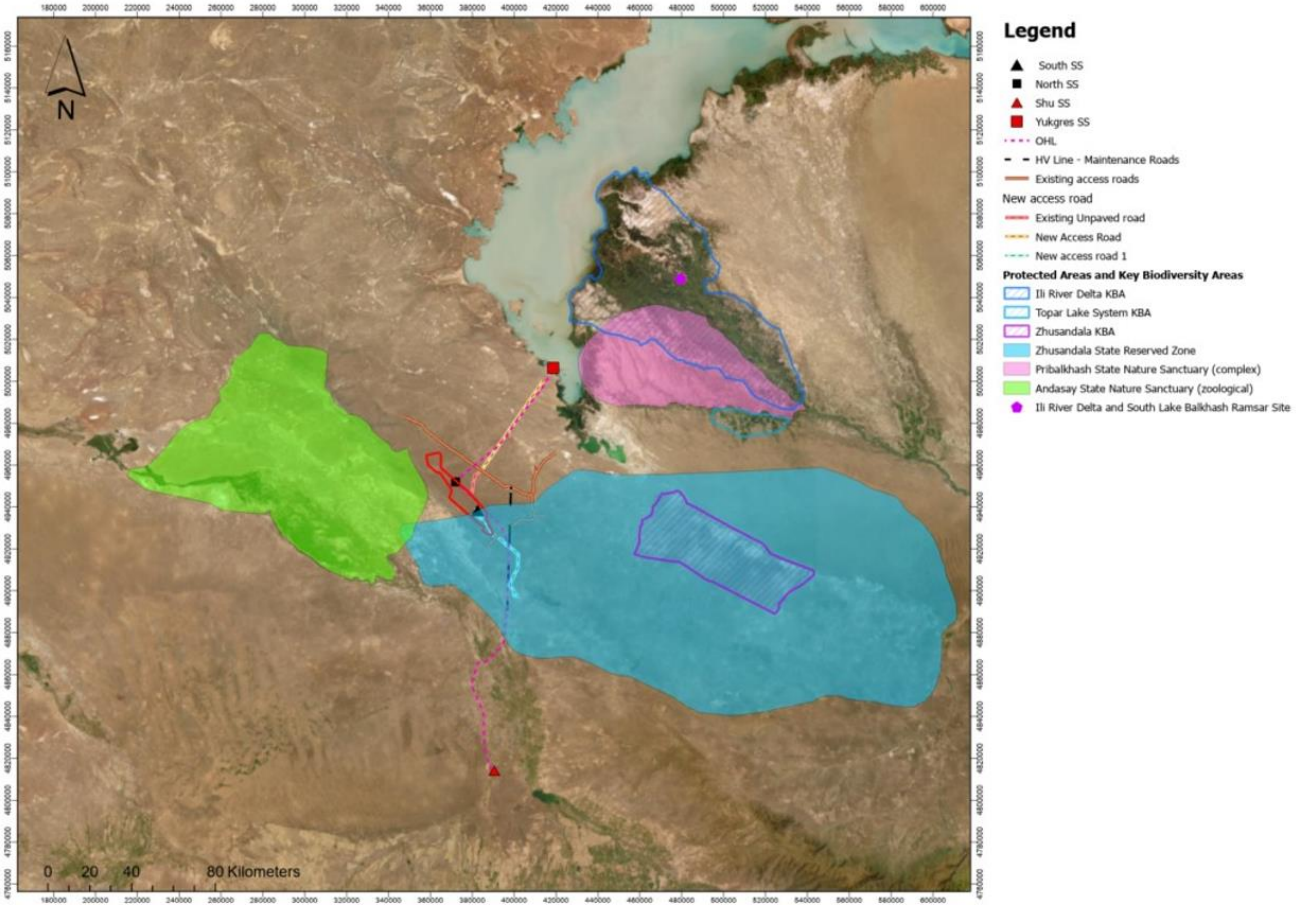


Figure 15: Legally protected and internationally recognized areas in the Study Area.

6.3.1.1 Legally protected areas

6.3.1.1.1 Zhusandala State Reserved Zone[22]

The Zhusandala State Reserved Zone was designated as State Natural Protected Zone at the national level in 2002. The 22,623.21km^2 area is a protected area with sustainable use of natural resources (IUCN management category VI) managed by the Forestry and Wildlife Committee of the Ministry of Ecology, Geology and Natural Resources. Two ecoregions, the Central Asian northern desert and the Central Asian riparian woodlands overlap with this Reserved Zone. The Reserved Zone supports grassland (95.65%), shrubland (3.89%) and bare areas (0.4%) as well as 231 species of birds and 56 species of mammals. As per global assessment, of these bird species, one is classified as IUCN critically endangered (CR), five endangered (EN) and six vulnerable (VU) bird species with one (CR) and two VU mammal species also known to be present.

The definition of the boundaries of this legally protected area is ambiguous due to conflicting information provided by several reliable sources. The information provided on the IBAT tool delineates the protected area as illustrated in Figure 15 above. However, data obtained from local consultants and previous studies demonstrate more extensive protected area boundaries, encompassing the entire WPP footprint and most of the OHL to the north. As a precautionary measure, this data has also been considered and is reported below for reasons of completeness.

[22] Zhusandala State Reserved Zone | DOPA Explorer (europa.eu)

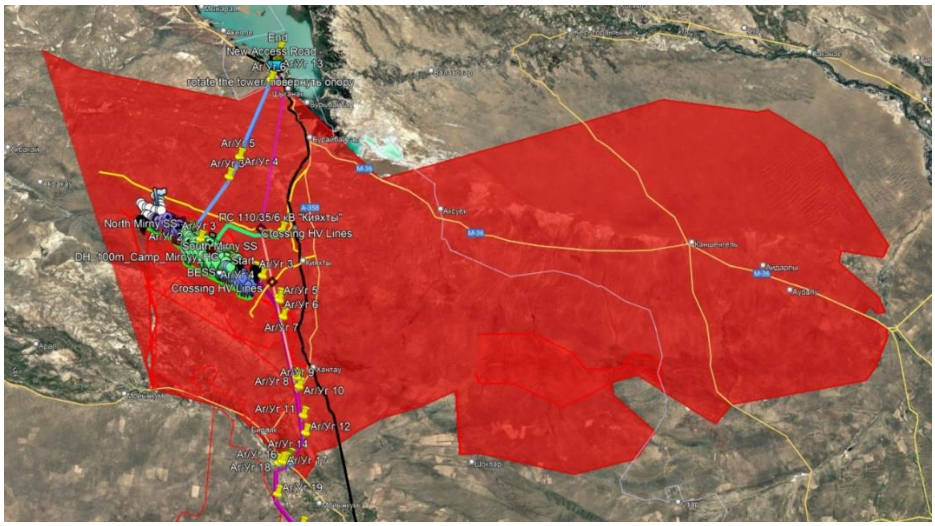


Figure 16: Zhusandala State Reserved Zone (recent data).

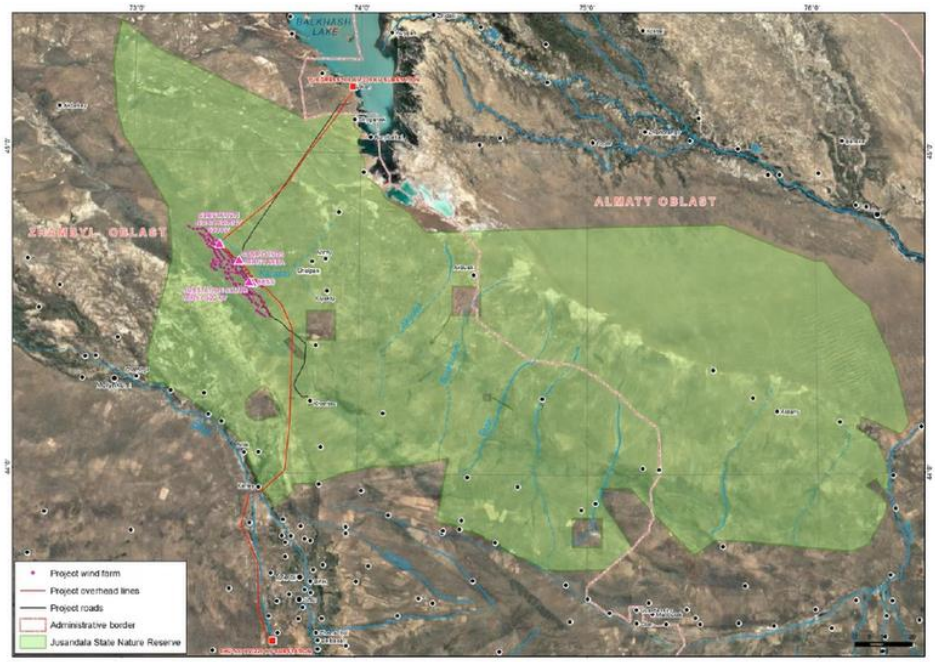


Figure 17: Zhusandala State Reserved Zone (Source: Ramboll)

6.3.1.1.2 Andasay State Nature Sanctuary[23]

Andasay State Nature Sanctuary (zoological) was designated in 2001 and spans a total of 8,499.34km^2. It is managed by Forestry and Wildlife Committee of the Ministry of Ecology, Geology and Natural Resources — IUCN management category IV (habitat management area and species management area. Two ecoregions, the Central Asian northern desert and the Central Asian riparian woodlands overlap with this Nature Sanctuary. Of the total landcover, 83.24% is grassland, 8.27% wetlands and 5.16% bare areas. A total of 175 bird species and 45 mammal species have been recorded of which three bird species are endangered and six vulnerable. One mammal is classified as critically endangered and two vulnerable.

[23] Andasay State Nature Sanctuary (zoological) | DOPA Explorer (europa.eu)

6.3.1.1.3 Pribalkash State Nature Sanctuary[24]

The «Ile-Balkhash» State Nature Reserve is located on the territory of the Balkhash district of the Almaty region of the Republic of Kazakhstan.

The territory of the reserve is an extremely important natural complex and is represented by 2 sites – «Pribalkhashsky» and «Ile River Delta». This is the only preserved river delta within Central Asia.

The Ile River Delta section covers the northwestern narrow part of the lake's water area. Balkhash at a distance of 500 m from the modern water edge and wetlands of the coastal part, including delta lakes and interstitial spaces between the channels of the Zhideli, Iir. In the middle part it includes the interfluve of the Shybyk, Kokuzek, Shagarai and Bayminey channels, as well as lakes.

The Pribalkhashsky site is located 20 km east of Karaoi village and includes a narrow strip of water area (500 m) and the coast of Lake. Balkhash. The northern boundary of the site runs along Lake Balkhash at a distance of 500 m from the water's edge towards the water area. The eastern border coincides with the border of the Balkhash district of the Almaty region. The southern border runs in a straight line parallel to the shoreline of Lake Balkhash and coincides with the border of the Karoy State Nature Preserve. The western border runs perpendicular to the water cut in the lake from north to south.

6.3.1.2 Internationally recognised areas

6.3.1.2.1 Zhusandala IBA/ KBA[25]

Zhusandala IBA/KBA is located within Zhusandala State Reserved Zone (see 6.3.1.2 for details on the protected area). The IBA/KBA comprises 216,173ha and provides habitat for a stable, high density of breeding houbara bustards *Chlamydotis undulata*. The area is also used regularly as a stop-over site by houbara bustards migrating from other regions and meets IBA criterion A1. The territory is a typical area of northern desert with the set of biome restricted species, so corresponds to IBA criterion A3.

6.3.1.2.2 Topar Lake System KBA[26]

The site is in Ilyisky district. Part of the northern area is in the Tay-Kum sandy desert and lies a short distance to the south of Topar village and approximately 20 km to the south-west of Zheltoranga. The IBA consists of a collection of salty or brackish lakes occupying innumerable depressions amid the low ridges of fixed sand dunes, representing the spreading network of waterbodies at the periphery of the branch of the Topar river that forms the south-western extremity of the Ili river delta. Most of the lakes are either small or medium sized, generally shallow, and have moderate aquatic and shoreline vegetation growth. The littoral vegetation consists mainly of scattered stands of reed mixed with patches of *Scirpus lacustris* and *Carex sp*. aggregations. The exposed slopes of the hillocks and dune ridges are covered by sparse ephemeral flora and several species of typical dwarf brush. Every significant hollow on the leeward side of these hillocks and dunes sustains enough moisture to allow the growth of more robust desert plants: *Lasiagrostis splendens*, *Halimodendron argeteum*, *Haloxylon sp*. and *Tamarix sp*. In a few, widely scattered patches of lowland there are small, stunted stands of *Populus diversfolia*.

[24] About the reserve — Иле-Балхашский заповедник

[25] Zhusandala, Kazakhstan - KeyBiodiversityAreas.org

[26] Topar Lake System, Kazakhstan - KeyBiodiversityAreas.org

6.3.1.2.3 Ili River Delta KBA and Ili River Delta and South Lake Balkash Ramsar site[27]

This site qualifies as a Key Biodiversity Area of international significance that meets the thresholds for at least one criterion described in the Global Standard for the Identification of KBAs. he Ili River Delta is the largest remaining natural delta on an inland lake in Central Asia. It supports 10 inland wetland types including permanent inland delta; freshwater lake; rivers, streams or creeks; and seasonal or intermittent freshwater lakes. The wetland provides a rich variety of desert flora (427 species) and fauna (345 species) and supports a range of threatened species, including 25 bird, 1 fish and 3 mammal species. Important threatened species include the goitered gazelle, marbeled polecat, white-headed duck, red-breasted goose and ship sturgeon. More than 70,000 birds have been counted at the site, including greater than 1% of the global population of 8 bird species, such as the dalmatian pelican. Balkash Lake and the Ili River Delta are important fishery water bodies and the floodplains in the area are the most productive haying lands and good pastures. The wetland is being threatened by a 30% reduction in the water inflow due to the construction of the Kapchagai hydroelectric station and creation of the Akdaly irrigation unit. The wetland area is managed under the authority of the Altyn-Emel State National Nature Park.

6.3.2 Natural and Modified Habitats

The Site is located in the Central Asian northern desert ecoregion[28]. This ecoregion is in the deserts and xeric shrublands biome and consists of varied landscapes with low plains, desert clay plateaus and hilly peneplains (a low relief plain formed by protracted erosion). The vegetation here is capable of enduring the extreme temperatures and high salinity in the soil. It covers a vast area of 663,900km^2 spanning areas mainly in Kazakhstan and Uzbekistan and smaller areas in Kyrgyzstan and Turkmenistan.

The Site is located in Moiynkum District in the Zhambyl Region, Kazakhstan. Moiynkum District features a diverse landscape characterized by varying soil types and topographical elements. The southern and western regions of the district are characterized by low hills and ridges, surrounded by sandy mounds and unique geological formations. In contrast, the northeastern part of the district borders Balkhash Lake, where the shoreline of the Shu-Ili Low Hill Terrain attracts significant land features, providing a contrast against the surrounding terrain. This area, part of the Kyrgyz Alatau, rises to an elevation of 1,800 meters above sea level, while the Khantau ridge reaches 1,053 meters from the Ai-Tau peak. The Jiek mountain range starts several decades back, extending through Zailinsky Mountain and Jambyl Mountain, which is 947 meters high, before merging with mountainsof Koyzharylgan, Maizharylgan, Baigary, and Shagyrly.

The landscape of Moiynkum District is notably fragile. The region's ecosystem is sensitive to various anthropogenic pressures, including climate change, overgrazing, and unsustainable agricultural practices. The delicate balance of plant species and their habitats can be easily disrupted, leading to soil degradation and desertification. Moreover, water scarcity issues complicate the landscape's sustainability, threatening both the natural vegetation and agricultural activities that depend on reliable water resources.

The vegetation reflects the dry climatic conditions of the region. Dominant plant species include various types of wormwood, camel thorn, marsh grasses, reeds, and shrubs, which thrive across the landscape.

The southern Project area is predominantly located on the flat-topped Maizharylgan Mountains, with its northern section extending onto the Jambyl Mountain. To the west are the Sekseul Dala Steppes, which have an average elevation of around 345 meters. Between the Sekseul Dala Steppes and the Maizharylgan mountains, there is

[27] Ili River Delta, Kazakhstan - KeyBiodiversityAreas.org; Ramsar Website: Ili River Delta and South Lake Balkhash | Ramsar Sites Information Service

[28] Central Asian Northern Desert | One Earth

a significant elevation rise in the Maizharylgan mountains. Maizharylgan mountains reaching heights from 450 to 550 meters. Toward the east, the terrain gradually slopes downward into the Kulanketpes Valley and extends toward the shores of Lake Balkhash.

The southern Project area is predominantly covered in natural herbaceous vegetation i.e natural habitat with some light cattle grazing and limited evidence of modification. The southern Project area overlaps with the Zhusandala State Reserved Zone Plain which primarily consists of herbaceous or grassland habitat with some sparse vegetation along the western side. The southern Project area is located in the shallow Mayzharylgan Mountains which primarily consists of herbaceous vegetation. The landcover types present within the southern Project area are presented in Table 6.

In the southern Project area there are multiple land users, mostly for farming and forestry production, as well as saxaul shrub thickets.

ACBK (2023) describes the southern Project area as a landscape zone of deserts with rubble piedmont plains and loamy plains with sparse saxaul forests, turning into xerophytic low mountains.

The southern Project area includes part of the Shu-Ilei low-mountain massif, which is a system of gentle ridges with levelled surfaces, sharply limited by steep slopes, and canyon-like valleys along watercourses. In this area, shrub thickets of meadowsweet (*Spiraea* sp.) and other species are well developed along with an abundance of cereals, legumes, and onion species providing excellent food conditions for both ungulates and birds. Along the riverbeds, typical flora species include: *Haloxylon aphyllum*, *Tamarix* sp., *Atriplex caragana*, *Eurotia ceratoides*, *Nitraria schoberi*, *Artemizia* sp., *Limonium* sp.

During the period of field work in April to May 2023, five main types of habitats were identified across the northern and southern Project areas:

- Xerophytic rocky low mountains;
- Outcrops of flat granite slabs;
- Saxual valley forests;
- Sagebrush and sagebrush deserts on gently undulating plains; and
- Gently sloping solonchak depressions on the plains.

Table 6: Landcover type within the southern Project area.

Landcover type	Southern project area - Area (ha)
Shrubland	249.86
Herbaceous vegetation	48711.31
Cropland	0
Built-up	0
Bare/sparse vegetation	1495.03
Permanent water bodies	0
Herbaceous wetland	0
Forest	0
TOTAL:	50456.20

According to the Sentinel-2 10m Land Use/Land Cover Time Series layer by Esri, the Project interacts with the following land use/land cover categories:

- Water: areas where water was predominantly present throughout the year; may not cover areas with sporadic or ephemeral water; contains little to no sparse vegetation, no rock outcrop nor built up features like docks; examples: rivers, ponds, lakes, oceans, flooded salt plains
- Flooded vegetation: areas of any type of vegetation with obvious intermixing of water throughout most of the year; seasonally flooded area that is a mix of grass/shrub/trees/bare ground; examples: flooded mangroves, emergent vegetation, rice paddies and other heavily irrigated and inundated agriculture.
- Crops: human planted/plotted cereals, grasses, and crops not at tree height; examples: corn, wheat, soy, fallow plots of structured land.
- Built Area: human made structures; major road and rail networks; large homogenous impervious surfaces including parking structures, office buildings and residential housing; examples: houses, dense villages / towns / cities, paved roads, asphalt.
- Bare ground: areas of rock or soil with very sparse to no vegetation for the entire year; large areas of sand and deserts with no to little vegetation; examples: exposed rock or soil, desert and sand dunes, dry salt flats/pans, dried lake beds, mines.
- Rangeland: Open areas covered in homogenous grasses with little to no taller vegetation; wild cereals and grasses with no obvious human plotting (i.e., not a plotted field); examples: natural meadows and fields with sparse to no tree cover, open savanna with few to no trees, parks/golf courses/lawns, pastures. Mix of small clusters of plants or single plants dispersed on a landscape that shows exposed soil or rock; scrub-filled clearings within dense forests that are clearly not taller than trees; examples: moderate to sparse cover of bushes, shrubs and tufts of grass, savannas with very sparse grasses, trees or other plants.

Natural and modified habitats are listed in Table 7. This table also reports the extension in hectares and the cover percentage of each habitat. Figure 18 and Figure 19 provides a visual representation of the habitats distribution in the Study Area.

Table 7: Natural and Modified Habitat present in the Study Area.

Land Cover	Area (hectares)	Area (m^2)	Area (%)
Natural Habitats			
Water	46.24	462,428.18	0.078
Flooded vegetation	1.46	14,593.34	0.002
Crops	139.84	1,398,425.56	0.235
Bare ground	29.42	294,229.81	0.049
Rangeland	59,343.34	593,433,416.32	99.585
Modified Habitats			
Built area	30.32	303,174.51	0.051
TOTAL	59,590.63	595,906,267.72	100

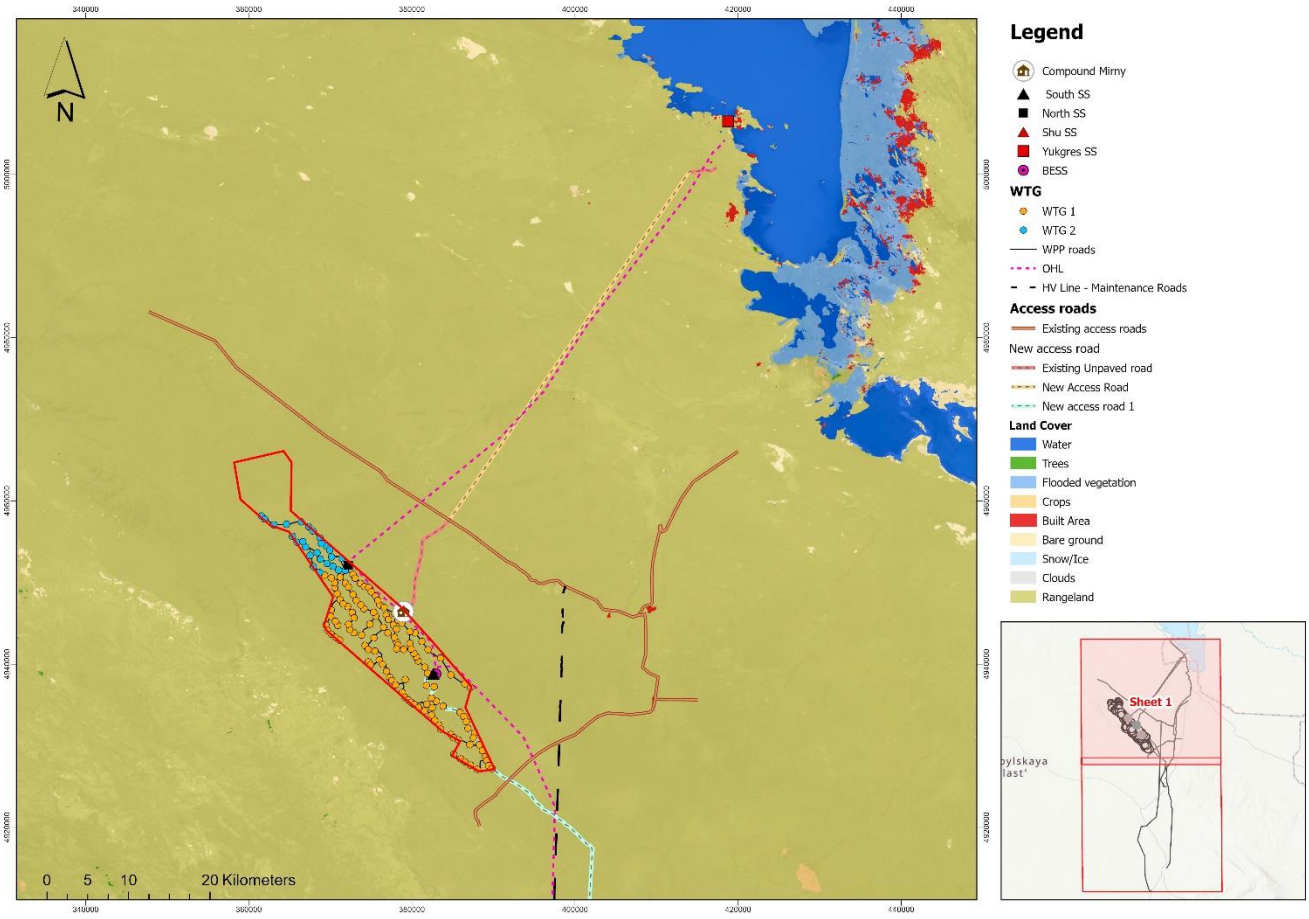


Figure 18: Natural and modified habitats present in the Study Area (1 out of 2).

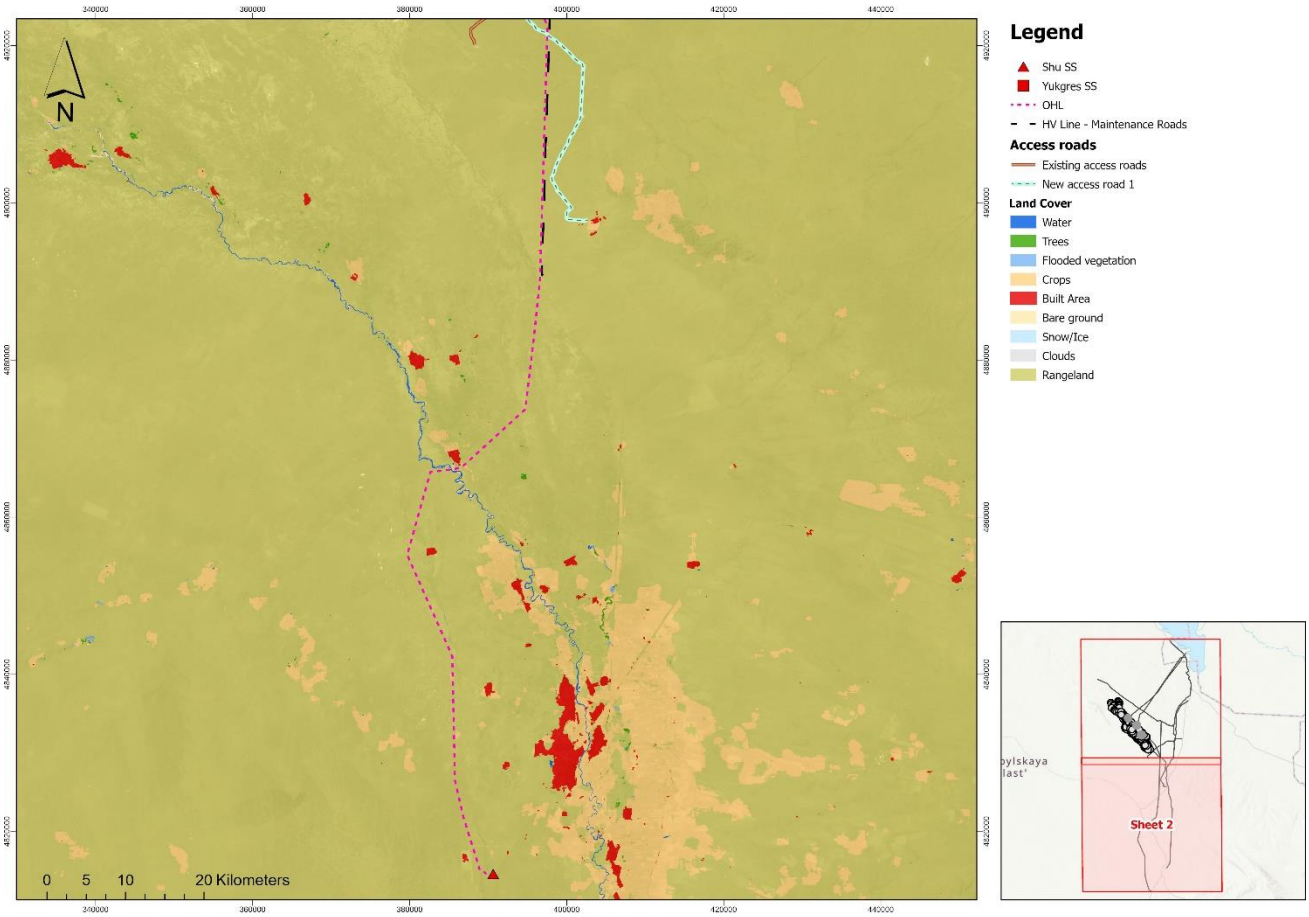


Figure 19: Natural and modified habitats present in the Study Area (2 out of 2).

6.3.3 Flora Species

6.3.3.1 Desk study

Data from IBAT indicates the Study Area supports 41 species of plants. Of these:

- One species of tulip Regels's Tulip Tulipa regelii is globally Endangered. This species is also classified as rare and Endangered in the Kazakhstan Red Book. All other species are IUCN Least Concern and not protected under the Kazakhstan Red Book.

6.3.3.2 Field survey

In general, the entire territory within the southern Project area can be characterized as the predominance of the wormwood-boylych complex (*Salsola arbusculiformis*, *Artemisia terrae-albae*, *Artemisia semiarida*, *Artemisia turanica*) with ephemera and ephemeroids along the petrophytic slopes and tops of the hills. Saxaul formations (*Haloxylon aphyllum*) are frequent in depressions of the relief, along the riverbeds, sometimes in combination with Tamarisk (*Tamarix ramosissima*), chingil (*Halimodendron halodendron*). Also, in the lowlands and depressions, there are frequent needlegrass (*Neotrinia splendens*) and reeds (*Phragmites australis*).

The plants across the southern and northern Project areas can be divided into 5 types, of which annuals (40%) and herbaceous perennials (35%) predominate. The proportions of semi-shrubs (10%), shrubs (5%) and semishrubs (5%) are less significant. In total 238 species were recorded and the full list if given in Appendix 3 of ACBK (2023a).

Three edaphotypes were noted in the plots across the southern and northern Project areas:

- petrophiles - confined to stony and gravelly soils (*Salsola arbusculiformis*, *Anabasis salsa*)
- gallophiles - growing on saline and alkaline soils (*Atriplex cana*, *Suaeda physophora*)
- eurytopic species - widespread, without any special attachment to the mechanical composition and degree of soil scaling (species of the genus *Artemisia*, *Poa bulbosa*).

Table 8 describes some of the contours of ecosystems within the Site, which can be seen on ***Figure** 20* as included in ACBK (2024). The full list of species recorded during the surveys can be found in Annex 3 of ACBK Centre for Conservation Biology LLP (2024) Final report for April 2023 – May 2024.

Table 8: Main ecosystems of the southern Project area and the Site.

Contour/s number	Ecosystem (plant association)	Within original Project area	Within final site boundary
1, 5	Wormwood wire with bluegrass and ebelek *(Ceratocarpus arenarius, Poa bulbosa, Kochia prostrata, Artemisia semiarida, Artemisia turanica)*	X	-
2	Kokpek-sagebrush on the plains (*Artemisia semiarida,* and *Atriplex cana*) and boyalych with bluegrass on the slopes of the hills (*Poa bulbosa*, *Salsola arbusculiformis*). Sporadically scattered on the slopes tulips. **Regel's Tulip** (*Tulipa regelii*) noted.	X	-
3	Wormwood with bluegrass	X	X
4, 6, 28, 29, 31	Wormwood wire with bluegrass and ebelek *(Ceratocarpus arenarius, Poa bulbosa, Kochia prostrata, Artemisia semiarida, Artemisia turanica)*	X	X
20, 30	A complex of boyalych associations with ephemera and ephemeroids along the slopes of the hills (*Rheum tataricum*, *Ferula songarica, Tulipa* spp. *Salsola arbusculiformis*) with sagebrush associations along the valleys between the hills (*Artemisia semiarida*, *Artemisia tarrae-albae*). On moist lowlands - reeds and mesophytic herbs.	X	X
25	Wormwood-boyalych associations along the slopes. **Regel's tulip** (*Tulipa regelii*) was noted.	X	-
26	On the plains - Wormwood associations with teresken (*Eurotia ceratoides, Artemisia semiarida,* and *Artemisia tarrae-albae*) in combination with boyalych's (*Salsola arbusculiformis*) associations on the slopes. Tulips sporadically on the slopes.	X	X
27	On the plains - Wormwood associations with teresken (*Eurotia ceratoides, Artemisia semiarida,* and *Artemisia tarrae-albae*) in combination with boyalych's (*Salsola arbusculiformis*) associations on the slopes. Tulips sporadically on the slopes.	X	-

Contour/s number	Ecosystem (plant association)	Within original Project area	Within final site boundary
56	On the plains - Wormwood associations with teresken (*Eurotia ceratoides*, Artemisia semiarida, and Artemisia tarrae-albae) in combination with boyalych (*Salsola arbusculiformis*) on the slopes. On the slopes, tulips are absently scattered. In swampy lowlands – needlegrass (*Neotrinia splendens*) and reed (*Phragmites australis*) formations	X	X
57	On the plains - Wormwood associations with teresken (*Eurotia ceratoides*, *Artemisia semiarida*, and *Artemisia tarrae-albae*) in combination with boyalych (*Salsola arbusculiformis*) on the slopes. Tulips scattered along the slopes. Also, floodplain saxaul formations in combination with chingil, comb (*Tamarix ramosissima*, *Halimodendron halodendron*, and *Haloxylon aphyllum*). **Regel's tulip** (*Tulipa regelii*) found within the contour	X	X

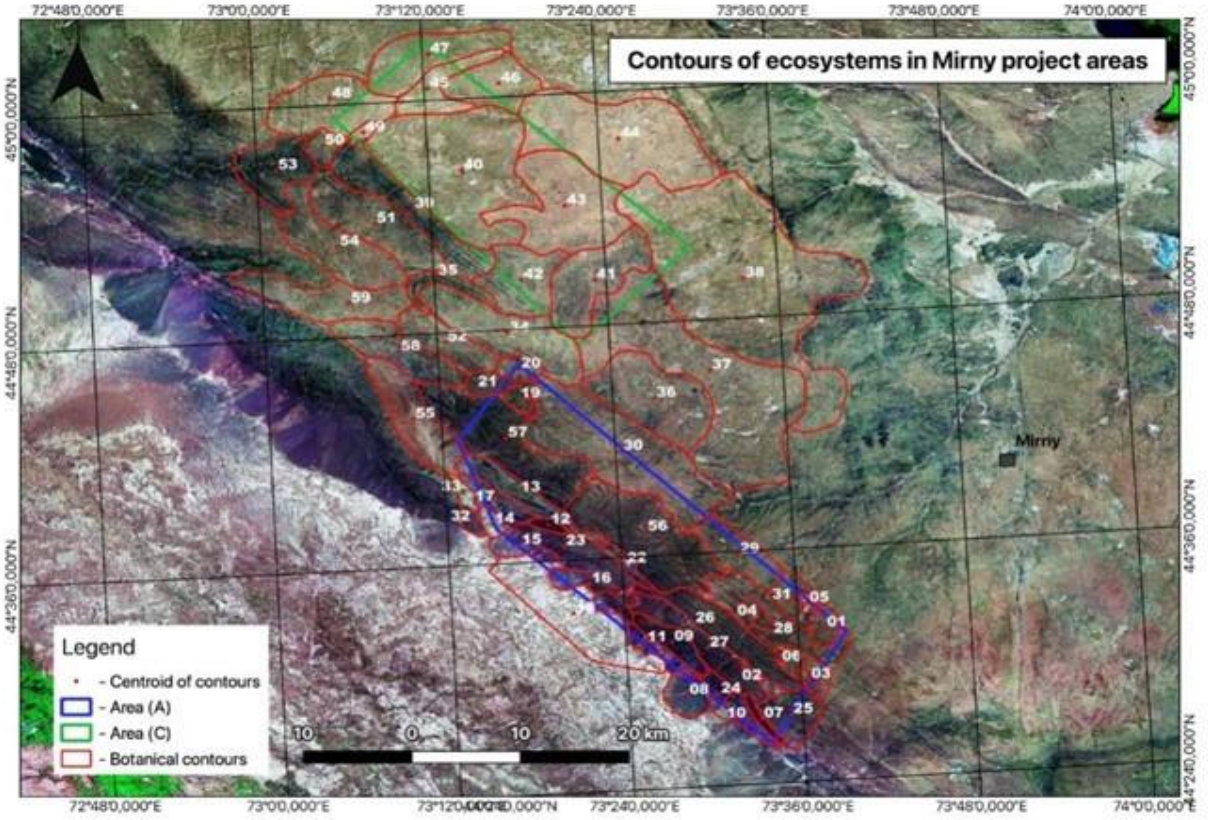


***Figure 20: Main contours of plant communities within the southern Project area.*[29]**

[29] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

The 2025 fieldwork was extended to the OHL. In general, most of the territory is characterized by an active cenosis-forming species - the petrophyllous *Salsola arbusculiformis*. The most frequently encountered associations in the study area during the field trip were:

- Wormwood with ephemerals (*Tulipa biflora, Rheum tataricum, Artemisia turanica+A. terra-albae*),
- Boyalich with ephemerals on rubble outcrops (*Tulipa biflora, Rheum tataricum, Salsola arbusculiformis*)
- Wormwood-boyalych with ephemerals (*Tulipa alberti*, *Tulipa behmiana*, *Rheum tataricum*, *Tulipa biflora, Salsola arbusculiformis* and *Artemisia turanica*)
- Wormwood with teresken (*Kraschenikovia ceratoides*, *Artemisia terra-albae*)
- Saxaul forests (*Haloxylon aphyllum*)
- Kokpechniki (*Atriplex cana*)

Additionally, it is possible to highlight floodplain formations of the rivers crossing the planned lines separately. In the northern part of the route, riverbeds of the Sarybastau, Karasai, Kiyaky and Sarybulak rivers are crossed by low-water and sometimes drying up riverbeds. In this area, the predominant vegetation is characterised by mesophilic meadow formations. To the south, the 500 kV YUM-Shu power transmission line traverses one of the region's largest transboundary rivers, the Chu, and its left tributary, the Kuragaty River.

A detailed examination was carried out of the areas designated for the construction of the southern and northern substations and the camp. As construction of these facilities necessitates the complete clearance of the upper soil and vegetation layer in certain areas, the territory is likely to experience significant pressure and risk with regard to rare flora.

Southern substation

The construction site of the Southern substation is located on the flattened top of the hill. The southern and western slopes of the hill are composed of a bogbean-ephemeral-turf grass community (*Tulipa alberti*, *Allium sp., Ferula ovina*, *Poa bulbosa*, *Salsola arbusculiformis*) with a total projective cover of 60-70% along the slope, and 1-2% at the top of the hill. Here, a species listed in the Red Book of the Republic of Kazakhstan is noted, Albert tulip (*Tulipa alberti*). The abundance of Albert tulip on the site is in separate spots up to 6-7 pcs/m^2 at the top of the hill, up to 12-13 pcs/m^2 along the slope and below. The number of *Tulipa alberti* growing sites is about 10 with an area of about 10 m^2 on average.

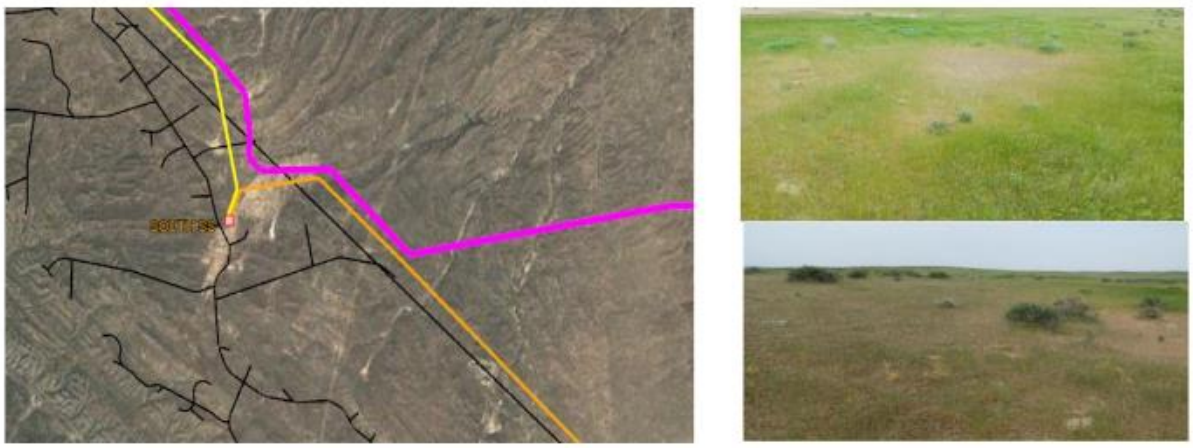


***Figure** 21: **Details of plant communities within the South Substation Section.**[30]*

Camp site

[30] Figure taken from the species surveys 2025 final report (ACBK Centre for Conservation Biology LLP, 2025)

The plot is rectangular in shape, 900 m x 400 m, located on a gently undulating-sloping plain. On the territory of the camp site, the vegetation is represented by a complex of associations. Most of the plots include communities of ephemerals (*Papaver pavoninum*, *Poa bulbosa*, *Salsola arbusculiformis*), in places turning into bluegrass (*Poa bulbosa*).

Also, significant areas within the camp site have a knocked-down nature of communities and are represented by wormwood-ruderal (*Eremopyrum triticeum*, *Descurainia Sophia*, *Artemisia terra*-albae) and mortuka patches (*Eremopyrum triticeum*) with TPP up to 60%. In some places, the weed species *Descurainia sophia* is quite abundant, forming entire glades, not only on the site of the planned camp, but also beyond it. The greatest decorative value here is the peacock poppy (*Papaver pavoninum*), which forms entire scarlet glades in April-early May. The species is not listed in the Red Book of the Republic of Kazakhstan, but requires careful handling due to the ephemerality and decorative nature of the species.

Figure** 22**: Details of plant communities within the Camp site.[31]

Northern substation

The site is covered with wormwood and ephemerals (Papaver pavoninum, Alyssum turcestanicum, Rheum tataricum, Poa bulbosa, Salsola arbusculiformis) in combination with turf grass associations (Stipa sp., Anisantha tectorum). The complex also includes dense communities (Descurainia sophia, Artemisia terra-albae, Ceratocephala orthoceras).

Of the rare species on the site, the two-flowered tulip (Tulipa biflora) was noted; the species is listed in the Red Book of the Republic of Kazakhstan. The abundance of the species on the site is small - in several places, 1-2 pcs/m^2. Also noted is the Alberta tulip (Tulipa alberti) – 3 pcs/m^2 on a total growing area of 50 m^2.

[31] Figure taken from the species surveys 2025 final report (ACBK Centre for Conservation Biology LLP, 2025)

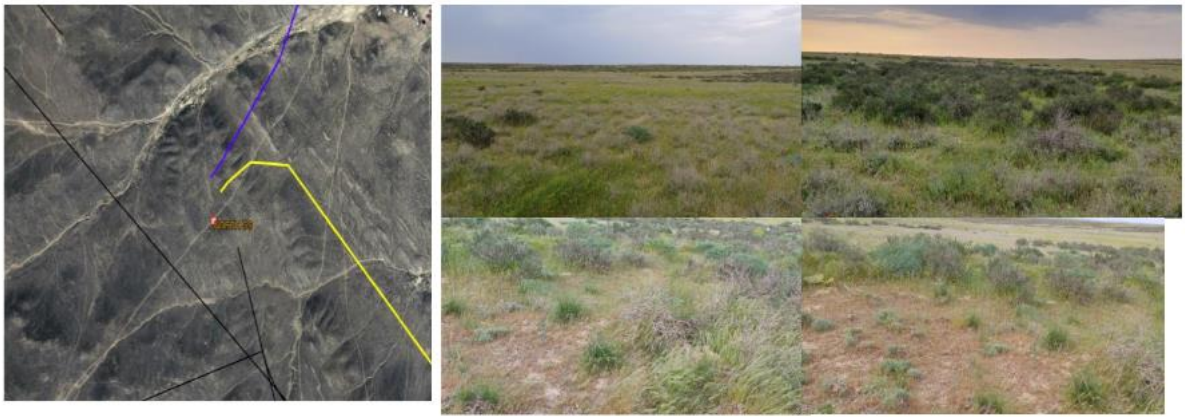


***Figure** 23: **Details of plant communities within the Northern substation.**[32]*

Rare species

During the field work carried out in 2023 and 2025, the presence of several plant species that have the status of rare and endangered, i.e. included in the Red Book of the Republic of Kazakhstan, were recorded:

- Albert's tulip (*Tulipa alberti*);
- Greig's tulip (*Tulipa greigii*);
- Borshchov's tulip (*Tulipa borszczowii*);
- Regel's tulip (*Tulipa regelii*);
- Biflora tulip (*Tulipa biflora*)

Black saxaul (*Haloxylon aphyllum*), saxaul forests are noted everywhere on all sections of the planned OHL, is not included in the Red Book but is under additional local protection (a moratorium on logging).

Tulip species were observed sporadically throughout almost the entire area of the Survey Areas plots but mainly along the rocky slopes and tops of the hills, with the exception of waterlogged depressions. At the time of the surveys, the tulips were at the stage of fruiting. Black saxaul was mostly found in formations on depressions along riverbeds.

Finally, the rare relict species Euphrates poplar (*Populus diversifolia*) was observed in 2025 survey. A small grove of about 30 trees has been identified 200 m north of the power transmission line in the floodplain terrace of the river crossing the eastern end of the 35 kV power transmission line to Kiyakhty 220 kV.

The following table lists the endemic plant species recorded across the northern and southern Project areas with a limited habitat and confined to the region.

Table 9: Endemic flora species to the region recorded across the northern and southern Project areas.

Common name	Scientific name	IUCN status /Endemism type
Sicilian honey garlic	*Allium trachyscordum*	-
-	*Stroganowia trautvetteri*	-
-	*Astragalus chaetodon*	-

[32] Figure taken from the species surveys 2025 final report (ACBK Centre for Conservation Biology LLP, 2025)

Common name	Scientific name	IUCN status /Endemism type
-	*Astragalus neo-popovii*	-
Jerusalem sage	*Phlomoides septentrionalis*	-
-	*Scutellaria titovii*	-
-	*Limonium leptophyllum*	-
-	*Arthrophytum subulifolium*	-
-	*Atraphaxis virgata*	-
Bema tulip	*Tulipa behmiana*	Endemic to the Balkhash region
Regel tulip	*Tulipa regelii*	EN - Red Book of the Republic of Kazakhstan Endemic to the Chu-Ili Mountains

6.3.4 Birds

6.3.4.1 Desk study

Data from IBAT (2023) indicates a total of 253 species of birds. Of these, one species is classified IUCN Critically Endangered, five Endangered and eight Vulnerable. The Zhusandala plain and edge of sand dunes provide optimal habitat for breeding houbara bustards that use this area as a stop-over site while migrating from other regions. Several bird species use the airspace above the two sites when flying between the lakes in the lower reaches of the Chu River and the Balkhash Lake. Species such as the saker falcon and steppe eagle that are found in the Andasay State Nature Sanctuary have been known to use this region as a foraging ground due to the suitable habitat found here.

As per the Mirny Wind Power Plant Sites Selection Environmental and Social Constraints Report, one IUCN Vulnerable species, great spotted eagle *Aquila clanga* and one IUCN Near Threatened species, the cinereous vulture *Aegypius monachus* (NT) has been identified as being present.

Bird species that are IUCN Critically Endangered, Endangered, Vulnerable and protected as per the Kazakhstan Red Book as well as those known to be sensitive to the impacts of wind developments due to collision risk with turbines are listed in Table 10.

Table 10: Bird species of conservation concern recorded within the Study Area.

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory
Sociable lapwing	*Vanellus gregarius*	Critically endangered	X	X
White-headed duck	*Oxyura leucocephala*	Endangered	X	X
Pallas' fish-eagle	*Haliaeetus leucoryphus*	Endangered	-	X
Egyptian vulture	*Neophron percnopterus*	Endangered	X	X
Steppe eagle	*Aquila nipalensis*	Endangered	X	X
Saker falcon	*Falco cherrug*	Endangered	X	X

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory
Common pochard	*Aythya farina*	Vulnerable	-	X
Yellow-eyed pigeon	*Columba eversmanni*	Vulnerable	-	X
European turtledove	*Streptopelia turtur*	Vulnerable	-	X
Great bustard	*Otis tarda*	Vulnerable	X	X
Greater spotted eagle	*Clanga clanga*	Vulnerable	-	X
Eastern imperial eagle	*Aquila heliacal*	Vulnerable	X	X
Rustic bunting	*Emberiza rustica*	Vulnerable	-	X
Asian houbara	*Chlamydotis macqueenii*	Vulnerable	X	X
Booted eagle	*Hieraaetus pennatus*	Least Concern	X	X
Golden eagle	*Aquila chrysaetos*	Least Concern	X	X
Common crane	*Grus grus*	Least Concern	X	X
Demoiselle crane	*Anthropoides virgo*	Least Concern	X	X
Little bustard	*Tetrax tetrax*	Least Concern	X	X
Black-bellied sandgrouse	*Syrrhaptes paradoxus*	Least Concern	X	X
Pin-tailed sandgrouse	*Pterocles alchata*	Least Concern	X	X
Pallas's sandgrouse	*Syrrhaptes paradoxus*	Least Concern	X	X
Ferruginous duck	*Aythya nyroca*	Least Concern	X	X
Whooper swan	*Cygnus cygnus*	Least Concern	X	X
Ibisbill	*Ibidorhyncha struthersii*	Least Concern	X	X
Osprey	*Pandion haliaetus*	Least Concern	X	X
White-tailed sea-eagle	*Haliaeetus albicilla*	Least Concern	X	X
Glossy ibis	*Plegadis falcinellus*	Least Concern	X	X
Eurasian spoonbill	*Platalea leucorodia*	Least Concern	X	X
Great white pelican	*Pelecanus onocrotalus*	Least Concern	X	X

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory
White stork	*Ciconia Ciconia*	Least Concern	X	X
Peregrine falcon	*Falco peregrinus*	Least Concern	X	X
Eurasian eagle owl	*Bubo bubo*	Least Concern	X	-

6.3.4.2 Field surveys 2023 – Wind power plant

In Spring 2023, 66 species were recorded within the southern Project area, 52 of which were either observed or were potentially breeding. Ten of the species recorded are included in the Red Data Book of the Republic of Kazakhstan and four of these species have the status of Near Threatened (NT and above) in the IUCN Red List. The 10 species are listed in Table 11.

Table 11: Birds of Conservation Concern recorded in Spring 2023.

Common name	Scientific name	IUCN status	Kazakhstan Red Book
Great white pelican	*Pelecanus onocrotalus*	Least Concern	X
Barbary falcon	*Falco pelegrinoides*	Least Concern	X
White tailed eagle	*Haliaeetus albicilla*	Least Concern	X
Steppe eagle	*Aquila nipalensis*	Endangered	X
Eastern imperial eagle	*Aquila heliaca*	Vulnerable	X
Golden eagle	*Aquila chrysaetos*	Least Concern	X
Houbara bustard	*Chlamydotis macqueenii*	Vulnerable	X
Little bustard	*Tetrax tetrax*	Vulnerable	X
Black bellied sandgrouse	*Pterocles orientalis*	Least Concern	X
Pallas's sandgrouse	*Syrrhaptes paradoxus*	Least Concern	X

Raptor surveys

During the Spring 2023 surveys, evidence of two bird of prey nests were recorded within the Site; these were long-legged buzzard. Evidence of a further 17 nests were recorded within the wider southern Project area; species included two steppe Eagle (RDB of the RK), six golden eagle (the species is listed in the Red Data Book of the RK), six long-legged buzzard, two saker falcon (RDB of the RK), and one kestrel.

Numerous old nests of birds of prey were also found within the southern Project area, although only a few are within the Site. Observation locations of all birds of prey is given in **Table 1** of ACBK (2023)[33]. The density and location of breeding birds of prey in the southern Project area are shown in Figure 24.

Surveys in June and July 2023 found that the most common species recorded were the long-legged buzzard and golden eagle which is a common breeding species for the southern Project area and by the beginning of July, most of the chicks were already hunting on their own. The main prey items for breeding raptors are tortoises

[33] ACBK (2023) Interim information report: April-May 2023

in the migration-post-migration period (i.e. Spring). In summer, the main prey is jerboas, voles, gerbils and young hares. The majority of raptors were observed hunting on average at altitudes from 70m to 200m.

The following birds of prey were observed to be nesting around the southern Project area in Spring and autumn 2024: Long-legged buzzard, golden eagle, and common kestrel.

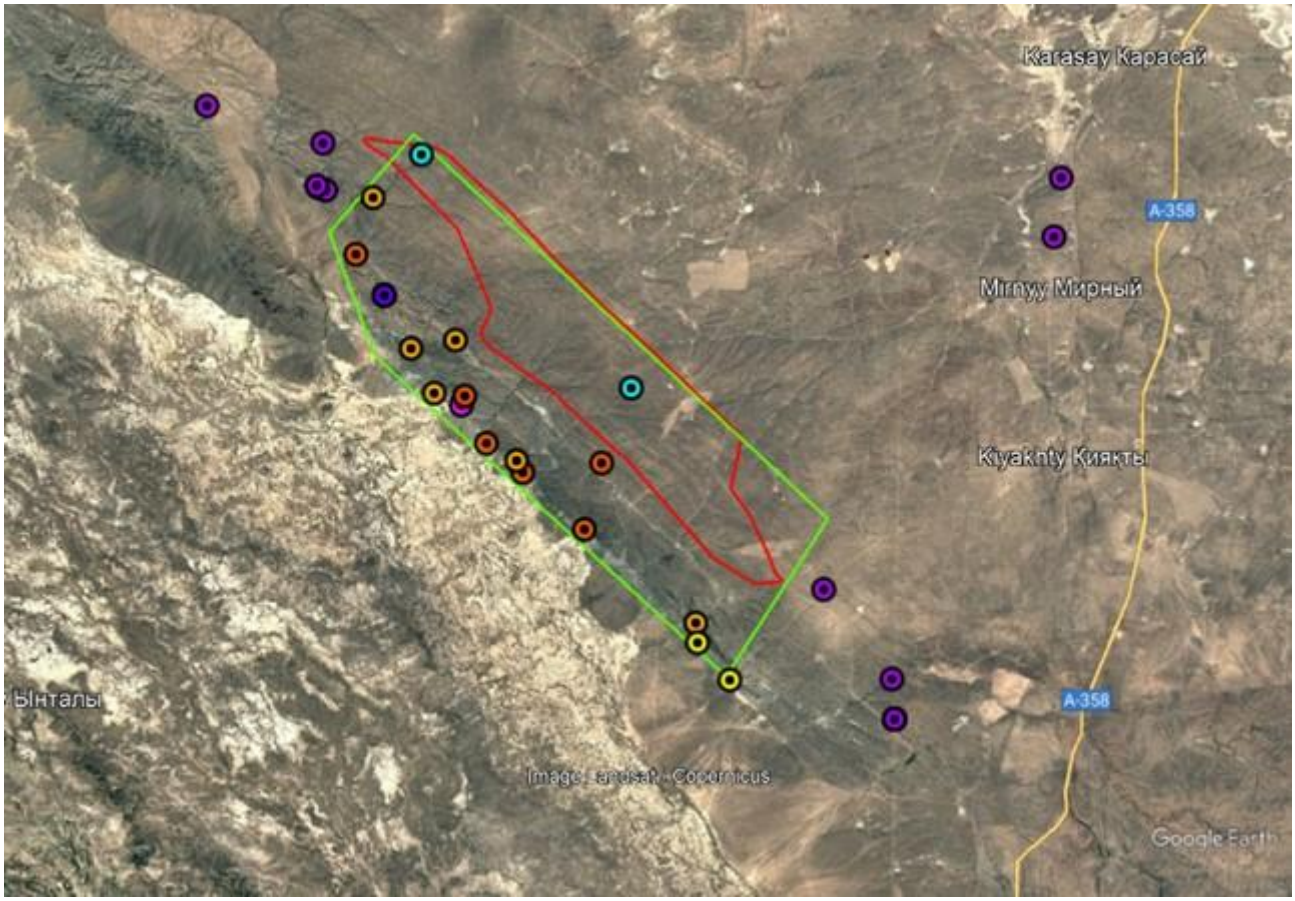


Figure 24: Location of birds of prey nesting evidence (i.e. nests or nesting pairs) within the Site, southern Project area, and immediate surroundings in Spring 2023.

(Light blue dots – long-legged buzzard; yellow dots – steppe eagle; Orange dots – golden eagle; Pink dots – saker falcon; Dark blue dots – kestrel; Purple dots – evidence of nests outside of southern Project area**)**

Migration: raptors

Despite the late start of spring migration surveys in April 2023 there was evidence of a number of different species migrating through the southern Project area. Species observed within the Site include common buzzard and sparrowhawk. Additional species within the wider southern Project area include shikra, golden eagle, imperial eagle, steppe eagle, long-legged buzzard, barbary falcon, hobby, kestrel and crested honey buzzard. Black kite was observed outside the southern Project area.

During the Autumn 2023 survey period across the northern and southern Project areas, in addition to the raptor species already recorded earlier during the nesting (summer) period, the bird species recorded during the autumn migration period, was more diverse including steppe eagle, short-toed eagle, pallid harrier, hen harrier, montagu's harrier, black kite, white-tailed eagle and common buzzard. There were also a number of species from the Falconidae family i.e. merlin, hobby and saker falcon. On the southern Project area, there are two high-

density flight corridors (>1.7 ind./hour) with a south-southwest direction, in addition to two medium-density flight corridors to the southwest and one low-density flight corridor to the south, which can be seen on Figure 25.

The higher concentration of Accipitridae during the autumn migration period through the southern Project area is possibly influenced by the topography of the southern Project area, which forces migratory raptors to concentrate along ridge features. There is also a significant supply of food resources closer to the lowland of the river Chu, which have been noted in the field.

During the winter 2023/24 surveys, wintering grounds of golden eagle, long-legged buzzard, and short-eared owl were confirmed across the northern and southern Project areas. A falcon (*Falco* sp.) was spotted, but the species could not be identified due to weather conditions. Large number of buzzards were observed in February 2024, and the white-tailed eagle, which does not winter here, was observed twice.

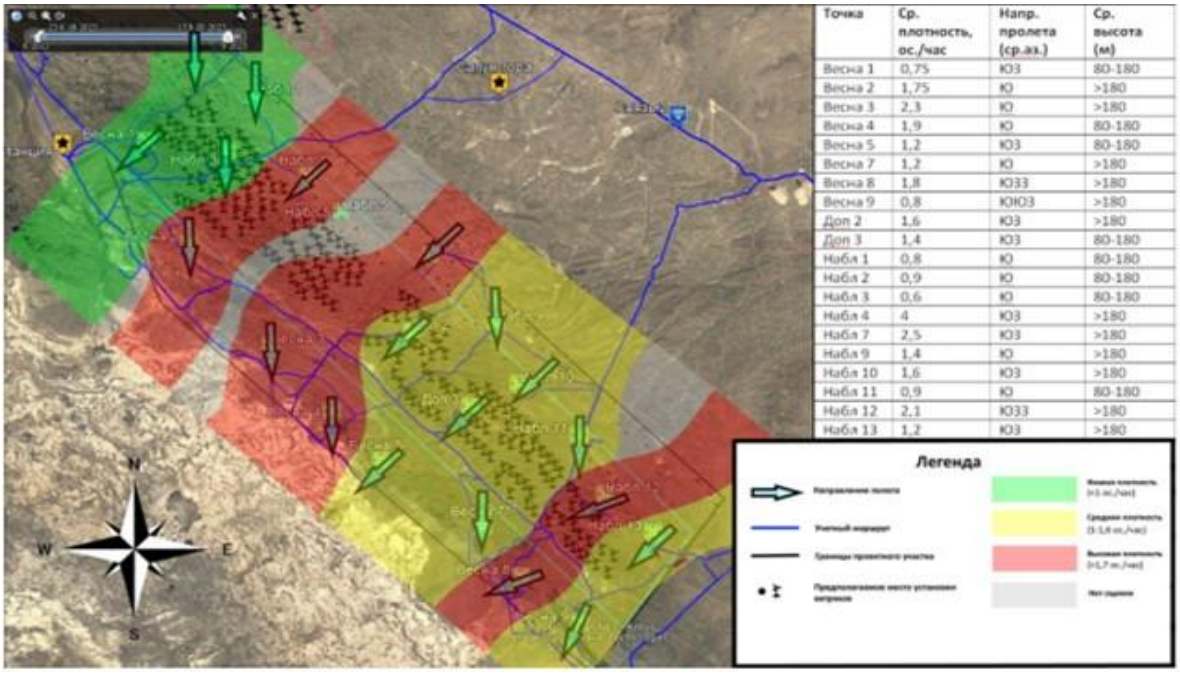


Figure 25: Raptor movement across the southern Project area in autumn 2023[34].

A number of migratory birds of prey were also observed in Spring 2024 - steppe eagle, short-toed eagle, pallid harrier, hen harrier, Montagu's harrier, marsh harrier, as well as black kite, white-tailed eagle, common buzzard, sparrowhawk, hobby, and saker falcon. Scavengers were noted singly, such as griffon vulture and black vulture, common honey buzzard, crested honey buzzard, osprey, and imperial eagle.

In spring 2024, an average (2-4 ind./hour; 2-4 ind./km2) and high (>4 ind./hour; >4 ind./km2) density of migratory raptors was observed (range M01-M01, M32; range M10-M19; range M27-M31), thus forming wide migration corridors. The main direction of flight is northeast - it is dominant (59%). The average range of heights of migratory birds is 20-200 m above the ground. Figure 26 and Figure 27 show the general flight directions and densities.

In autumn 2024, a significant number of species of birds of prey were observed migrating: steppe eagle, short-toed eagle, black kite, white-tailed eagle, common buzzard, pallid harrier, hen harrier, Montagu's harrier, marsh

[34] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

harrier, sparrowhawk, hobby. The black vulture, imperial eagle and the saker falcon were noted singly. Below is shown that the main general direction of raptor flights is southwest. The average range of flight altitudes is 20-200m above the ground.

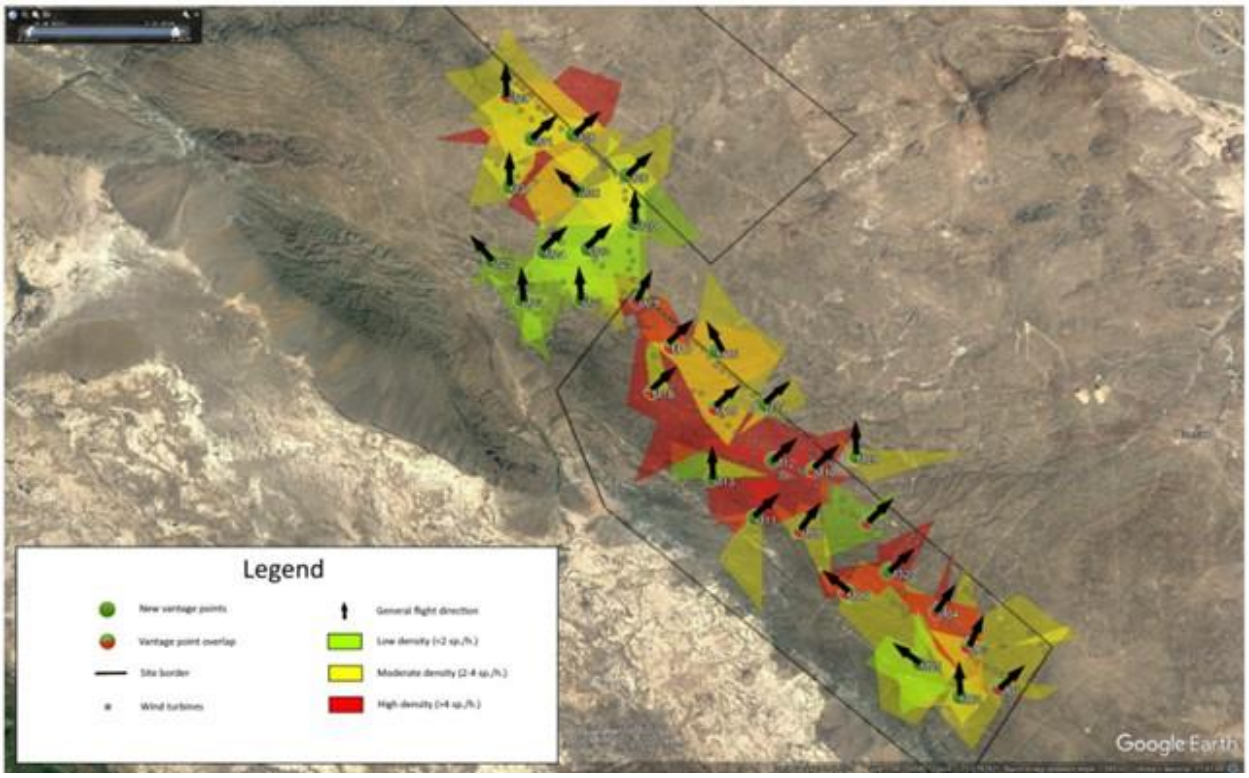


Figure 26: Raptor movement across the southern Project area in spring 2024 (flight density by indicator individual per hour)[35].

[35] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

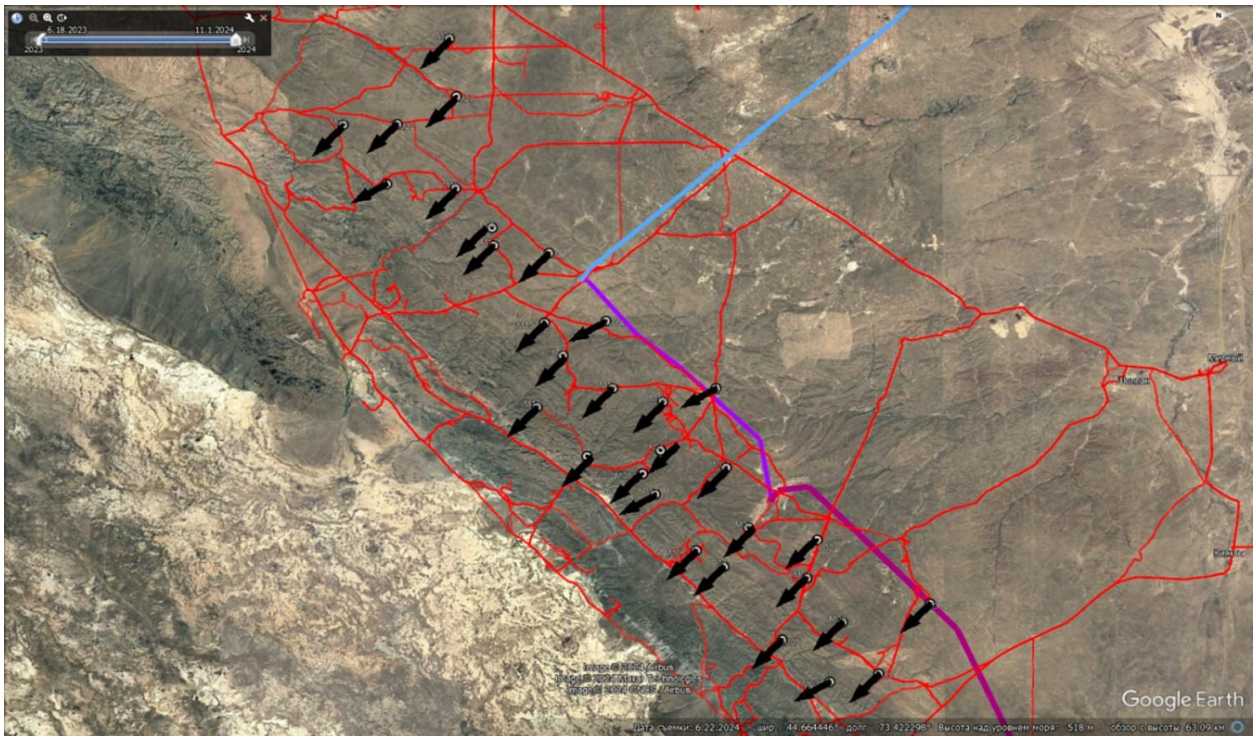


Figure 27: Density of raptor flights (ind./hour)[36].

During winter 2024/25 surveys carried out to date, the following species have been recorded: Golden eagle, white-tailed eagle, common kestrel, and rough legged buzzard. Species from the following genera were also noted: *Buteo*, *Circus,* and *Aquila.*

Migration: Waterbirds and other bird species

During the summer 2023 period, there is at least one waterbird flyway route across the central area of the Project site, for which the birds flew low (up to 30 m).

During the Autumn 2023 survey period, vulture species were observed sporadically i.e. griffon vulture and black vulture. No local movements of wetland birds were observed during autumn 2023.

During the winter 2023/24 surveys, a flock of chukars was seen west of the southern Project area. Of the passerines, only a few species of larks (*Melanocorypha yeltoniensis*, *Melanocorypha leucoptera*, *Melanocorypha calandra*, *Alaudidae*) were observed, with a predominance of the calandra lark (*Melanocorypha calandra*). To the west of the southern Project area, three flocks of chukars were seen. Seven Pallas's sandgrouse were seen, which may also symbolize the beginning of spring migrations. Of the passerines, as before, wintering species of larks were observed, with a predominance of the calandra lark. There were rare sightings of redpoll (*Acanthis flammea*), twite (*Linaria flavirostris*), Turkestan tit (*Parus bokharensis*), and little owl (*Athene noctua*).

During the spring 2024 survey period, waterbird migration was noted for pelicans (great white pelican and dalmatian pelican *Pelecanus crispus*), whooper swan, black-headed gull, caspian tern (*Hydroprogne caspia*), ruddy shelduck (*Tadorna ferruginea*), common merganser (*Mergus merganser*), great egret (*Ardea alba*), and caspian gull. In addition, local movements of waterbirds were noted, mainly movements of gull-billed tern (*Gelochelidon nilotica*) and common tern (*Sterna hirundo*). The main direction of flight is northeast, and for local

[36] Figure taken from the brief report for Autumn 2024 (ACBK Centre for Conservation Biology LLP, 2024)

movements, the northeast and southwest, which corresponds to the geographical location of large wetlands (Lake Balkhash and the Chu River valley). The average range of flight altitudes for pelicans, ducks and herons is from 100m to 1km; gulls and terns - up to 100m above the ground.

During autumn 2024 stationary observations, both the main migration and local movements were noted. Migratory species recorded include: Great white pelican, Dalmatian pelican, whooper swan, black-headed gull, ruddy shelduck, common merganser, great egret, and yellow-legged gull. Local movements of birds of the wetland complex are mainly the gulls mentioned above and the following terns: gull-billed tern *Gelochelidon nilotica* and common tern. The main direction of flight is south-southwest, and for local movements - northeast and southwest (which corresponds to the geographical location of large wetlands - Lake Balkhash and the Shu River valley, between which birds can move). The average range of flight altitudes for pelicans, ducks and herons is from 100m to 1km, for gulls and terns - up to 100m above the ground.

6.3.4.3 Field surveys 2024/2025

From September 2024 to August 2025, 173 species were observed within the Study Area. Thirty-one (31) of the species recorded are included in the Red Data Book of the Republic of Kazakhstan and ten (10) of these species have the status of Endangered (EN) or Vulnerable (VU) in the IUCN Red List. The 10 species are listed in Table 12.

Table 12: Birds of Conservation Concern recorded in 2024/2025 surveys.

Family	Common name (english)	Scientific Name	IUCN Global Status	Kazakhstan Red Book	RDB KZ Status
Accipitridae	Eastern Imperial Eagle	*Aquila heliaca*	VU	X	Category III. A rare species, whose population is declining.
Accipitridae	Steppe Eagle	*Aquila nipalensis*	EN	X	Category V. The population is relatively large, but until recently it was declining rapidly.
Otididae	MacQueen's bustard	*Chlamydotis macqueenii*	VU	X	Category II. A species that is endangered in some parts of its range but still survives in significant numbers in Kazakhstan.
Columbidae	Yellow-eyed pigeon	*Columba eversmanni*	VU	X	Category III. A narrowly distributed endemic species with declining numbers.
Falconidae	Saker Falcon	*Falco cherrug*	EN	X	Category I. The population of this species has declined so sharply over the past 3-4 years that it is now threatened with extinction in Kazakhstan.
Accipitridae	Pallas' fish-eagle	*Haliaeetus leucoryphus*	EN	X	Category I. Species threatened with extinction.
Accipitridae	Egyptian vulture	*Neophron percnopterus*	EN	X	Category III. Rare species, population declining.
Otididae	Great bustard	*Otis tarda*	EN	X	Category I. Species threatened with extinction.

Family	Common name (english)	Scientific Name	IUCN Global Status	Kazakhstan Red Book	RDB KZ Status
Anatidae	White-headed duck	*Oxyura leucocephala*	EN	X	Category I. Rare, mosaic distribution.
Otididae	Little Bustard	*Tetrax tetrax*	VU	X	Category II. A species that is endangered in some parts of its range but still survives in significant numbers in Kazakhstan.

Raptor surveys

Recording work in April 2025 included recording predator nesting within the Project site and in a 2-kilometer buffer zone (Figure 28).

As a result of the work in April 2025, 59 nests of birds of prey were found within the survey boundaries, for a total of 63 nests. Of the 59 nests within the Site, 5 were inhabited (marsh harrier, short-toed snake eagle). It should be noted that during the three days of data collection, only part of the saxaul forests within the boundaries of the Site and buffer zone were surveyed.

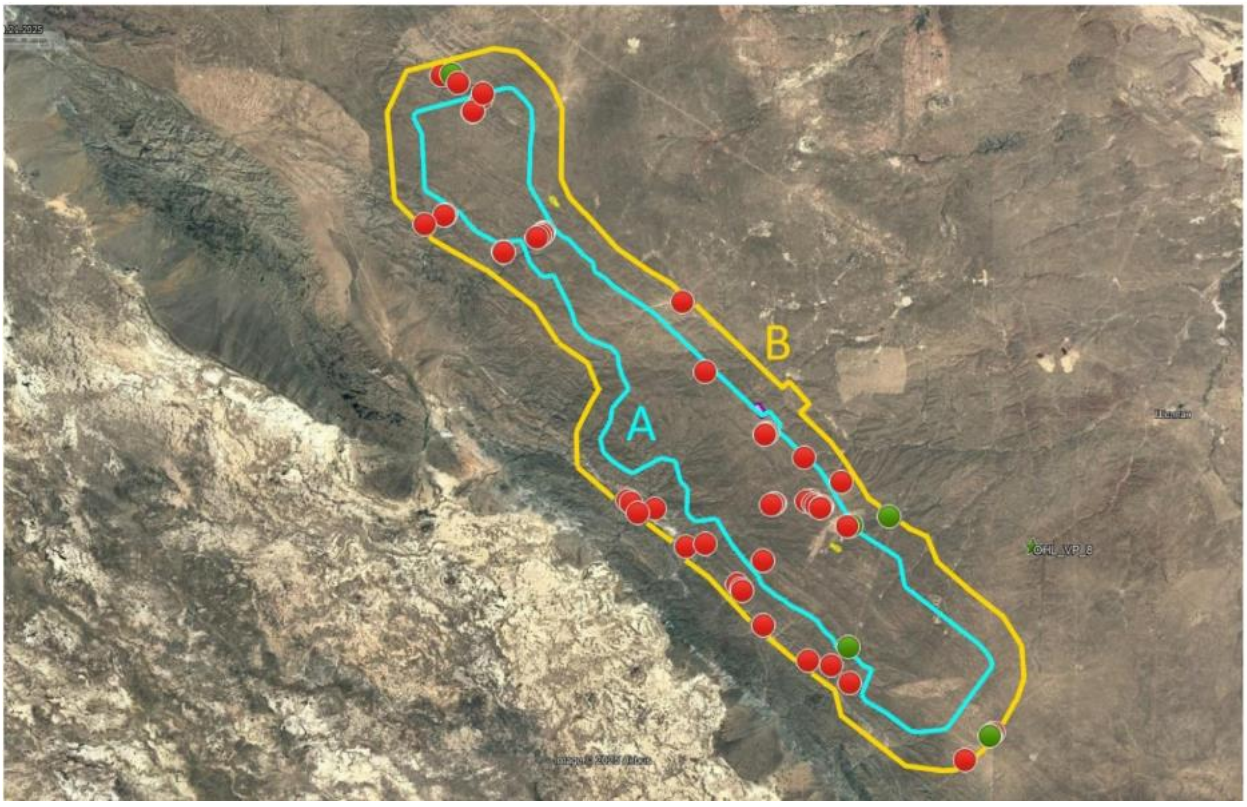


Figure 28: Recorded predator nests in spring 2025[37] (red dots – uninhabited nests, green dots – inhabited nests; A – Project site boundaries, B – 2 km buffer zone boundaries).

[37] Figure taken from the species surveys final report for September 2024 – August 2025 (ACBK Centre for Conservation Biology LLP, 2025)

As indicated on the map, the three active nests are concentrated in the south-eastern the WTGs area. Two of these are located outside the project site, but within the 2 km buffer zone, while one is on the edge of the Project site perimeter.

Migration: raptors

During the autumn 2024, in addition to local breeding species (long-legged buzzard - *Buteo rufinus*, golden eagle - *Aquila chrysaetos*, common kestrel - *Falco tinnunculus*), a significant number of other species of birds of prey were observed migrating: steppe eagle - *Aquila nipalensis*, short-toed eagle - *Circaetus gallicus*, black kite - *Milvus migrans*, white-tailed eagle - *Haliaeetus albicilla*, common buzzard – *Buteo buteo*, harriers (pallid harrier - *Circus macrourus*, hen harrier - *Circus cyaneus*, Montagu's harrier - *Circus pygargus*, marsh harrier - *Circus aeruginosus*), sparrowhawk - *Accipiter nisus*, hobby - *Falco subbuteo*. The black vulture (*Aegypius monachus*), imperial eagle (*Aquila heliacal*) and the saker falcon (*Falco cherrug*) were noted singly.

The main direction of flight can be considered to be the southwest - it is dominant (83%, Figure 29). The average range of flight altitudes is 20-200 m above the ground.

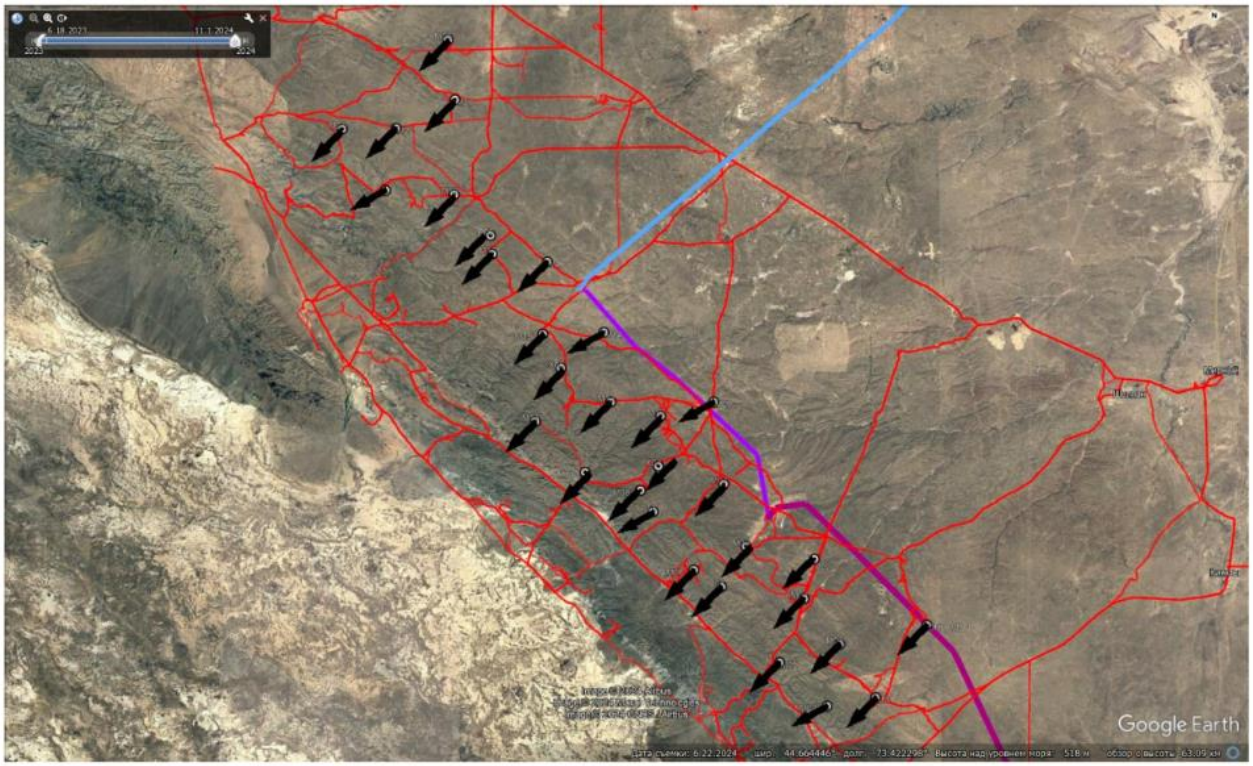
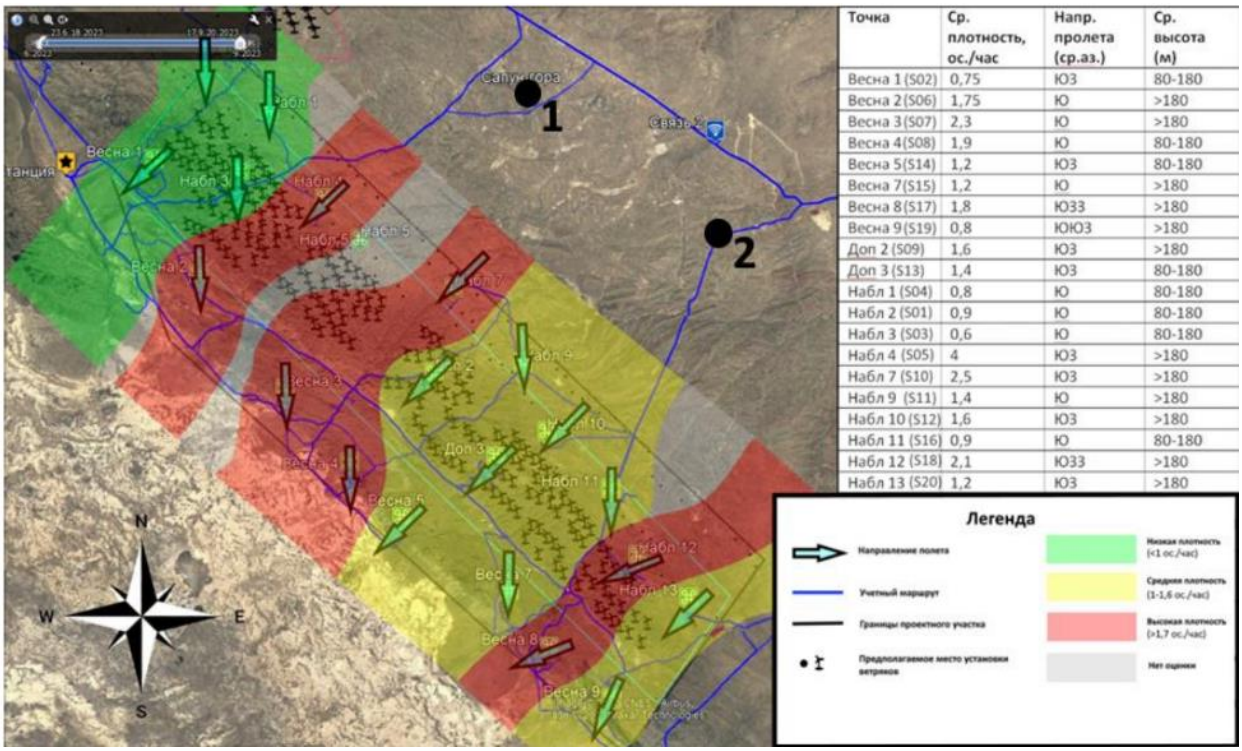


Figure 29: General directions of flight of raptors at stationary observation points (Autumn: September – November 2024 survey).



Точка	Ср. плотность, ос./час	Напр. пролета (ср.аз.)	Ср. высота (м)
Весна 1 (S02)	0,75	ЮЗ	80-180
Весна 2 (S06)	1,75	Ю	>180
Весна 3 (S07)	2,3	Ю	>180
Весна 4 (S08)	1,9	Ю	80-180
Весна 5 (S14)	1,2	ЮЗ	80-180
Весна 7 (S15)	1,2	Ю	>180
Весна 8 (S17)	1,8	ЮЗЗ	>180
Весна 9 (S19)	0,8	ЮЮЗ	>180
Доп 2 (S09)	1,6	ЮЗ	>180
Доп 3 (S13)	1,4	ЮЗ	80-180
Набл 1 (S04)	0,8	Ю	80-180
Набл 2 (S01)	0,9	Ю	80-180
Набл 3 (S03)	0,6	Ю	80-180
Набл 4 (S05)	4	ЮЗ	>180
Набл 7 (S10)	2,5	ЮЗ	>180
Набл 9 (S11)	1,4	Ю	>180
Набл 10 (S12)	1,6	ЮЗ	>180
Набл 11 (S16)	0,9	Ю	80-180
Набл 12 (S18)	2,1	ЮЗЗ	>180
Набл 13 (S20)	1,2	ЮЗ	>180

Figure 30: Raptor movement across the southern Project area in autumn 2024[38].

A number of migratory birds of prey were also observed in spring 2025, in addition to nesting species (long-legged buzzard (*Buteo rufinus*); golden eagle (*Aquila chrysaetos*); common kestrel (*Falco tinnunculus*), a number of birds of the Accipitridae family were observed migrating – the steppe eagle (*Aquila nipalensis*), short-toed snake eagle (*Circaetus gallicus*), harriers – steppe harrier (*Circus macrourus*), the hen harrier (*Circus cyaneus*), the Montagu's harrier (*Circus pygargus*), the marsh harrier (*Circus aeruginosus*), the black kite (*Milvus migrans*), the white-tailed eagle (*Haliaeetus albicilla*), the common buzzard (*Buteo buteo*); honey buzzards (*Pernis apivorus*, *Pernis ptilorhynchus*); a number of birds of the hawk and falcon family – the sparrowhawk (*Accipiter nisus*), the common kestrel (*Falco subbuteo*). The imperial eagle (*Aquila heliaca*) and the booted eagle (*Hieraaetus pennatus*) were observed on rare occasions.

The relatively low number of migratory predators is primarily due to the omission of accounting work in March, when the most massive migration is observed, as confirmed by the 2024 report. Nevertheless, it is still possible to distinguish the ranges of polygons by the parameter of individuals per hour.

Comparing the density of migrating predators with spring 2024, the ranges of the polygons should be equivalent. This means that the ranges should be reduced by 5.4 times (the total number of recorded predators during migration in 2024 was 935 individuals; in 2025 – 173 individuals). Accordingly, the ranges of the polygons in 2025 are: low (0 - 0.4 individuals/hour and individuals/km^2), medium (0.5 –0.7 individuals/hour and individuals/km^2) and high (>0.8 individuals/hour; and individuals/^{km2}) density of migratory predators (for comparison, the ranges of polygons in 2024: <2 individuals/hour and individuals/km^2, 3 individuals/hour and individuals/km^2, and >4 individuals/hour and individuals/km^2, respectively). As in 2024, wide migration corridors are again formed. The main direction of migration can be considered northeast – it is dominant (60%, Figure 31). The average altitude of migration is 20-200 m above the ground.

[38] Figure taken from the species surveys final report for September 2024 – August 2025 (ACBK Centre for Conservation Biology LLP, 2025)

As a result of analyzing data from spring observations in 2024, three corridors with relatively high numbers of birds in migration were also identified. The migration corridors identified in the 2024-2025 observations are relatively similar (Figure 31, see landmarks: 1 - Mount Alatagyl; 2 - turn to the first substation). Given that the similarity in the location of migration corridors is also present in the autumn observations of 2023-2024, it can be confidently stated at this point that the relatively high density of migratory birds of prey in these corridors is quasi-stable from year to year.

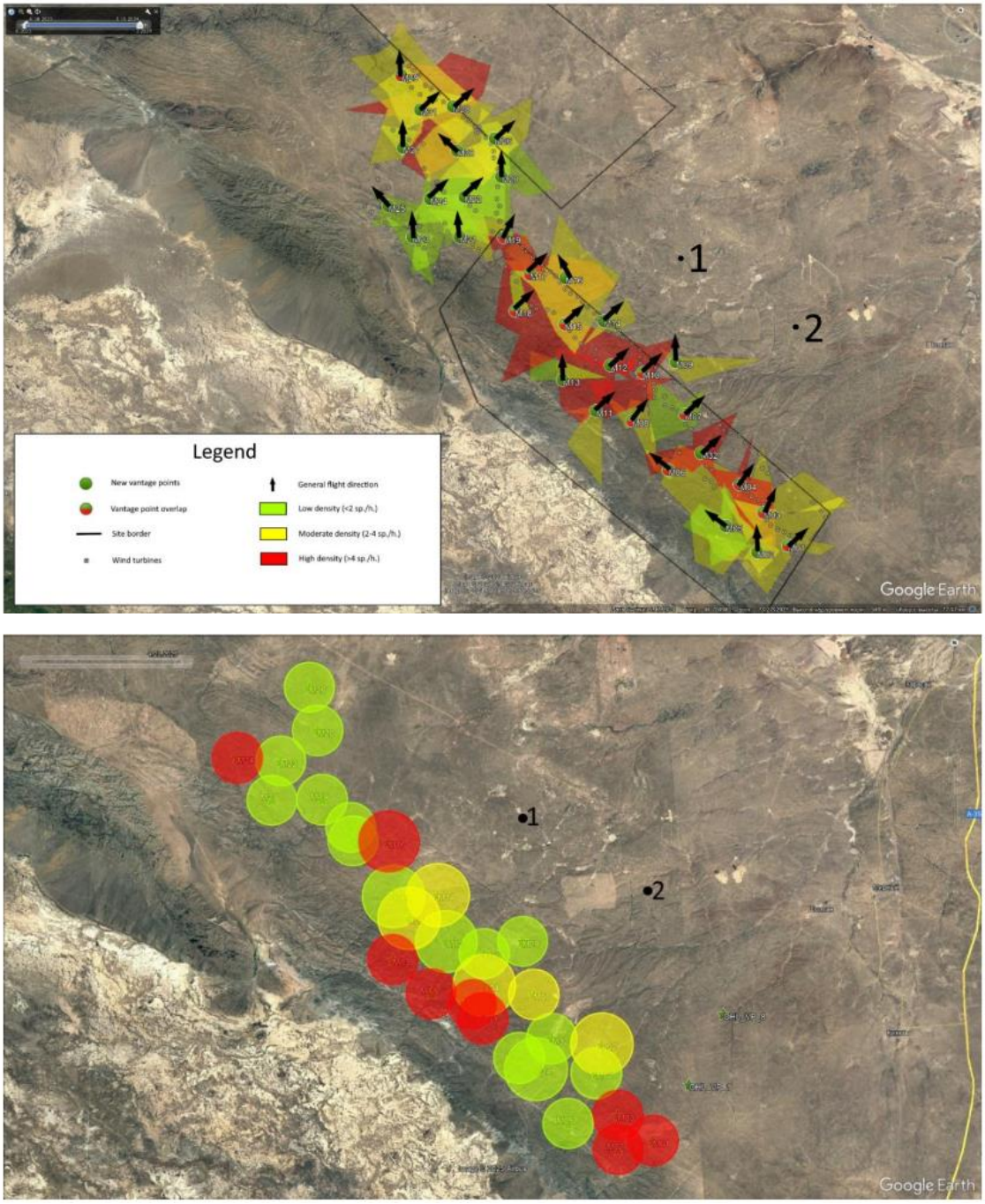


Figure 31: Comparison of predator flight density polygon ranges (obs/hour), top – data from the 2024 analysis, bottom – data from the 2025 analysis[39].

[39] Figure taken from the species surveys final report September 2024 – August 2025 (ACBK Centre for Conservation Biology LLP, 2025)

In order to justify the selection of areas for the installation of wind turbines, according to the methodology, it is not sufficient to simply assess flight density, it is also necessary to analyze data from simulations of possible bird collisions during flight. For this purpose, taking into account migratory bird species, the flight time of birds within this radius was recorded in altitude zones of 0-20 m; 20-200 m; >200 m.

Migration: Waterbirds and other bird species

During the autumn 2024, both the main migration and local movements were observed on a regular basis.

The following species were observed to be migratory: the white pelican (*Pelecanus onocrotalus*), the Dalmatian pelican (*Pelecanus crispus*), the whooper swan (*Cygnus cygnus*), the black-headed gull (*Chroicocephalus ridibundus*), the ruddy shelduck (*Tadorna ferruginea*), the common merganser (*Mergus merganser*), the great egret (*Ardea alba*), and the yellow-legged gull (*Larus cachinnans*). With regard to local movements of birds of the wetland complex, these are primarily comprised of the aforementioned gulls and terns: the gull-billed tern (*Gelochelidon nilotica*) and the common tern (*Sterna hirundo*). The main direction of flight is south-southwest, and for local movements, the northeast and southwest directions are in evidence (corresponding to the geographical location of the large wetlands of Lake Balkhash and the Shu River valley, which provide a route for bird movement). The average range of flight altitudes for pelicans, ducks and herons is between 100 and 1,000 metres, while for gulls and terns it is up to 100 metres above ground level.

Other bird species of interest recorded during autumn work included demoiselle crane (*Anthropoides virgo*), greylag goose (*Anser anser*), houbara bustard (*Chlamydotis macqueenii*), desert raven (*Corvus ruficollis*), little owl (*Athene noctua*), black-bellied sandgrouse (*Pterocles orientalis*), and Pallas's sandgrouse (*Syrrhaptes paradoxus*).
pelican (*Pelecanus crispus*), black-headed gull (*Chroicocephalus ridibundus*), ruddy shelduck (*Tadorna ferruginea*), northern pintail (*Anas acuta*), black-headed gull (*Larus cachinnans*), as well as local movements of waterbirds (mainly movements of ruddy shelducks, black-headed gulls, and gull-billed terns (*Gelochelidon nilotica*). The main direction of migration can be considered north; northeast, and for local movements – northeast and southwest (which corresponds to the geographical location of large wetlands – Lake Balkhash and the Chu River valley). The average altitude range for the migration of pelicans, ducks, and herons is from 50 m to >1 km; for gulls and terns, it is up to 100 m above the ground.

6.3.4.4 Field survey 2024/2025 – OHL

During autumn 2024, winter 2024/2025, spring and summer 2025 surveys, in general, the same species were observed at the observation points of the designed power transmission line as at the points of the wind turbine construction site. Among the birds of prey, the following were observed: long-legged buzzard (*Buteo rufinus*), golden eagle (*Aquila chrysaetos*), common kestrel (*Falco tinnunculus*), steppe eagle (*Aquila nipalensis*), short-toed snake eagle (*Circaetus gallicus*), pallid harrier (*Circus macrourus*), hen harrier (*Circus cyaneus*), Montagu's harrier (*Circus pygargus*), marsh harrier (*Circus aeruginosus*) and white-tailed eagle (*Haliaeetus albicilla*). Among the birds of the wetland, the following were observed: black-headed gull (*Chroicocephalus ridibundus*), ruddy shelduck (*Tadorna ferruginea*), and gull-billed tern (*Gelochelidon nilotica*). In general, by December, a fairly stable composition of wintering birds with low diversity and abundance is established, which persists throughout the winter, with the constant presence of two rare species (Red Book of Kazakhstan), the golden eagle and the white-tailed eagle, and in December, the saker falcon.

6.3.4.5 Collision risk modelling

The results of the collision risk modelling are provided in greater detail within Appendix E: Bird Collision Risk Modelling Report (WSP, 2025)[40]. Thirty eight species were initially identified for the modelling. However, this

[40] WSP (2025) Mirny 1GW Wind Power Project – Kazakhstan. Appendix E: Bird Collision Risk Modelling Report.

was narrowed to exclude birds that were not identified to species level, and which had less than five flights at the potential collision height. Results from surveys in Summer 2023, Autumn 2023, Spring 2024, Autumn 2024, Winter 2024-25, Spring 2025, Summer 2025 have been used for the modelling. Therefore, 13 species were taken forward and included in the modelling:

- Black bellied sandgrouse;
- Black kite;
- Common kestrel;
- Eurasian Hobby;
- Eurasian sparrowhawk;
- Golden eagle;
- Lesser kestrel;
- Little bustard;
- Long legged buzzard;
- Rough legged buzzard;
- Short toed snake eagle;
- Steppe eagle;
- White tailed eagle.

The best estimates of annual collision risk, using the accepted avoidance rates and uncertainties outlined in Section 2.9 of WSP (2025), is given below in the following table for all species for which collision risk was modelled.

Table 13: Best estimate of annual collision risk.

Species	Avoidance rate (%)	Annual collision estimate	Best estimate range
Black bellied Sandgrouse	98%	0.25 ± 82%	0 – 1.1
Black Kite	99%	0 ± 82%	0 – 0.8
Common Kestrel	98%	1.6 ± 32%	1.3 – 1.9
Eurasian Hobby	98%	0 ± 82%	0 – 0.8
Eurasian Sparrowhawk	98%	0.05 ± 82%	0 – 0.9
Golden Eagle	99%	0.6 ± 32%	0.3 – 0.9

Species	Avoidance rate (%)	Annual collision estimate	Best estimate range
Lesser Kestrel	95%	0.05 ± 82%	0 – 0.9
Little Bustard	98%	0 ± 82%	0 – 0.8
Long legged Buzzard	98%	0.05 ± 82%	0 – 0.9
Rough Legged Buzzard	98%	0 ± 82%	0 – 0.8
Short Toed Snake Eagle	98%	0 ± 82%	0 – 0.8
Steppe Eagle	98%	0.1 ± 82%	0 – 0.9
White tailed Eagle	95%	0.05 ± 82%	0 – 0.9

For any additional details, refer to APPENDIX E.

6.3.5 Bats

6.3.5.1 Desk study

Based on the Mammals of Kazakhstan (1985), the following species could be present at the southern Project area: David's myotis (*Myotis davidii*), common pipistrelle (*Pipistrellus pipistrellus*), Savi's pipistrelle (*Hypsugo savii)*, serotine bat (*Eptesicus serotinus*) and particoloured bat (*Vespertilio murinus*).

Data from the IBAT PS6 report lists nine species of bats within 50kms of the Site, three of which are migratory and are known to be especially vulnerable to wind turbine related mortality. Two species are IUCN data deficient (DD), one of which is potentially restricted range (RR), two species are protected as per the Red List of Kazakhstan.

Table 14 includes species that are of importance and protected in the Kazakhstan Red Book and species known to be sensitive to wind development projects.

Table 14: includes species that are of importance and protected in the Kazakhstan Red Book and species known to be sensitive to wind development projects.

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory	Restricted range
Noctule	*Nyctalus noctula*	Least Concern	-	X	-
Particoloured bat	*Vespertilio murinus*	-	-	X	-

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory	Restricted range
Common pipistrelle	*Pipistrellus pipistrellus*	Least Concern	-	X	-
Bobrinski's Serotine	*Eptesicus bobrinskoi*	Data Deficient	X	-	X
European free-tailed bat	*Tadarida eniotis*	Least Concern	X	-	-
Turkestan pipistrelle – a common pipistrelle sub-species	*Pipistrellus pipistrellus aladdin*	Data Deficient	-	-	-

6.3.5.2 Field survey

General habitat suitability

Access to water is limited during the summer, with the rivers and streams almost dry in the second half of June. Only in some places small temporary reservoirs with an open water surface remained. The temporary reservoirs (streams, depressions filled with water) are likely to be suitable for bats. The combination of arid conditions, desert biotopes, topography, remoteness from human settlements determines the poor potential species composition of bats in the study areas.

Roosting and sheltering opportunities

The southern Project area is mountainous, and cracks in the numerous natural outcrops of rock can provide shelter and roosting opportunities for bats. An example of this is shown in the following figure**.** It is worth noting that breeding colonies of the David's myotis aka Steppe bat *Myotis davidii* were recorded in the northern Project area.

Figure 32: Example of fissures in numerous outcrops of rock that could provide shelter and roosting opportunities for bats[41].

[41] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

Bat activity levels

The table below details the quantity of audio files recorded on the transects within the southern Project area. During this time, 1000s of audio files were recorded.

Across the northern and southern Project areas, ultrasonic calls of at least 6 bat species were found in the Project area: serotine bat, Savi's pipistrelle, David's myotis, noctule bat, common pipistrelle, and parti-coloured bat. The most common species in the wind farm area are parti-coloured bat, serotine bat, and noctule bat according to passive detectors operating at a height of 50 m on meteorological masts. The calls of other species were much less frequent. Due to the poor study of bats in Kazakhstan (the last large-scale work was conducted more than 40 years ago), not all ultrasonic calls of bats could be attributed to species whose ranges extend to the Project areas.

All bat species identified are classified as Least Concern and are not considered threatened. The Red Book of the Republic of Kazakhstan (2010) does not include species of bats registered on the territory of the planned wind farm.

Table 15: Quantity of recorded audio files on transects within southern Project area.

Date	Transect ID	Files
22.06.2023	Mountain-5	110
23.06.2023	Mountain-4	116
24.06.2023	Mountain-3	101
25.06.2023	Mountain-2	196
28.06.2023	Mountain-2	110
29.06.2023	Mountain-3	130
30.06.2023	Mountain-5	110
01.07.2023	Mountain-4	127
	Total	**1,000**

During the reporting period, stationary detectors were installed at 38 registration points, 3 of which are meteorological towers. In total, stationary detectors recorded data for 52 detector days, not taking into account the time spent by three detectors on meteorological towers, see the following table.

Table 16: Volume of recorded audio files at stationary points within the southern Project area

Date	Files at Detector A01, № of point	Files at Detector A02, № of point	Files at Detector A03, № of point	Files at Detector A04, № of point
22.06.2023	698	1251	454	159
23.06.2023	184	2939	3569	49
24.06.2023	65			
25.06.2023	65			
28.06.2023	2	426	2707	99
29.06.2023	35			

Date	Files at Detector A01, № of point	Files at Detector A02, № of point	Files at Detector A03, № of point	Files at Detector A04, № of point
30.06.2023	21	318	10	-
01.07.2023	318	-	Data not collected	Data not collected
02.07.2023	-	-		
In total	1,388	4,934	6,740	307
In total for all detectors				13,369

Further driven transects were out in July 2025 (between the 18th and 23rd of July). These additional surveys were commissioned to strengthen the overall bat baseline and to take account of changes to turbine positions from the locations known during the 2023-24 surveys. The results are not yet available as the records have not yet been analysed, but they will be analysed and utilised in the forming of the subsequent Biodiversity Management Plan (BMP).

6.3.6 Herpetofauna

6.3.6.1 Desk study

Data from IBAT indicates twenty-five species of reptiles and one amphibian species are identified within the Study Area. All of these are IUCN Least Concern and one of them is protected under the Kazakhstan Red Book.

The Mirny Wind Power Plant Sites Selection Environmental and Social Constraints Report identified one IUCN Vulnerable, one Near Threatened species as well as 18 other Least Concern species that are not protected[42] as per the following table includes species that are of conservation concern and protected in the Kazakhstan Red Book.

Table 17: Herpetofauna species of conservation concern recorded within the Biodiversity Study Area.

Common name	Scientific name	IUCN status	Kazakhstan Red Book
Steppe tortoise	*Testudi horsfieldii*	Vulnerable	
Central Asian brown frog	*Rana asiatica*	Central Asian brown frog	X

6.3.6.2 Field surveys

Seven herptofauna were recorded at the northern and/or southern Project areas during 2023 survey, these are listed in the table further below. A characteristic feature of the region, except for rocky areas, is the relatively high abundance of the steppe tortoise (*Testudo horsfieldi*) with on average 10 sightings per day, with a run of 20-120 km/day). At the same time, many steppe tortoises were also encountered in April, but many were yet to come out of hibernation.

Table 18: Herpetofauna species of conservation concern recorded across the northern and/or southern Project areas.

Common name	Scientific name	IUCN status
Pewzow's toad	*Bufotes pewzowii or B. zugmayeri*	Near Threatened

[42] EcoSocio Analysts LLP. Mirny WPP Environmental and Social Constraints report.

Common name	Scientific name	IUCN status
Steppe tortoise	*Testudo (Agryonemys) horsfieldii*	Vulnerable
Sunwatcher toadhead agama	*Phrynocephalus helioscopus*	Least Concern
Steppe agama	*Trapelus sanguinolentus*	Least Concern
Rapid racerunner	*Eremias velox*	Least Concern
Dice snake	*Natrix tesselata*	-
Tartar sand boa	*Eryx tataricus*	Least Concern

During 2024-2025 survey, the only amphibian species identified in the area was Perrin's green toad (*Bufotes perrinii*). This species was recently isolated from the collective species *Bufotes gr. viridis* and is known to be a typical inhabitant of the desert areas of Central Asia (Dufresn et al., 2019). During the spring season, the green toad (*Bufonidae*) was observed in the Project site. The species was particularly abundant in proximity to temporary watercourses in the low-hill region. At this time, adult individuals were recorded both visually (i.e. encounters on foot and by car) and by singing (i.e. noted in almost all visited valleys).

A total of ten species of reptiles were encountered, categorised into three distinct orders: Testudinidae (one species of turtle), Sauria (three species of lizard) and Serpentes (two species of snake).

Rare species of reptiles and amphibians have not been found during the herpetofauna surveys in 2025. The steppe tortoise (*Testudo horsfieldi*) has VU status on the IUCN Red List, and the tortoise and the tartar sand boa (*Eryx miliaris*) are included in Annex II of CITES.

6.3.7 Freshwater species

6.3.7.1 Desk study

Although there are no freshwater bodies within the Site or the southern Project area, there are wetlands present to the southwest side of the Project site. Below in the following table are species of conservation concern as per the IUCN red list as well as the Kazakhstan Red Book.

Table 19: Freshwater species of conservation concern recorded within the Study Area.

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory
Ship sturgeon	*Acipenser nudiventris*	Critically endangered	X	-
Chu sharpray	*Capoetobrama kuschakewitschi*	Endangered	X	-
Bulatmai barbel	*Luciobarbus capito*	Vulnerable	-	X
Severtsoy's loach	*Triplophysa sewerzowi*	Vulnerable	-	-
Plain thicklin loach	*Triplophysa labiata*	Vulnerable	-	-
-	*Schizothorax rgentatus*	Vulnerable	X	X (Altitudinal migrant)
-	*Schizothorax pseudoaksaiensis*	Vulnerable	-	-

6.3.7.2 Field study

Control net catches revealed the presence of commercial fish fauna in the surveyed water bodies. The current composition of the fish population in the floodplain water bodies of the lower reaches of the Shu River is presented in Table 20. A total of eight commercial fish species were recorded in scientific net catches in all water bodies. Roach and rudd are considered to be integral components of the fish community in all surveyed water bodies. The results of the studies indicate that the floodplain water bodies of the lower reaches of the Shu River, which are characterised by a shared challenge of water scarcity and relatively similar landscape and ecological conditions in the surrounding area, exhibit distinct species compositions within their fish communities. The distribution of species across all surveyed water bodies is not uniform. The relative abundance of these species, measured in terms of catch per unit effort (i.e. specimens per net day), also varies. The largest number of fish species and their relative abundance were recorded in Lake Akkol and Lake Bolshiye Kamkally. The floodplain systems are distinct from one another, with significant distances separating them. The study area extends for approximately 300 kilometres. The hydroecological conditions for ichthyofauna vary, resulting in different species compositions and ratios in terms of relative abundance. In addition to hydrological conditions, the availability of water bodies to the local population has a significant impact on the fish fauna. For instance, Lake Karakol, which is the uppermost lake in the study area and is believed to have a more stable water balance, had the poorest species composition in scientific net catches. It is worth noting that only four species of fish were recorded as being caught in this lake. This is comparatively less than the number of species recorded in the highly salinated and practically degraded Lake Akzhaikyn. The human impact is clearly evident in this example. Lake Karakol is relatively close and accessible to the population of neighbouring settlements. Lake Karakol is included in the list of fishery water bodies. Furthermore, the lake is situated on the grounds of a hunting farm and is a popular destination for both professional hunters and amateur fishermen. In the terminal lake Akzhaikyn and the uppermost of the surveyed reservoirs, Lake Karakol, an imbalance in the fish communities has been noted. In Lake Akzhaikyn, 85% of the catch is roach, while in Lake Karakol, 58% is rudd. Lake Karakol is characterised by the lowest species diversity and relative abundance of fish species in catches.

Table 20: Species composition and relative abundance of fish fauna in the lakes of the lower reaches of the Shu River (in specimens per net).

Common name	Scientific name	Lake Akzhaikyn	%	Lake Akkol	%	Lake B. Kamkaly	%	Lake Karakol	%
Zherekh	*Leuciscus aspius*	8	1.8	24	5.9	20	4.2	-	-
Redfin	*Pseudaspius leptocephalus*	8	1.8	32	7.8	96	20.3	48	54.5
Bream	*Abramis brama*	-	-	104	25.4	80	16.9	-	-
Perch	*Perca sp.*	-	-	100	24.4	64	13.6	-	-
Roach	*Rutilus rutilus*	376	85.5	76	18.6	152	32.2	16	18.2
Carp	*Cyprinus carpio*	40	9.1	-	-	-	-	-	-
Pike perch	*Sander lucioperca*	8	1.8	4	1.0	-	-	-	-
Pike	*Esox sp.*	-	-	13	3.2	40	8.5	16	18.2

Common name	Scientific name	Lake Akzhaikyn	%	Lake Akkol	%	Lake B. Kamkaly	%	Lake Karakol	%
Ide	*Leuciscus idus*	-	-	56	13.7	20	4.2	8	9.1

Of the water bodies surveyed, Lake Bolshie Kamkaly is also classified as a fishery. Despite the presence of the small village of Shyganak in the immediate vicinity, seven commercial fish species have been recorded in scientific net catches.

Lake Akkol is characterised by the greatest diversity and balance in the relative abundance of recorded fish species. To date, the research has recorded eight species of fish, representing the maximum number recorded during the study period.

It should be noted that four additional fish species were recorded on the shore of Lake Akkol. The remains of a snakehead, which was not among our catches, were found, including five heads of fairly large individuals, presumably up to 60 cm in length. It is evident that these heads were discarded by local fishermen. During a biological analysis of a caught pike, one snakehead specimen measuring 19 cm was recorded. In addition, local fishermen have reported catching fairly large specimens of pike perch, measuring up to 60 cm, carp up to 50 cm, and crucian carp up to 20 cm. A fourth species of non-commercial fish fauna in vivo in shallow water was observed, which we identified as presumably young Chinese gobies. According to the records kept by our research team, the fish fauna of Lake Akkol is made up of 12 species. This is the maximum level of diversity that was observed during the research period in all water bodies. The relatively rich species diversity of Lake Akkol is probably due to the favorable hydrological regime (replenishment by a self-flowing well) and its remote location. Despite its remote location, discarded Chinese-made nylon nets have been found on the shore. Fishermen with similar nets have also been observed.

The biological parameters of the fish specimens caught in all surveyed water bodies were found to be within normal limits. It was noted that the females of all the species under consideration had gonads at stage 3 of maturity. No individuals with developmental abnormalities or internal organ anomalies were found among the catches. It is also important to note that 66% of rudd from Lake Karakol were found to be infected with ligulosis. It should also be noted that ligulosis was identified in one individual bream in Lake Bolshiye Kamkally.

The survey of the lower reaches of the Shu River as part of the project revealed the presence of ichthyofauna in the Ulanbel, Kamkal and Akzhaikyn floodplain water systems. A survey of commercial fish species was conducted in all designated control water bodies, and the results are now available for review. The biological parameters of individuals from scientific net catches indicate satisfactory living conditions for the existing populations. Concurrently, an imbalance in the ichthyocenoses was identified in the terminal lake Akzhaikyn and the uppermost of the surveyed reservoirs, Lake Karakol. The state of the fish community in Lake Akzhaikyn is evident: the reservoir has been severely degraded due to a critical shortage of water resources in the lower reaches of the Shu River.

Lake Karakol is characterised by the poorest species diversity and the lowest relative abundance of fish species in catches. This is obviously due to both reduced water content and significant fishing pressure.

The species composition of the commercial fish fauna is mainly represented by native species. Among the commercial alien species present in the fish communities is the snakehead. A non-commercial alien representative of the Goby family (genus and species as yet undetermined) has also been noted.

Following a comprehensive analysis of the available sources and this research, it is possible to state with a high degree of certainty that an endemic fish subspecies, the Chui ostrolučka, has been lost from the lower reaches of the Shu River basin.

Studies of the water bodies of the lower reaches of the Shu River have shown a high level of degradation of both the riverbed and the floodplain system. A review of existing literature on the subject has revealed that the issue of water scarcity in the region is not a recent development, as supported by the findings of several authors.

Most researchers agree that the water shortage in the lower reaches of the Shu is a result of the irreversible water consumption for irrigation in the upper part of the basin. Due to the transboundary nature of the Shu River, the majority of water resources are consumed in Kyrgyzstan. According to an intergovernmental agreement, the neighbouring state consumes 58% of the flow, despite having a significantly smaller length of the basin on its territory. At the same time, in Kazakhstan, the Tashutkol Reservoir and the region's outdated irrigation system contribute significantly to the disruption of the hydrological regime of the lower reaches of the Shu River.

Finally, it should be noted that the restoration of the fish fauna in the lower reaches of the Shu River is necessary for general environmental reasons. The floodplain system of the lower reaches of the Shu River is an important area for fish-eating and other water birds. During the migration period, a significant number of rare and endangered bird species, including Dalmatian and pink pelicans, Bewick's swans, ospreys, and white-tailed eagles, have been observed gathering here.

From a social perspective, the restoration of fish stocks in the lower reaches of the Shu River is necessary to implement WHO recommendations, according to which each person should consume at least 16kg of fish per year. Given the considerable distance of the region's settlements from major population centers, the local population requires access to high-quality fish products from local water bodies.

6.3.8 Other mammals

6.3.8.1 Desk study

Data from IBAT indicates the Study Area supports 64 species of mammals. Of these, two species are IUCN Critically Endangered, two are Vulnerable, three species are Near Threatened, 54 are Least Concern and three are Data Deficient (DD). The Kazakhstan Red Book also includes one Critically Endangered, two Vulnerable and one Near Threatened species. A part of the migratory route of *Saiga tatarica* has been highlighted as potentially being present. Two species are IUCN Critically Endangered.

The table below includes species that are IUCN threatened (Critically Endangered, Endangered, Vulnerable), those of importance in the Kazakhstan Red Book and species known to be sensitive to wind development projects.

Table 21: Mammal species of conservation concern recorded within the Study Area.

Common name	Scientific name	IUCN status	Kazakhstan Red Book	Migratory
Common hamster	*Cricetus cricetus*	Critically Endangered	-	-
Saiga	*Saiga tatarica*	Near Threatened	X	X
Goitered gazelle	*Gazella subgutturosa*	Vulnerable	X	-
Marbled polecat	*Vormela peregusna*	Vulnerable	X	-
Argali	*Ovis ammon*	Near Threatened	X	-

6.3.8.2 Field survey

Ten species of mammals (excluding bats) were recorded during surveys in the southern Project area during 2023 survey. These are listed in the following table. Two of the mammal species recorded on the surveys are included in the Red Data Book of the Republic of Kazakhstan, these are: Goitered gazelle (*Gazella subgutturosa*) Vulnerable in IUCN Red List and argali (*Ovis ammon karelini*) Near Threatened. There are no other protected species of animals, including those threatened according to the IUCN Red List.

Table 22: Mammals recorded within the southern Project area.

Common name	Scientific name	IUCN status	Kazakhstan Red Book
Asian badger	*Meles leucurus*	Least Concern	-
Steppe cat	*Felis lybica ornata*	Least Concern	-
Red fox	*Vulpes vulpes*	Least Concern	-
Jackal	*Canis aureus*	Least Concern	-
Wild boar	*Sus scrofa*	Least Concern	-
Goitered gazelle	*Gazella gracilicornis*	Vulnerable	-
Argali	*Ovis ammon karelini*	Near Threatened	X
Tolai hare	*Lepus tolai*	Least Concern	-
Great gerbil	*Rhombomys opimus*	Least Concern	-
Eastern mole-vole	*Ellobius tancrei*	Least Concern	-

The main observations of mammals were conducted in 2023-24. As part of the Project's bird migration monitoring programme, observations of mammals were conducted in the designated area during the April-May period of 2025. All encounters with animals were meticulously documented. As a result of monitoring, *Meriones libycus*, *Meriones tamariscinus*, and *Microtus socialis* were added to the list of mammals encountered in the Project site during the 2023-2024 survey.

Argali

The Tien Shan subspecies of argali (Ovis ammon karelinii) lives in the southern Project area. It is included in the Red Book of the Republic of Kazakhstan as a declining species (category 2). It was recorded by seven camera traps within the southern Project area, including in all camera traps operating in the small hills of Koizharylgan and Mayzharylgan, of which a large number of recordings the argali were in groups of 2 to 6 animals. In addition, argali were visually observed over the course of the year and/or their traces (droppings, trails, beds) were noted at 73 points in the same two types of habitats across the northern and/or southern Project areas. The distribution of argali within in the southern Project area is presented below.

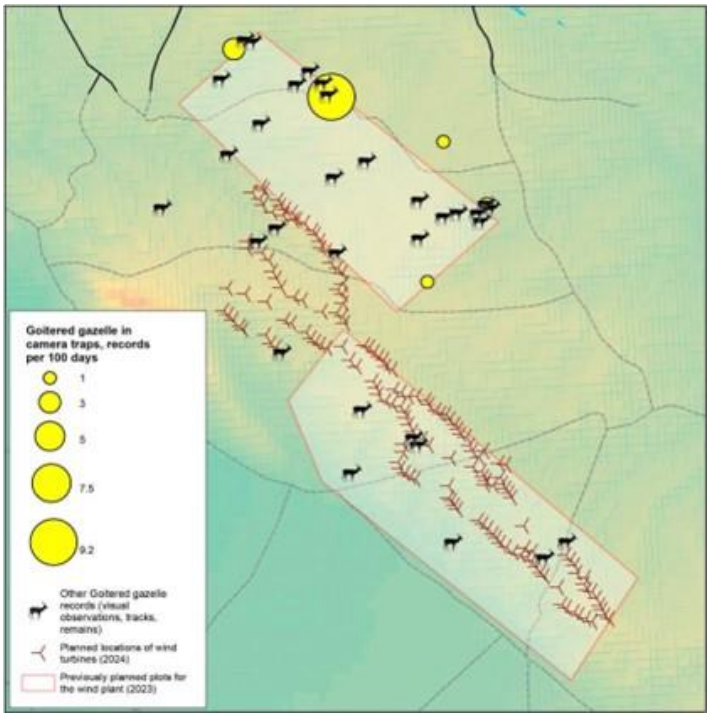


Figure 33: Records of argali in the southern Project area, May 2023 – May 2024[43].

Argali were found in the southern Project area in all seasons of the year. The occurrence in the summer season (from April to October) is noticeably higher than in the winter season (November-March), which reflects a general decrease in the activity of animals during the cold period. No differences in the general distribution of the population in the summer and winter seasons were identified - the areas of summer and winter occurrences on the ground are not separated (see Figure 34).

[43] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

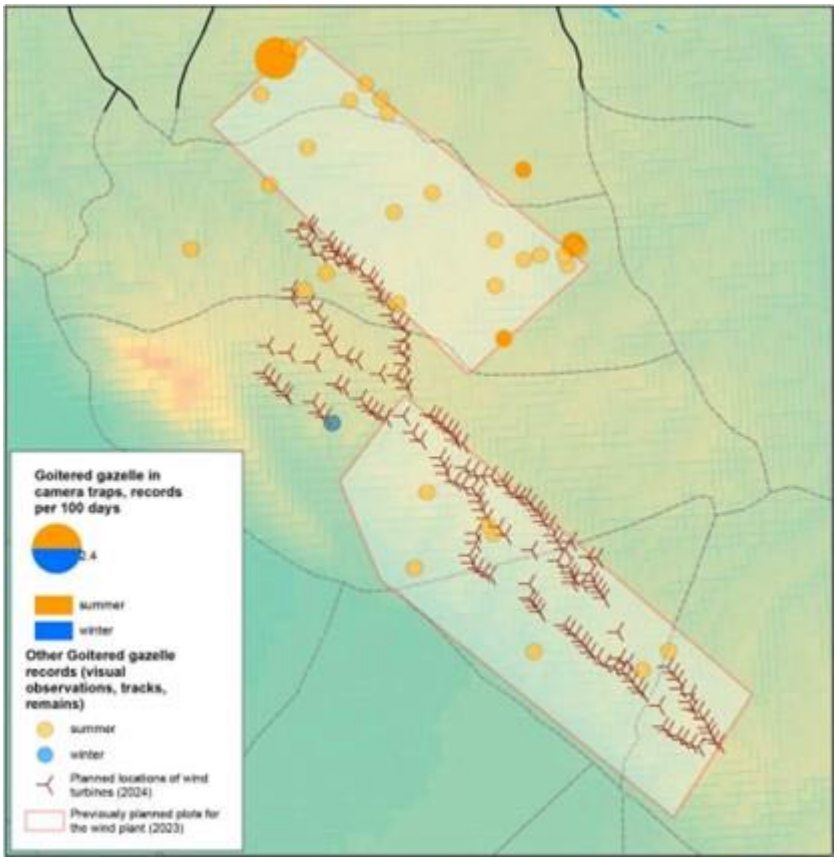


Figure 34: Winter (November-March 2023/2024) and summer (April-October 2023) records of argali in the southern Project area[44].

ll age and sex groups of argali were recorded, including females with lambs. The earliest sightings of lambs was 19 and 20 May. Judging by their estimated age, lambing took place (in 2023) in the middle of April.
Argali living in low dry mountains with desert vegetation, usually have relatively high mobility. During the season they do not make long-distance directed movements (migrations), but actively move up to 5 km (for females with lambs) and more (for males) for grazing, to watering holes and for rest, and back to places to graze (Fedosenko and Kapitonov, 1983[45]; Berber, 2007[46]). Based on this, a 3km buffer was built around each argali observed to indicate the approximate distribution for argali in the surveyed territory. As shown below, argali inhabit predominantly the small hilly part of the southern Project area. This area includes almost the entire southern Project area, and subsequently the Site.

[44] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)
[45] Fedosenko A.K., Kapitonov V.I. (1983). Argali – Ovis ammon. In: Mammals of Kazakhstan. Vol. 3, part 3. 144-208. (in Russian)
[46] Berber A.I. 2007. The Argali (Ovis a. ammon) of Kazakh tableland. Karagandy: Printing house TAiS. 168 pp. (in Russian)

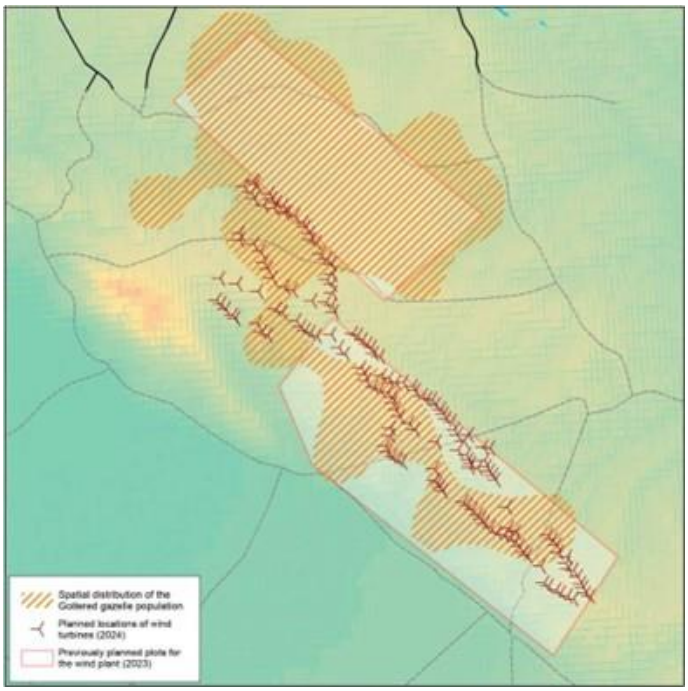


Figure 35: Estimated distribution of argali population within the southern Project area[47].

During the September 2024 – August 2025 survey, Argali was observed on multiple occasions as part of the ongoing bird seasonal stationary surveys. However, these sightings were recorded within the previously established distribution boundaries.

Data on argali encounters in summer 2025 reflects both route encounters (vehicle and pedestrian transects) and observations from fixed observation points. In quantitative terms, only 17 individuals were observed in 2025 (Figure 36). It should be noted that the average number of working hours and travel time by car is 25-30% less than in 2024 (due to the absence of autumn and winter observations in 2025). A decrease in the number of observed argali should therefore be expected, although not to such an extent (the observed number is only 13% of the observed number in 2024). Another potential explanation for the observed decline in the population is the gradual increase in anthropogenic pressure on the territory. This pressure is the result of the activities of geologists, archaeologists, mountaineers and others, and has a direct and indirect impact on the location and movement of argali within their habitat.

[47] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

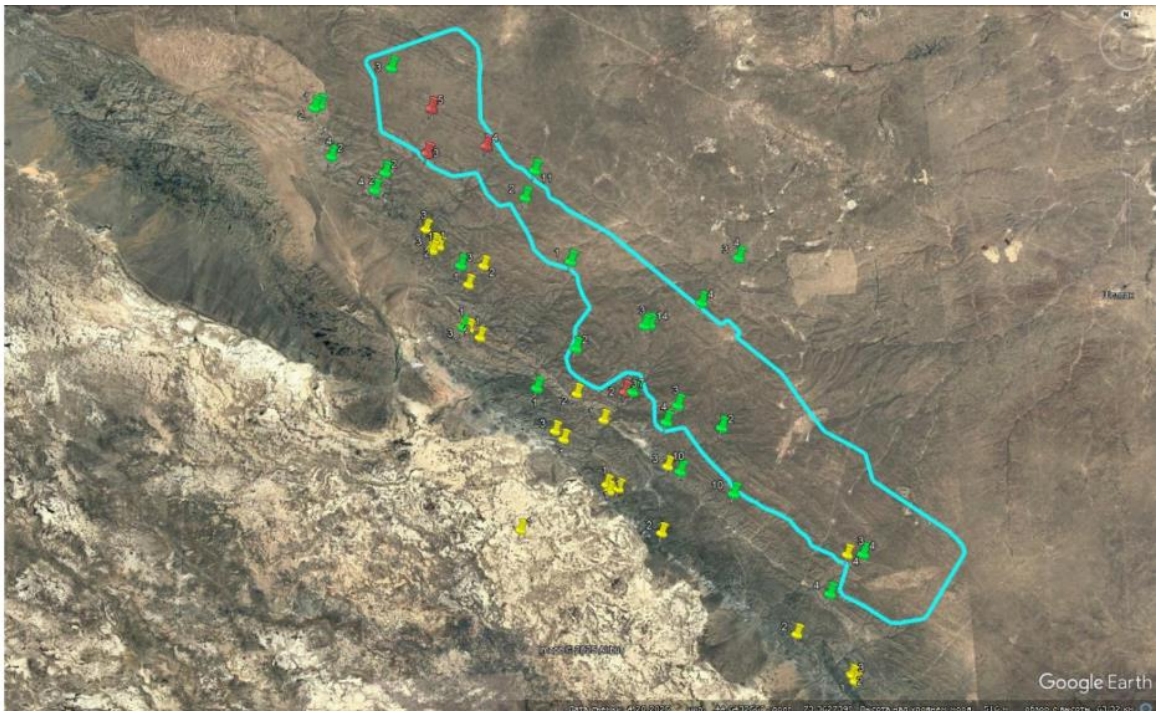


Figure 36: Map of argali sightings, 2025 (the Project site boundary is shown in blue, and individual 2025 sightings are shown in red, 2024 sightings in green and 2023 sightings in yellow).[48]

Goitered gazelle

The subspecies of gazelle living in Kazakhstan (*Gazella subgutturosa gracilicornis*), is listed in the Red Book of the Republic of Kazakhstan as a rare species (category 3). The camera traps within the southern Project area did not record any goitered gazelle, however other evidence was observed within the southern Project area (e.g. sightings, tracks, droppings) (see figure below).

[48] Figure taken from the species surveys final report for September 2024 – August 2025 (ACBK Centre for Conservation Biology LLP, 2025)

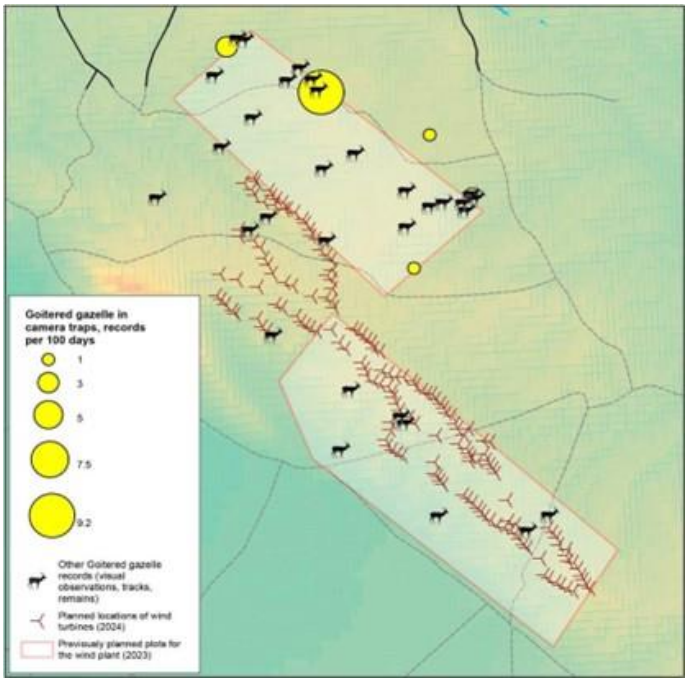


Figure 37: Records of goitered gazelle in the southern Project area, May 2023 – May 2024[49].

Goitered gazelle makes regular seasonal migrations. The vast majority of sightings occurred during the warm season, from April to October, while winter sightings are very few (see figure below).

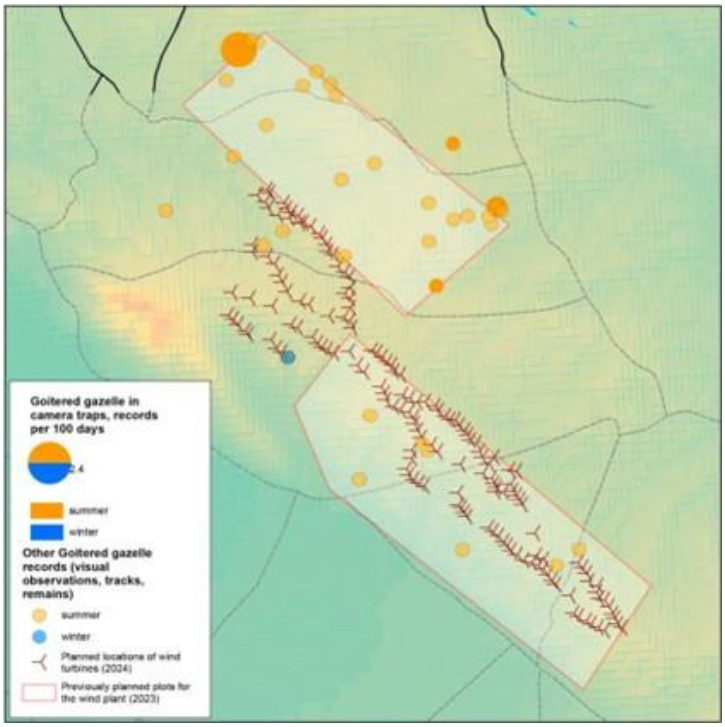


Figure 38: Winter (November-March) and summer (April-October) records of goitered gazelle in the southern Project area.[50]

[49] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

[50] Figure taken from the species surveys final report for April 2023 – May 2024 (ACBK Centre for Conservation Biology LLP, 2024)

Goitered gazelles live in the summer in the east of Betpak-Dala, and winter in the Moyynkum sands. They undertake longer-distance seasonal migrations, up to 500km. The Project areas in a broad sense are to the east of Betpakdala. Thus, the goitered gazelles here may migrate from the Project areas to the Moyynkum sands or further to the southwest for winter. However, reliable direct data on the direction and range of migrations of this group are currently missing. Based on the results of the surveys, the goitered gazelle inhabits the Project areas mainly in the summer, while only a few individuals remain for the winter.

All age and sex groups of goitered gazelle, including underyearlings, were recorded. The estimated distribution of the goitered gazelle is shown below. Evidence of the goitered gazelle in the southern Project area is confined mainly to valley saxaul forests and, in general, to wide, well-developed valleys with floodplain terraces. The area of the gazelle habitat in the Project territory is approximately 950 km2.

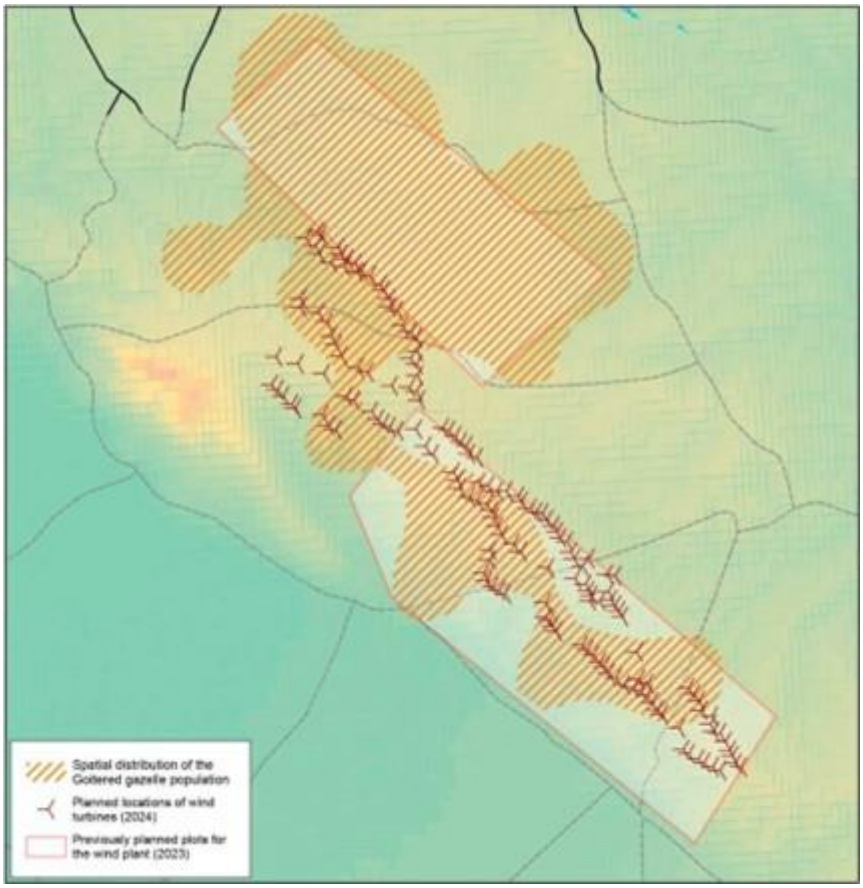


Figure 39: Estimated distribution of goitered gazelle population within the southern Project area.

During the September 2024 – August 2025 survey, goitered gazelle was observed on multiple occasions as part of the ongoing bird seasonal stationary surveys. However, these sightings were recorded within the previously established distribution boundaries.

Greater gerbil

This species is endemic to deserts and is distributed across a vast range, extending from the temperate desert zone to the semi-desert regions in the north, where large gerbil settlements have been observed. The preferred habitats of the species are determined primarily by the suitability of the soil for burrowing, the micro-relief of the terrain, and the nature of the vegetation cover, as well as the depth of the water table. The large gerbil is characterised by its propensity for a family-colonial lifestyle, which is exhibited throughout the year, with activity occurring diurnally. The complex burrow system of gerbils, which has been designated a "colony" in the extant literature, is a substantial and typically conspicuous structure. It possesses a discernible ecological centre and

periphery, exhibiting multiple exits situated at varying distances from one another, with a depth reaching a maximum of 2.5-3 metres.

In the vicinity of bird observation point OHL_VP_6, great gerbil settlements are diffuse in nature, with a density ranging from 0.3 to 4.0 per 1 ha, averaging 2.3. During the observation period (the second ten days of April), the occupancy rate of the colonies was 91% (based on an inspection of 100 colonies), with an average of 2.2 animals per inhabited burrow before the young emerged. At monitoring point OHL_VP_7, changes in the sand vole population in an anthropogenically altered microlandscape were examined. When a water pipeline was installed several years ago, a mound of clay soil was formed, which was subsequently colonised by large sand voles. During monitoring along a linear route along the embankment, nine colonies were counted per kilometre of the route, and seven in the natural landscape. The difference was 30%, but the changes per unit area were less significant. At the same time, the habitability of the colonies and the number of animals per burrow were the same in both cases – 89% habitability of burrows and eight animals per burrow (beginning of the second decade of May, emergence of young animals to the surface).

Following a thorough investigation, it has been determined that the colonies are located at a distance of 20 to 200 m or more from each other, based on the trench dug in previous years and the embankment of soil from it, passing through the bird observation points M04 and P02. In the natural landscape of this area, isolated colonies have been noted at a considerable distance from each other. In both cases, burrows were found in loamy soil. No burrows were found in another section of this ditch, which has a rocky embankment stretching for 2 km.

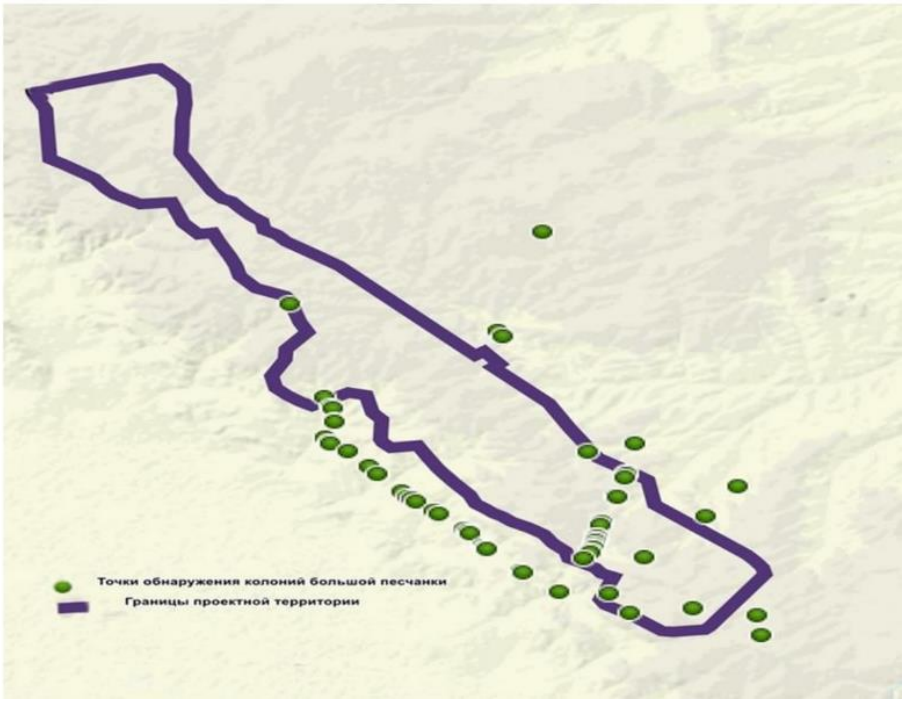


Figure 40: Distribution pattern of the great gerbil in the Project site[51]

Libyan gerbil

Meriones libycus is widespread in Kazakhstan, inhabiting clayey and gravelly deserts from the northeastern coast of the Caspian Sea to the southern part of the country. The Cricetidae subfamily Gerbillinae is present in Kazakhstan's clayey and gravelly deserts, which extend from the northeastern coast of the Caspian Sea in the

[51] Figure taken from the species surveys final report for September 2024 – August 2025 (ACBK Centre for Conservation Biology LLP, 2025)

west to the border with China in the east. The animal displays a marked preference for desert lowlands and foothills with clayey and clayey-gravelly soils throughout its range.

According to the incomplete data collected, the Libyan gerbil is present in the majority of the Project site, with the exception of areas characterised by mountainous terrain and exposed rock formations. Its distribution is in a mosaic pattern and it does not form large settlements. Settlements have been identified in areas of boilyach, grassland, wormwood and various herbs, as well as in rolling plains and hillsides, and in valley bushes. During the survey, the average occupancy rate of burrows was between 55 and 65%.

Tamarisk gerbil

Meriones tamariscinus is a rodent species of gerbil and requires a high level of moisture in order to thrive. It is found in mesophytic habitats with succulent vegetation. The Cricetidae subfamily Gerbillinae is characterised by its high moisture tolerance, making it one of the most moisture-loving species among gerbils. These species prefer mesophilic habitats with succulent vegetation. Its distribution is mosaic but widespread, extending from the northeastern Caucasus to northwestern China. Gerbillinae are most commonly found in river floodplains, dry riverbeds and shallow, fixed sands, where there is well-developed shrub and tall grass vegetation. These species are able to thrive in areas characterised by thickets of juniper, salt marshes and wormwood, often found in proximity to salt lakes. Comb-toothed gerbils are known to be creatures of habit,and tend to be most active at dusk and during the night.

In the Project site, the Tamarisk gerbil has been observed to be present in low-lying areas characterised by tamarisk shrubs, and along streams in thickets of shrubs and weedy vegetation.

Common vole

Microtus socialis is distributed in isolated areas of dry grassland and grass-wormwood steppes, as well as semi-deserts of plains and foothills in Kazakhstan. The formation of colonial settlements is characterised by a system of shallow burrows, each with up to 40 entrance holes. It leads a mainly crepuscular and nocturnal lifestyle. The population is subject to significant variations due to weather and climatic conditions. In years of high population, it is one of the main food sources for small terrestrial predators, as well as some birds of prey, such as the common and steppe buzzards, kestrels, and owls.

The Project site is characterised by the presence of slopes in hilly plains, with a distinctive gravelly loam soil. These areas are notable for their boylyach shrubs and plant associations comprising wormwood and grasses. It should be noted that this vole is more widespread across the territory of the proposed wind farm construction and its infrastructure facilities than the data above suggests.

6.3.9 Invertebrates

6.3.9.1 Desk study

It is estimated the number of invertebrate species (Invertebrata) in the southeast and south of Kazakhstan approaches 100 thousand. Although the invertebrate fauna is generally poorly studied and invertebrate reports specific to this territory are absent, the presence of many unique, rare, endemic and relict species has been reliably established here. The gaps in the knowledge of the invertebrate fauna therefore does not allow an exhaustive description of the invertebrate fauna that is present in this region. Instead, the descriptions of the following species groups have been made using available indicative information on relatively well studied groups.

Annex 7 of the ACBK final report for April 2023 – May 2024 (2024) details a preliminary list of key indicator insect species of the region. The report also lists the typical species of invertebrates found in the main ecosystem complexes within the Study Area, as well as invertebrates associated with aquatic biotopes. Depending on the type of landscape, five main faunistic complexes can be distinguished: stony-desert, sandy-desert, clay-desert, saline and intrazonal meadow-steppe. These complexes include all the main groups of invertebrates living in the desert zone. However, the species composition of each complex is unique and depends on the ecological

preferences of its representatives. Insects, for example, are tied to certain biotopes or groups of biotopes, which is determined by their connection with vegetation and microclimate, as well as the degree of ecological plasticity of the species.

Worms (Vermes)

This group consists of four types (annelids - more than 100 species, nemerteans - several species, primary cavity worms - several hundred species, flatworms - more than 100 species). In the territory, only helminths parasitizing vertebrates have been relatively well studied. Of the nematodes, several dozen agricultural pests species are known.

Molluscs (Mollusca)

This group of invertebrates inhabiting terrestrial biotopes is numerous in terms of species and population density. In the southern half of Kazakhstan, there are about 300 species from 69 genera of 36 families (Увалиева, 1990[52]). The heavily peneplained Shu-Ilei Mountains are inhabited by representatives of 27 species from 17 genera and 14 families. Of these, 9 species are widespread with a palearctic range and species from the families Buliminidae (4), Dradybatnidae (3), Hygrominidae (3 species). Representatives of two ecological groups of mollusks are found here: species living on rocks, rubble screes, among stone blocks overgrown with xerophilic shrubs, and species living in intrazonal biotopes with psychrophilic vegetation. The malacofauna of the semi- desert zone is similar in species composition to that of the steppe zone, but in a slightly different ratio and consists of 17 xerophytic species adapted to an extremely dry climate. There is not a single endemic genus here, and endemics of the species rank belong to the genera Carychium, Lindholmomneme, Xerosecta. The most widespread species of mollusks, usually having a palearctic range and occurring in large quantities, such as *Bradybaena lantzi*, *Ponsadenia semenovi*, *Angiomphalia regeliana*, *Pseudonapaeus seculinus*, *Oxyloma sarsi*, *Zonitoides nitidus*, *Pupilla muscorum* (Увалиева, 1990). The distribution of mollusks is very uneven and is determined by the conditions of specific habitats i.e. they are not present in areas devoid of water and vegetation. In dry habitats, they gravitate towards depressions in the relief and water sources, where they can form dense populations.

Arachnida

Arachnida in arid areas include ticks, scorpions, solpugas and spiders.

Eight species of scorpions (Scorpiones) are present within deserts and semi-deserts. They are active at night and during the day they hide under stones, in cracks in the ground, destroyed buildings and other shelters. The food is most often insects, as well as arachnids, woodlice and other arthropods (Arthropoda).

Solpugas (Solifugae), are distributed mainly in desert and dry biotopes. The Asian fauna is characterized by the presence of five endemic genera (*Gylippus, Karschia, Gluviopsis, Triditarsus, Dinotrax*), while the genus *Galeodes* is especially numerous. They feed on insects and other invertebrates, and partly also small vertebrates, such as lizards.

Spiders (Araneae), the most numerous groups in the class, are able to react sensitively to the deterioration of the environmental situation due to pollution by industrial waste and can be successfully used as bioindicators. About 367 species of spiders, 127 genera and 32 families are classified as inhabitants of the desert and semi-desert zone (Виноградов, 1948[53]). Species of the Lucosidae family are notable. Common genera and families

[52] Uvalieva K.K. (1990) Terrestrial mollusks of Kazakhstan and adjacent territories. Almaty, Science

[53] Vinogradov B. S., Tugarinov A. Ya., Chernov S. A. (1948) Formation of the modern fauna of the zone deserts //Animal world of the USSR. – T. 2. – P. 321-331.

of spiders in the desert include the genus Tegenaria, and spiders of the Lephthyphantes, Pholcidae, Uroctenidae, Agelinidae families (Виноградов, 1948).

Insects

The fauna of this group in Kazakhstan is not well studies. It consists of 28 orders, which is more than 550 families (Митяев et al., 2005[54]) and includes numerous endemic species and species of scientific interest. 459 species of insects belonging to 7 orders, 40 families, 253 genera were identified in the steppe zone (Кадырбеков, 2016). The fauna of the southern semi- desert and desert regions is no less diverse. It is estimated the region includes at least 2000 species, including about 50 species of orthoptera, 150 species of homoptera, 200 species of hemiptera, 500 species of beetles, 400 species of hymenoptera, 350 species of lepidoptera, 300 species of diptera, and 50 species of all other insects (Мелдебеков et al., 2011[55]).

Rare and endangered invertebrate species

According to the available preliminary data, there are 12 species listed in the Red Book from 7 orders (Red Data Book of RK, 2006), these are listed in the following table.

Table 23: Invertebrate species listed on the Red Data Book.

Common name	Scientific name	IUCN status	Kazakhstan Red Book
Beautiful demoiselle	Calopteryx virgo (Odonata)	Least Concern	X
Blue emperor	*Anax imperator* (Odonata)	Least Concern	X
Bolivar's short winged mantis	*Bolivaria brachyptera* (Manthoptera)	Dada Deficient	X
Common predatory bush-cricket	*Saga pedo* (Orthoptera)	Vulnerable	X
-	*Ceraeocercus fuscipennis* (Orthoptera)	-	X
-	*Porphyrophora sophorae* (Homoptera)	-	X
-	*Porphyrophora victoriae* (Homoptera)	-	X
-	*Dorcadion balchashense* (Coleoptera)	-	X
-	*Chilocorus bipustulatus* (Coleoptera)	-	X
-	*Stethorus punctillum* (Coleoptera)	-	X
-	*Sphex flavipennis* (Hymenoptera)	-	X
-	*Coenonympha mongolica* (Lepidoptera)	-	X

[54] Mityaev I. D., Kazenas V. L., and Kashcheev V. A. (2005) History, state and prospects of entomology in Kazakhstan //Proceedings of the Institute of Zoology of the Ministry of Education and Science of the Republic of Kazakhstan. Almaty. – T. 49. – P. 73

[55] Materials for the Cadastre of the fauna of the Almaty region. Part 1 – Insects. (Tr.In-ta zool., vol. 53). – Almaty: Nur-Print, 2011. - 390 p.

The lack of accurate data in this regard indicates the need for effective measures for the general conservation of all biodiversity.

6.3.9.2 Field study

Depending on the type of landscape, five main faunistic complexes can be distinguished: stony desert, sandy desert, clay desert, saline and intrazonal meadow-steppe.

However, it should be noted that the species composition of each complex is unique and depends on the ecological preferences of its representatives. For instance, insects are linked to specific biotopes or groups of biotopes. These are determined by their relationship with vegetation and the microclimate, as well as the degree of ecological plasticity of the species.

A significant proportion of species can be found in multiple habitats, a consequence of their diverse ecological requirements. Concurrently, each desert type contains minute inclusions of other types, thereby enabling the existence of species adapted to the conditions of these "alien deserts". For instance, within mountain rocky deserts, there are small areas of sand, clay or saline, which are home to characteristic species of invertebrates. Similar "alien" inclusions have also been found in other deserts.

Typical species of invertebrates of the main ecosystem complexes are listed below:

Stony-desert complex. *Amara aenea* De Geer, *Cleonis pigra* (Scopoli), *Mylabris sibirica* F.-W., *Ocypus cupreus* (Rossi), *Prosodes rugulosa* Gebl, *Cicadatra querula* Pall., *Bembix bicolor* Rad., *Cerceris flavicornis* Br., *Tachysphex incertus* Rad., *Cataglyphis aenescens* Nyl., *Formica pratensis* Retz., *Sphex funerarius* Guss., *Eumenes sareptanus* Andre, *Pontia daplidicae* (L.), *Euchloe pulverata* (Christoph), *Chazara enervata* (Alpheraky), *Melanargia russia* (Esper), *Oedipoda coerulescens* (L.), *Sphingonothus nebulosus* (Fischer-Waldh.), *Asiotmethis muricatus* (Pallas), *Decticus verrucivorus* (L.), *Mesobuthus eupaeus* Koch.

Sand-desert complex. *Julodis variolaris* Pall., *Scarites bucida* Pallas, *Lasiostola pubescens* (Pall.), *Opatrum sabulosum* L, *Carpocoris fuscipennis* Boheman, *Cicadatra querula* Pall., *Bembecinus tridens* (F.), *Bembix oculata* Panzer, *Bembix gracilis* Handl., *Oxybelus* spp., *Sphecius lutescens* (Rad.), *Tachysphex desertorum* F.Mor., *Cataglyphis pallidus* (Mayr), *Podalonia tydei* (Guillou), *Prionyx niveatus* (Dufour), *Prionyx viduatus* Christ., *Katamenes dimidiatus dimidiatus* (Brullé), *Pontia daplidicae* (L.), *Myrmeleon formicarius* L, *Dericorys tibialis* (Pallas), *Ochrilidia hebetata* (Uvarov, 1926).

Clay-desert complex. *Harpalus distinguendus* (Duftschmied), *Chrysolina graminis* (L.), Theone silphoides Dalm, *Chrysochares asiatica orientalis* Lopatin, *Cerocoma schreberi* (F.), *Adesmia gebleri* Gebler, *Pimelia cephalotes* Pall., *Graphosoma lineatum* L., *Cicadatra querula* Pall., *Aphis craccivora* Koch, *Cerceris buprestic*ida Duf., Lindenius albilabris (F.), *Bembix bicolor* Rad., *Cerceris flavicornis* Br., *Liris nigra* (Lind.), *Oxybelus mucronatus* (F.), *Tachysphex mediterraneus* Kohl, *Cataglyphis aenescens* Nyl., *Messor aralocaspius* Ruzsky, *Scolia (Scolioides) schrenckii* Eversmann, *Ammophila heydeni* Dahlbom, *Prionyx kirbii* (Lind.), *Prionyx subfuscatus* (Dahlb.), *Sphex flavipennis* Fabricius, *Polistes* (s. str.) *nimpha* (Christ), *Orgyja dubia* Tausch., *Tyta luctuosa* (Denis & Schiffermuller), *Colias erat*e Esper., *Gonepteryx rhamni* (L.), *Pontia daplidicae* (L.), *Chazara enarvata* (Alpheraky), *Mantis religiosa* L., *Ascalaphus macaronius* Schneider, *Arcyptera microptera* (Fischer-Waldh.), *Calliptamus italicus* (L.) , *Celes variabilis* (Pallas), *Dociostaurus kraussi* (Ingen.), *Oedaleus decorus* (Germar), *Ramulus bituberculatus* Redt., *Latrodectus tredecimguttatus* (Rossi).

Salty-desert complex. *Chrysochares asiatica orientalis* Lopatin, *Cicindela littoralis conjunctaepustulata* Dokht., *Bulaea lichatshovi* Hum., *Chromosomus verrucosus* (Gebler), *Anechura asiatica* Semenov, *Cerceris rubida* Jur., *Vespula (Paravespula) germanica* (F.), *Eremochares dives* (Brulle), *Epacromius tergestinus* (Charpentier), *Sphingonothus halophilus* Bey-Bienko, *Gryllotalpa unispina* Saussure, *Chrotogonus turanicus* Kuthy, *Pyrgomorpha bispinosa* Walker; *Lycosa singoriens*is; *Hemilepistus* sp..

Intrazonal meadow-steppe complex. *Calosoma sycophanta* L., *Plagionotus floralis* Pall.,*Cetonia aurata* (L.), *Lipara lucens* Meigen, *Adelphocoris lineolatus* Goeze, *Lygus pratensis* L., *Dolycoris baccarum* L., *Aphis craccivora* Koch, *Bombus terrestris* L., *Glyptomorpha discolor* (Thunb.), *Cerceris tuberculata* Vill., *Trypoxylon scutatum* Chevrier, *Polistes dominula* Christ, *Vespula (Paravespula) germanica* (F.), *Lythria purpurata* (L.),

Carcharodus alceae (Esper), *Thymelicus lineola* L., *Aricia agestis* (Denn. et Schiff.), *Eumedonia eumedon* Esper, *Lycaena phlaeas* (L.), *Polyommatus icarus* (Rott.), *Thersamonia thersamon* Esper, *Argynnis pandora* (Den. et Schiff.), *Issoria lathonia* (L.), *Nymphalis urticae* (L.), *Vanessa cardui* L., *Papilio machaon* L., *Anthocharis cardamines* (L.), *Aporia crataegi* L., *Colias erate* Esper, *Chorthippus biguttulus* (L.), *Melanogryllus desertus* (Pallas), *Gryllotalpa unispina* Saussure, *Platycleis intermedia* (Audinet-Serville), *Tettigonia caudata* (Charp.); *Thomisus onustus* Walckenaer.

In addition to the listed ecological complexes, the region also has a complex of invertebrates associated with aquatic biotopes. Dragonflies (*Odonata*), mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), caddisflies (*Trichoptera*), some Heteroptera, beetles (*Coleoptera*), butterflies (*Lepidoptera*) and *diptera* live in aquatic biocenoses. Insect larvae sometimes make up a significant part of the population of water bodies, with *diptera* larvae and pupae forming a particularly large biomass. The composition of the inhabitants of water bodies depends on many factors, but primarily on the degree of water salinity.

These complexes include all the main groups of invertebrates living in the desert zone. The species diversity of invertebrates at the planned site has been evaluated as limited in species richness and insignificant in numbers.

6.3.10 Ecosystem services

According to IFC GN6, ecosystem services (ES) are *"the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services".*

For the purposes of Performance Standard 6 implementation, ecosystem services are categorized as two types (GN116):

- Type I: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and where impacts on such services may adversely affect communities.
- Type II: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and on which the project directly depends for its operations.

Below is a list of ES likely to apply to the Mirny context. These are categorised as either Type I or Type II, based on the available information.

Table 24: ES Type I and Type II analysis.

Ecosystem service	Category (provisioning, regulating, cultural, supporting)	Potential relevance in Mirny Project	Type I / Type II
Drinking water / water for domestic use / agriculture / livestock	Provisioning	In the event of springs or water bodies being utilised by local communities for grazing or farming purposes, it is imperative to consider the potential risks associated with runoff, erosion and hydrological alteration, which can be caused by changes to soil and vegetation cover.	Type I: local communities are dependent on the resources, and the Project may have an impact on them. Type II: the Project requires water for construction and maintenance.

Ecosystem service	Category (provisioning, regulating, cultural, supporting)	Potential relevance in Mirny Project	Type I / Type II
Fertile soil / soil productivity / grazing	Provisioning / supporting	This is an important consideration for communities where livestock farming is a key industry. It is essential to take into account the impact on vegetation, wildlife and the potential risk of soil compaction and erosion.	Type I as local communities (nomadic sheperds) utilise the pasture for grazing.
Habitat for wildlife (birds, mammals, migratory species)	Supporting / regulating / cultural	The potential risks to wildlife from wind turbines include the possibility of fatal collisions with turbine blades, changes in migratory routes and electrocution or fatalities on power lines.	Type I applies as protected species or with value for conservation are present.
Climate regulation / carbon storage	Regulating	The wind farm itself contributes positively to reducing emissions; natural vegetation and soil store carbon.	Type I as it is beneficial to communities and the climate.
Water regulation / runoff / erosion control	Regulating / supporting	In arid and semi-arid regions, the maintenance of vegetation cover is of paramount importance in preventing erosion and regulating rainwater; however, the presence of buildings and infrastructure has the potential to disrupt these processes.	Potentially Type I, particularly if communities are affected by erosion, flooding or water quality issues. There is a possibility that this could be also Type II, in instances where infrastructure stability is contingent on effective runoff management and the integrity of the surrounding soil and vegetation.
Cultural / aesthetic / recreational / spiritual services**	Cultural	The landscape, view and aesthetic value, along with the cultural values linked to the territory and the pastoral use with cultural significance, are all factors worthy of consideration.	Potentially Type I, but the area is not characterised by cultural ties, presence of sacred sites, or tourist use.
Clean air / air quality / noise	Regulating / cultural	As a source of energy, wind power has been demonstrated to generate very low levels of emissions. However, the processes involved in its construction and	Type I, community health/well-being.

Ecosystem service	Category (provisioning, regulating, cultural, supporting)	Potential relevance in Mirny Project	Type I / Type II
		transportation can result in the emission of dust and other particulate matter. Furthermore, the operation of turbines can generate noise, which can have an acoustic effect on both wildlife and human communities.	
Energy / electricity generated (supply)**	Provisioning	The Project itself is responsible for the generation of energy, with the distribution of this being handled by power lines. This results in a substantial direct benefit for the local and national population.	This is beneficial for communities, but according to the definition, it does not fall under "ecosystem service" in the classic sense unless mediated by ecosystems. However, renewable energy production can be considered a regulatory/climate service. In accordance with standard classification criteria, this is not typically designated as Type II, except in cases where a business is dependent on an ecosystem for its generation (e.g. hydroelectric).

In consideration of the data presented in the table, the following conclusions can be drawn:

- Type II ES: The number of Type II ES is generally low due to the fact that a wind farm does not typically require ecosystem services such as water or habitat in order to function, with the exception of construction and associated infrastructure. The inquiry pertains to the potential influence of the water regime, encompassing its utilisation for washing and maintenance activities, on the observed phenomenon. Consequently, the water service may be classified as Type II. It is imperative to acknowledge the significance of soil stability and vegetation cover in determining the integrity of foundations, facilitating access, and enhancing wind resistance. Consequently, the regulation of vegetation and soil may be regarded as an ecosystem service that is crucial to the success of the project.
- Type I ES: these are more numerous and may be negatively impacted by the Project, directly affecting communities or other beneficiaries. In particular, the following aspects are to be considered: grazing and nomadic sheperds, vegetation, wildlife habitat (birds), water quality, soil quality, aesthetic services, runoff and erosion regulation, health especially for noise.

6.3.11 Invasive species

No alien invasive species were recorded during the surveys. All observed flora and fauna species are native, and the majority are typical of the Deserts & Xeric Shrublands of the Central Asian northern desert ecoregion. The primary ecological pressure in the area is grazing, particularly near wells and settlements. Other disturbances, such as mining and infrastructure development, are localized but can have moderate to high impacts on sensitive habitats.

Despite extensive research, no specific sources have been identified that reliably document local invasive species in the Study Area. Nevertheless, it is feasible to expand the assessment to analogous regions within Kazakhstan by identifying species that have already been documented in other regions.

National data (EPPO Global Database; CBD, 2018[56]) indicates that Kazakhstan has a number of alien/invasive species, both flora and fauna, which can serve as case studies for subsequent assessment of the risk of introduction and spread in the Study Area.

The following species have been documented:

- Flora:
  - *Ambrosia artemisiifolia* (common ragweed) – agricultural and allergic weed; reported in various regions of Kazakhstan.
  - *Acroptilon repens* (also known as Russian knapweed) – invasive perennial species, capable of spreading via rhizomes and seeds.
  - *Cuscuta* spp. (plant parasites) – reported in agricultural contexts and as border species.
- Fauna:
  - Mammals such as the brown rat (*Rattus norvegicus*) or species commensal with humans are mentioned among the alien/truly invasive species in the national document on alien species in Kazakhstan.
  - “Myna” birds (generic term for introduced exotic bird species) are mentioned.
  - Fish: there are reports of fish species being introduced, either deliberately or accidentally.
- New species reported recently:
  - *Proagopertha lucidula*, phytophagous beetle (*Scarabaeidae, Rutelinae*), found for the first time in some regions of Kazakhstan (Almaty, Zhetysu). Potentially harmful to fruit crops (FAO AGRIS, 2025[57]).
  - Beetle *Polygraphus proximus*, a noteworthy invasive species, has been documented in forest regions but not yet in deserts (Kirichenki *et al.*, 2023[58]).

[56] Kazakhstan in EPPO Global Database (by country); CBD Sixth National Report - Kazakhstan (English version)

[57] A new invasive species Proagopertha lucidula (Faldermann, 1835) (Coleoptera, Scarabaeidae, Rutelinae) for Kazakhstan)

[58] *First record of the invasive bark beetle Polygraphus proximus* Blandford (Coleoptera: Curculionidae, Scolytinae) in the Republic of Kazakhstan | Acta Biologica Sibirica

wsp.com