Environmental and Social Impact Assessment

PUBLIC

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August 2024

Uzbekistan: Samarkand 1 Solar PV and BESS Project

Appendixes – Part 8

Prepared by ACWA Power for the Asian Development Bank (ADB).

Annex B. Check list of Mammal species

Solar 100 MW PV plant

Table 22: List of mammal species (excluding bats) potentially inhabiting the Solar 100 MW PV Plant

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+	+	Common				
2	*Hemiechinus hypomelas*	+		Rare		3(NT)	LC	
3	*Crocidura suaveolens*	+		Sparse				
4	*Lepus tolai*	+		Locally rare				
5	*Spermophilus fulvus*	+	+	Numerous				
6	*Ellobius tancrei*	+	+	Common				
7	*Microtus ilaeus*	+	+	Sparse				
8	*Meriones libycus*	+	+	Sparse				
9	*Mus musculus*	+		-				
10	*Vulpes corsac turcmenicus*	+	+	Rare		2(VU:D)	LC	
11	*Vulpes vulpes*	+	+	Common				
12	*Mustela eversmanni*	+	+	Rare		2(VU:D)	LC	
13	*Vormela peregusna*	+		Rare		2(VU:D)	VU	
14	*Felis lybica*	+	+	Sparse				

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Nurabad substation

Table 23: List of mammal species (excluding bats) potentially inhabiting the Nurabad Substation

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+	+	Common				
2	*Hemiechinus hypomelas*	+		Rare		3(NT)	LC	
3	*Crocidura suaveolens*	+		Sparse				
4	*Lepus tolai*	+		Locally rare				
5	*Spermophilus fulvus*	+	+	Numerous				
6	*Ellobius tancrei*	+	+	Common				

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
7	*Microtus ilaeus*	+		Sparse				
8	*Meriones libycus*	+		Sparse				
9	*Mus musculus*	+		-				
10	*Vulpes corsac turcmenicus*	+		Rare		2(VU:D)	LC	
11	*Vulpes vulpes*	+	+	Common				
12	*Mustela eversmanni*	+	+	Rare		2(VU:D)	LC	
13	*Vormela peregusna*	+		Rare		2(VU:D)	VU	
14	*Felis lybica*	+	+	Sparse				

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Nurabad BESS

Table 24: List of mammal species (excluding bats) potentially inhabiting the Nurabad Substation

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+	+	Common				
2	*Hemiechinus hypomelas*	+		Rare		3(NT)	LC	
3	*Crocidura suaveolens*	+		Sparse				
4	*Lepus tolai*	+		Locally rare				
5	*Spermophilus fulvus*	+	+	Numerous				
6	*Ellobius tancrei*	+	+	Common				
7	*Microtus ilaeus*	+		Sparse				
8	*Meriones libycus*	+		Sparse				
9	*Mus musculus*	+		-				
10	*Vulpes corsac turcmenicus*	+		Rare		2(VU:D)	LC	
11	*Vulpes vulpes*	+	+	Common				
12	*Mustela eversmanni*	+	+	Rare		2(VU:D)	LC	
13	*Vormela peregusna*	+		Rare		2(VU:D)	VU	
14	*Felis lybica*	+	+	Sparse				

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Solar 400 MW PV plant and pooling station

Table 25: List of mammal species (excluding bats) potentially inhabiting the Solar 400 MW PV plant and pooling station

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+		Common				
2	*Hemiechinus hypomelas*	+	+	Rare		3(NT)	LC	
3	*Crocidura suaveolens*	+		Sparse				
4	*Lepus tolai*	+		Locally rare				
5	*Spermophilus fulvus*	+	+	Numerous				
6	*Allactaga elater*	+		Common				
7	*Allactaga severtzovi*	+		Sparse				
8	*Cricetulus migratorius*	+		Sparse				
9	*Ellobius tancrei*	+		-				
10	*Microtus bucharensis*	+		Rare				
11	*Meriones libycus*	+		Common				
12	*Meriones meridianus*	+		Rare				
13	*Mus musculus*	+		Rare				
14	*Canis aureus*	+		Sparse				
15	*Vulpes corsac*	+	+	Rare		2(VU:D)	LC	
16	*Vulpes vulpes*	+	+	Common				
17	*Mustela eversmanni*	+	+	Rare		2(VU:D)	LC	
18	*Felis lybica*	+		Rare				Cites II

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Solar 500 MW PV plant

Table 26: List of mammal species (excluding bats) potentially inhabiting the Solar 500 MW PV plant

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+		Common				
2	*Hemiechinus hypomelas*	+	+	Rare		3(NT)	LC	
3	*Crocidura suaveolens*	+		Sparse				
4	*Lepus tolai*	+		Locally rare				
5	*Spermophilus fulvus*	+	+	Numerous				

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
6	*Allactaga elater*	+		Common				
7	*Allactaga severtzovi*	+		Sparse				
8	*Cricetulus migratorius*	+		Sparse				
9	*Ellobius tancrei*	+		-				
10	*Microtus bucharensis*	+		Rare				
11	*Meriones libycus*	+		Common				
12	*Meriones meridianus*	+		Rare				
13	*Mus musculus*	+		Rare				
14	*Canis aureus*	+		Sparse				
15	*Vulpes corsac*	+	+	Rare		2(VU:D)	LC	
16	*Vulpes vulpes*	+	+	Common				
17	*Mustela eversmanni*	+	+	Rare		2(VU:D)	LC	
18	*Felis lybica*	+		Rare				Cites II

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Khalka substation and 360 km 550 kV OHTL

Table 27: List of mammal species (excluding bats) potentially inhabiting the Khalka substation and 360 km 550 kV OHTL

№	Species	Species presence acc. to literary sources	Species noted during surveys	Present species in the regions				Conservation status		
				Tas	Syr	Jiz	Sam	UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+	+	X	X	X	X			
2	*Hemiechinus hypomelas*	+	+			X	X	3 (NT)	LC	
3	*Suncus etruscus*	+		X	X		X			
4	*Crocidura suaveolens*	+	+	X	X	X	X			
5	*Lepus tolai*	+			X	X	X			
6	*Spermophilus fulvus*	+	+	X	X	X	X			
7	*Allactaga elater*	+	+		X	X	X			
8	*Allactaga severtzovi*	+	+		X	X	X			
9	*Cricetulus migratorius*	+	+	X	X	X	X			
10	*Ellobius tancrei*	+	+	X	X	X	X			
11	*Microtus bucharensis*	+	+		X	X	X			
12	*Microtus ilaetus*	+	+	X						

№	Species	Species presence acc. to literary sources	Species noted during surveys	Present species in the regions				Conservation status		
				Tas	Syr	Jiz	Sam	UzRDB	IUCN	CITES
13	*Meriones tamariscinus*	+	+	X	X	X	X			
14	*Meriones libycus*	+	+		X	X	X			
15	*Meriones meridianus*	+	+		X	X	X			
16	*Mus musculus*	+	+	X	X	X	X			
17	*Rattus norvegicus*	+		X	X	X	X			
18	*Canis aureus*	+	+	X	X	X	X			
19	*Vulpes corsac*	+	+		X	X	X	2 (VU:D)	LC	
20	*Vulpes vulpes*	+	+	X	X	X	X			
21	*Felis lybica*	+	+	X	X	X	X			Cites II

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

70 km OHTL (Pooling station – Nurabad SS)

Table 28: List of mammal species (excluding bats) potentially inhabiting the 70 km OHTL (Pooling station – Nurabad SS)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Conservation status		
				UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+	+			
2	*Hemiechinus hypomelas*	+	+	3 (NT)	LC	
3	*Suncus etruscus*	+				
4	*Crocidura suaveolens*	+	+			
5	*Lepus tolai*	+				
6	*Spermophilus fulvus*	+	+			
7	*Allactaga elater*	+	+			
8	*Allactaga severtzovi*	+	+			
9	*Cricetulus migratorius*	+	+			
10	*Ellobius tancrei*	+	+			
11	*Microtus bucharensis*	+	+			
12	*Meriones tamariscinus*	+	+			
13	*Meriones libycus*	+	+			
14	*Meriones meridianus*	+	+			
15	*Mus musculus*	+	+			

№	Species	Species presence acc. to literary sources	Species noted during surveys	Conservation status		
				UzRDB	IUCN	CITES
16	*Rattus norvegicus*	+				
17	*Canis aureus*	+	+			
18	*Vulpes corsac*	+	+	2 (VU:D)	LC	
19	*Vulpes vulpes*	+	+			
20	*Felis lybica*	+	+			Cites II

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Karakul BESS

Table 29: List of mammal species (excluding bats) potentially inhabiting the Karakul BESS (Pooling station – Nurabad SS)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Conservation status		
				UzRDB	IUCN	CITES
1	*Hemiechinus auritus*	+	+			
2	*Lepus totai*	+	+			
3	*Spermophilopsis leptodactylus*	+	+			
4	*Allactaga elater*	+				
5	*Eremodipus lichtensteini*	+				
6	*Paradipus ctenodactylus*	+				
7	*Dipus sagitta*	+				
8	*Ellobius tancrei*	+				
9	*Mus musculus*	+				
10	*Phombomys opimus*	+	+			
11	*Meriones libycus*	+	+			
12	*Meriones meridianus*	+				
13	*Phombomys opimus*	+				
14	*Vulpes vulpes*	+	+			
15	*Canis aureus*	+				
16	*Felis silvestris ornate*	+				

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.#

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REPTILE REPORT

Environmental and Social Impact Assessment (ESIA) for the development of a solar power project in Samarkand Region, Uzbekistan

Juru

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Introduction

In accordance with the Resolutions of the President of the Republic of Uzbekistan No. PP-207 dated July 4, 2023, "On measures for the implementation of the investment project 'Construction of a 500 MW Solar Photovoltaic Power Station, a 334 MW Electric Energy Storage System, and a Substation to support its operation in the Nurabad District of the Samarkand Region - Sazagan Solar 1'," and No. PP-208 dated July 4, 2023, "On measures for the implementation of the investment project 'Construction of a 500 MW Solar Photovoltaic Power Station, a 334 MW Electric Energy Storage System, and a Substation to support its operation in the Nurabad District of the Samarkand Region - Sazagan Solar 2'," investment agreements were signed on April 19, 2023, between the Ministry of Investments, Industry, and Trade of the Republic of Uzbekistan, the company "ACWA Power Company" (Investor), and the companies "ACWA Power Sazagan Solar 1" and "ACWA Power Sazagan Solar 2" (hereinafter referred to as the "Project Companies").

Under the aforementioned investment agreements, the Project Companies are implementing the projects "Sazagan Solar 1" and "Sazagan Solar 2," within which three solar photovoltaic power stations with a total capacity of 1000 MW and a substation with a capacity of 500/220 kV will be constructed in the Nurabad District of the Samarkand Region. Additionally, two energy storage systems will be built - one in the Nurabad District of the Samarkand Region and another in the Karakul District of the Bukhara Region. Furthermore, two parallel overhead power transmission lines with a voltage of 220 kV and a length of 70 km will be constructed to connect the main project facilities. 360 km overhead transmission line will also connect stations located in Samarkand region with the Khalka substation, located in Tashkent region.

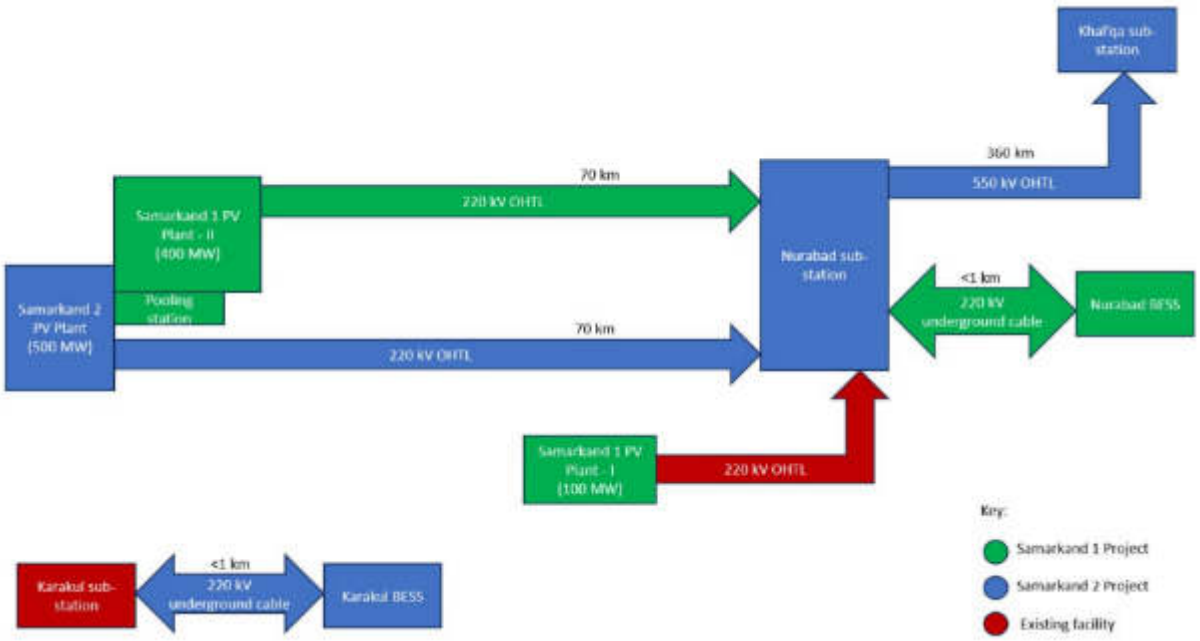

Figure 1: The project scheme

The report presents data and materials of field and desktop herpetofauna survey.

1. Project area

Figure 2: UZB-ACWA-Samarkand Solar 1 and Solar 2 & OHTL ESIA Project area

Project consists of the following parts:

1) Khalka substation and 360 km 550 kV OHTL (Samarkand 2 project)
2) Nurobod substation (Samarkand 2 project)
3) Nurobod BESS (Samarkand 1 project)
4) Solar 100 MW PV plant (Samarkand 1 project)
5) Solar 400 MW PV plant and pooling station (Samarkand 1 project)
6) Solar 500 MW PV plant (Samarkand 2 project)
7) Karakul BESS (Samarkand 2 project)

Site 1: Khalka substation and 360 km 550 kV OHTL (Samarkand 2 project)

Figure 3: Khalka substation and 360 km 550 kV OHTL

Site 2: Nurobod substation (Samarkand 2 project)

Figure 4: 500/220 KV Nurobod Substation

Site 3: Nurobod BESS (Samarkand 1 project)

Figure 5: Nurobod 500 MW Bess.

Site 4: Solar 100 MW PV plant (Samarkand 1 project)

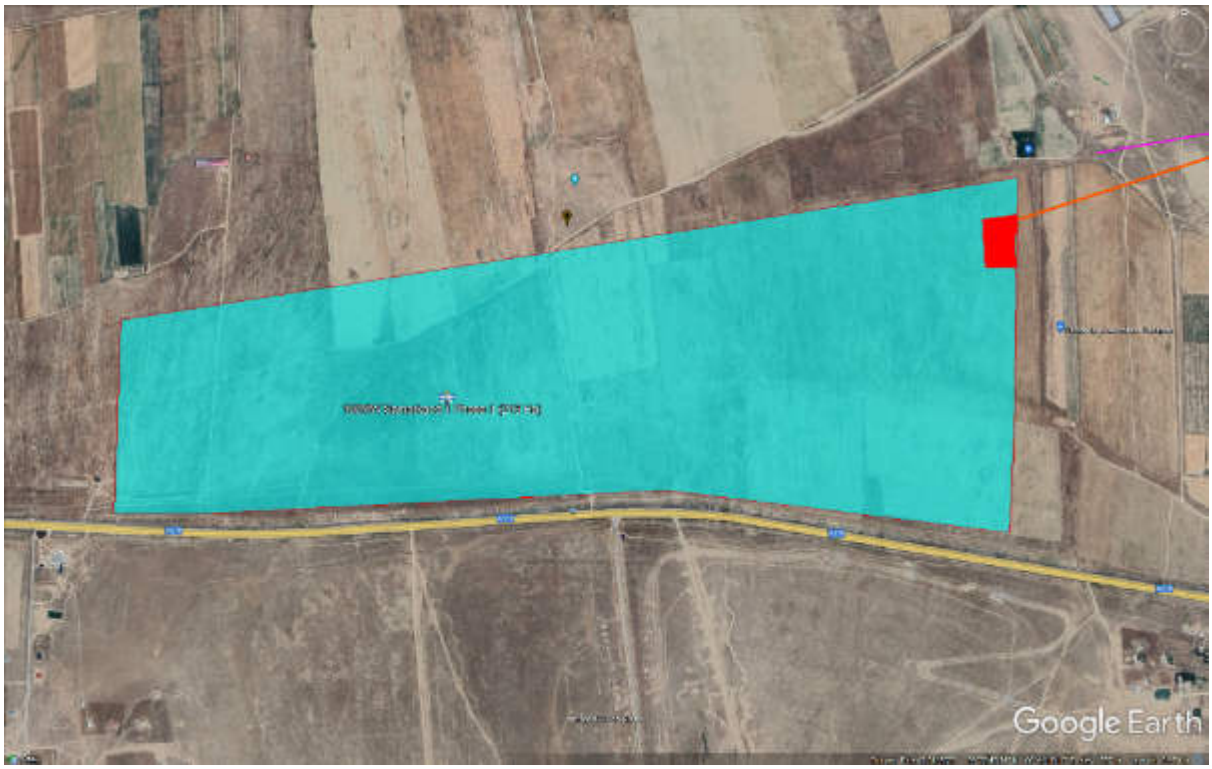

Figure 6: Solar 100 MW PV plant

Site 5: Solar 400 MW PV plant and pooling station (Samarkand 1 project)

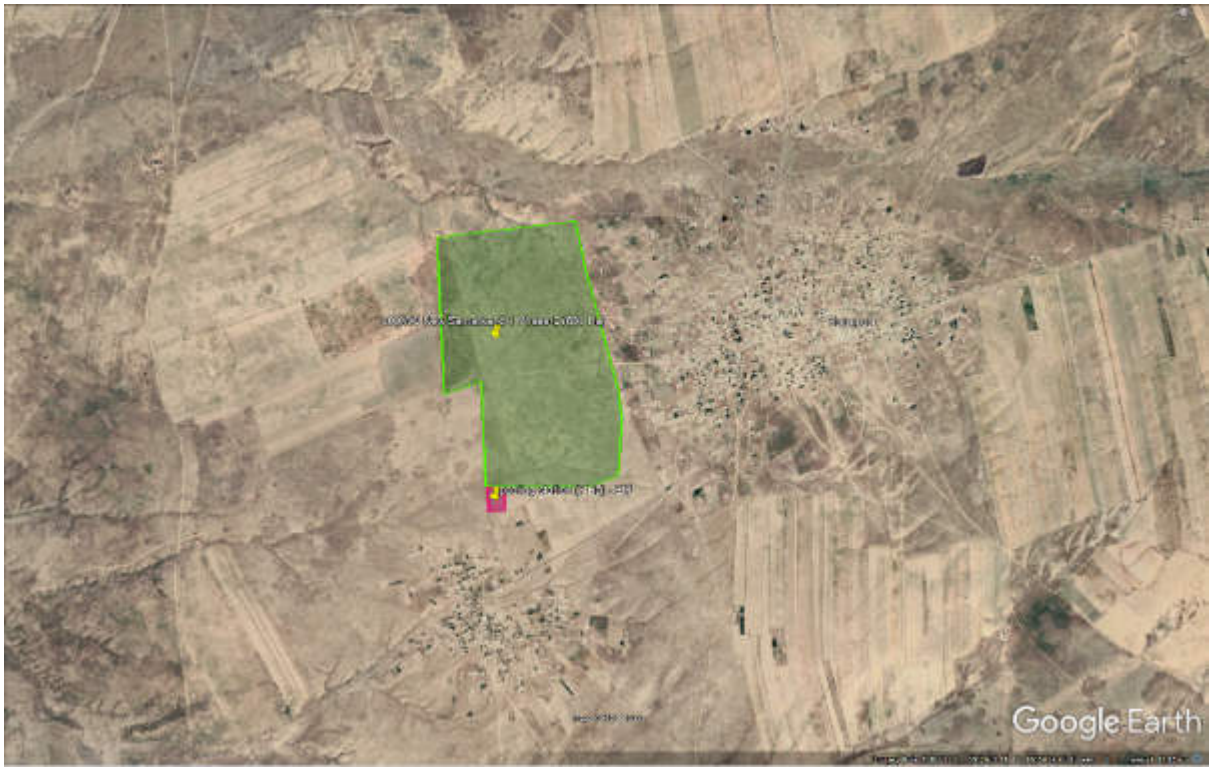

Figure 7: Solar 400 MW PV plant and Pooling station

Site 6: Solar 500 MW PV plant (Samarkand 2 project)

Figure 8: Solar 500 MW PV plant

Site 7: Karakul BESS (Samarkand 2 project)

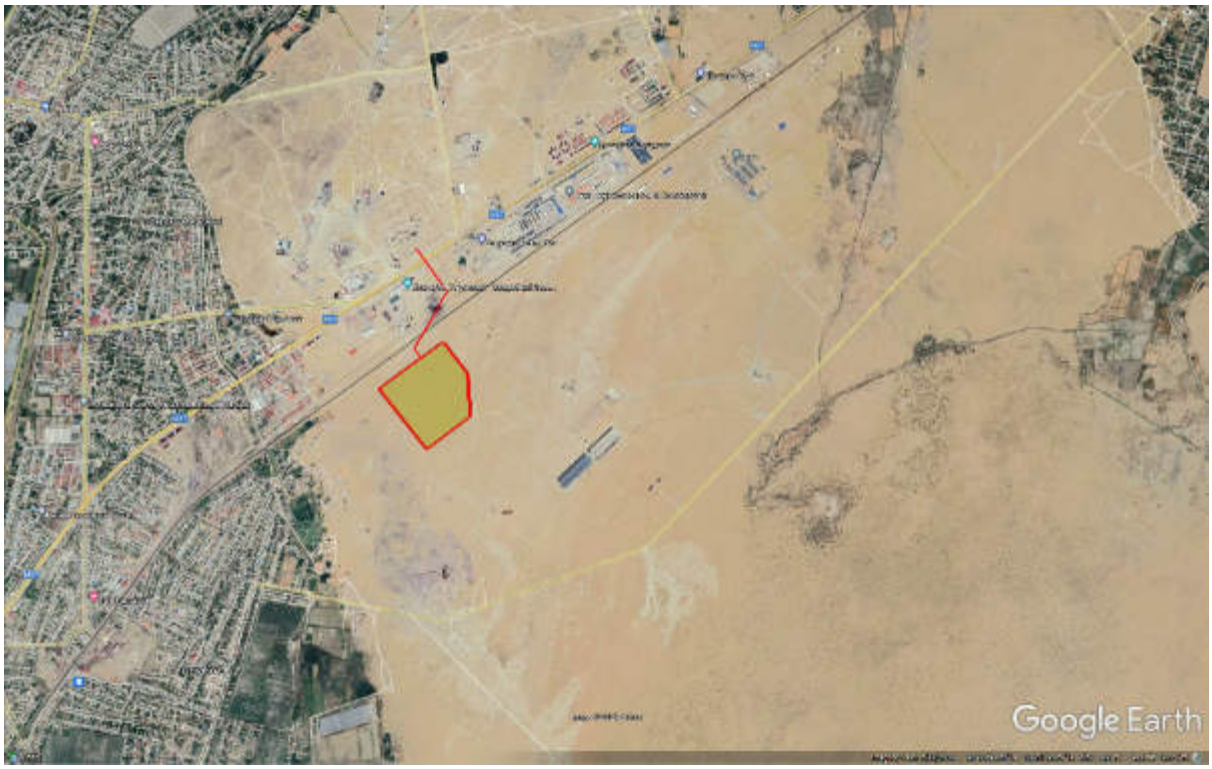

Figure 9: Karakul BESS

2. Materials and methods

During the field survey an attempt was made to assess the status of reptiles and amphibians in the study area (specification of the species and quantitative composition, territorial distribution, including places of concentration, the state of habitats). However, it should be noted that, the combination of field survey and desktop analysis was used.

Field studies were carried out according to generally accepted zoological methods for identifying species composition. The following methodological guidelines were used in the survey: L. G. Dinesman, M. L. Kaletskaya (1952)[1], V. M. Makeev, A. T. Bozhansky (1988)[2], D.A. Bondarenko, N.G. Chelintsev (1996)[3]. Literature sources and statistical data had been processed.

The main research method used was mixed stationary and transect survey. Points and transects for conducting research were outlined at the project monitoring stations in accordance with different types of habitats.

The field research methodology reflects the following aspects:

1. species composition in the study area;
2. distribution across habitats.

Thus, the method of quantitative assessment was based on the ecology of the species under consideration, landscape and geographical conditions, season and type of work.

[1] Dinesman L.T., Kaletskaya M.L. Methods of counting the number and geographical distribution of terrestrial vertebrates. Moscow: AN USSR, 1952 [in Russian]

[2] Makeev V.M., Bozhansky A.T., (1988). Some results herpetological inspections East Turkmenistan /Rare and little-studied animals of Turkmenistan. Ashgabat. Ylym. (in Russian).

[3] Bondarenko D.A., Chelintsev N.G. 1996. A comparative estimation of different methods of the line transect census of desert reptiles. Bulletin of Moscow Society of Naturalists, Biological series, 1996, vol.101, iss.3., pp. 26-35 (in Russian)

The quantitative assessment of reptiles and amphibians was mainly based on the transect survey. The transect method consists in counting individuals along a fixed long line (transect), on both sides of it, with the duration of the survey determined by the known distance, which is selected depending on the type of reptile and the area, but does not exceed 1 km in one way. In this case, all individuals encountered on the transect are registered, regardless of the distance they are identified at. The perpendicular distance is measured between the transect axis and each individual. The results obtained are used to calculate the density of recorded reptiles. The 1 km transect was chosen because heaviest errors arise when long transects are used for species that, like the Central Asian Tortoise, have high density, daily and seasonal activity cycles fluctuations with high peak values, and are caused by incorrect selection of a minimum survey area for a particular species (Vashetko et al, 2001).

The Central Asian tortoise population density (D) was calculated using the following formula:

$$D = \frac{n}{2LB}$$

where n – number of animal individuals recorded on the transect; L – length of the transect; B – formula to calculate an effective width of the survey strip:

$$B = W(0{,}79F + 0{,}21F^4)$$

where W – width of the limited strip on both sides of the transect axis; F:

$$F = \frac{2y}{W}$$

The use of perpendicular distances to carry out survey on a strip of limited width excludes underestimation of the population density of the Central Asian tortoise caused by a decrease in their detectability in remote parts of the survey strip, regardless of the degree of its limitation.

The abundance of the reptiles in habitats was estimated using the following population density scale for 1 ha (Kuzyakin, 1962[4]): 0.1 – 0.9 – rare, 1.0 – 9.9 – common, 10.0 and higher – abundant.

3.1. Sazagan area (Site 2: Nurobod Substation, Site 3: Nurobod Bess, Site 4: Solar 100 MW PV): Survey points and transects

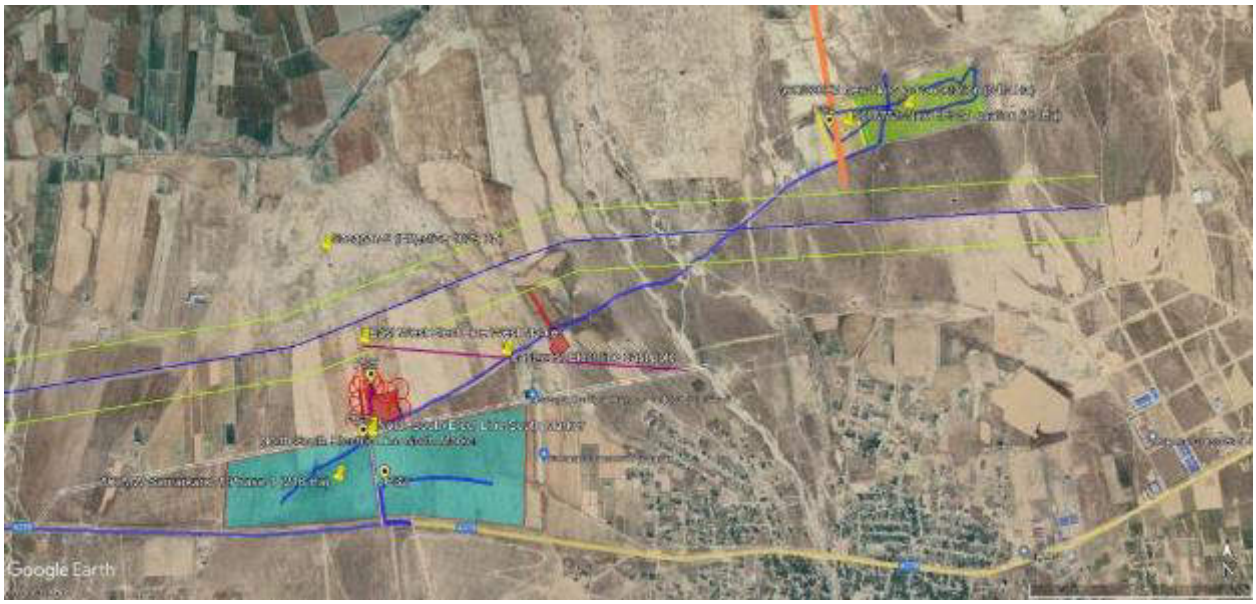

Figure 10: Survey map including survey points and transects on Sazagan (Site 2: Nurobod Substation, Site 3: Nurobod Bess, Site 4: Solar 100 MW PV)

[4] Kuzyakin A.P. 1962. Zoogeography of the USSR. Scientific notes of the Moscow regional pedagogical institute. 109: 9-182 pp.

Table 1: Survey points on Sazagan (Site 2: Nurobod Substation, Site 3: Nurobod Bess, Site 4: Solar 100 MW PV)

No	Name of point	Date and time	N (dd format)	E(dd format)	Biotope	t air °C	t soil, °C	humidity, %
1	PS-1	28/06/23	39.549109°	66.685559°	Deposited lands	34,3	37,2	22
2	PS-2	28/06/23	39.545677°	66.687853°	Deposited lands	34,7	40,3	21
3	PS-3	28/06/23	39.576767°	66.744959°	Deposited lands	34,9	42,8	21
4	PS-4	28/06/23	39.574226°	66.737152°	Agricultural fields	35,3	44,6	20
5	PS-5	28/06/23	39.553687°	66.686383°	Agricultural fields	35,6	47,2	20

Table 2: Survey transect on Sazagan (Site 2: Nurobod Substation, Site 3: Nurobod Bess, Site 4: Solar 100 MW PV)

No	Name of transect	Date and time	Length	Biotope	t air °C	t soil, °C	humidity, %
1	PS-1	28/06/23	1 km	Deposited lands	34,3	37,2	22
2	PS-2	28/06/23	1 km	Deposited lands	34,7	40,3	21
3	PS-3	28/06/23	2 km	Deposited lands	34,9	42,8	21
4	PS-4	28/06/23	1 km	Agricultural fields	35,3	44,6	20
5	PS-5	28/06/23	1 km	Agricultural fields	35,6	47,2	20

3.2. Koshkuduk (Site 5: Solar 400 MW PV and pooling station, Site 6: Solar 500 MW PV): Survey points and transects

Figure 11: Survey map including survey points and transects on Koshkuduk (Site 5: Solar 400 MW PV and pooling station, Site 6: Solar 500 MW PV)

Table 3: Survey points on Koshkuduk (Site 5: Solar 400 MW PV and pooling station, Site 6: Solar 500 MW PV)

No	Name of point	Date and time	N (dd format)	E(dd format)	Biotope	t air °C	t soil, °C	humidity, %
1	P-1	27/06/23	39.443530°	65.977999°	Deposited lands	33,7	41,4	21
2	P-2	27/06/23	39.444009°	65.987181°	Deposited lands	33,5	40,6	21
3	P-3	27/06/23	39.426815°	65.966046°	Gravelly-clay plain	33,4	41,7	21
4	P-4	27/06/23	39.427411°	65.933010°	Gravelly-clay plain	31,2	38,6	22
5	P-5	27/06/23	39.419400°	65.944827°	Gravelly-clay plain	30,8	37,3	22

Table 4: Survey transect on Koshkuduk (Site 5: Solar 400 MW PV and pooling station, Site 6: Solar 500 MW PV)

No	Name of transect	Date and time	Length	Biotope	t air °C	t soil, °C	humidity, %
1	P-1	27/06/23	5 km	Deposited lands	34,7	46,4	20
2	P-2	27/06/23	3,6 km	Deposited lands	33,5	40,6	21
3	P-3	27/06/23	2 km	Gravelly-clay plain	33,4	41,7	21
4	P-4	27/06/23	2,6 km	Gravelly-clay plain	31,2	38,6	22
5	P-5	27/06/23	4 km	Gravelly-clay plain	30,8	37,3	22

3.3 Site 7: Karakul BESS: Survey points and transects

Figure 12: Survey map including survey points and transects on Karakul BESS

Table 5: Survey points on Karakul BESS

No	Name of point	Date and time	N (dd format)	E(dd format)	Biotope	t air ºC	t soil, ºC	humidity, %
1	PB-K-1	27/06/23	39.515641°	63.872612°	Fixed sands, significant anthropogenic pressure in the form of a landfill and quarry.	34,2	44,7	21

Table 6: Survey transect on Karakul BESS

No	Name of transect	Date and time	Length	Biotope	t air ºC	t soil, ºC	humidity, %
	PB-K-1	27/06/23	1 km	Fixed sands, significant anthropogenic pressure in the form of a landfill and quarry.	34,2	44,7	21

3. Findings and Results

3.1. Sazagan (Site 2: Nurobod Substation, Site 3: Nurobod Bess, Site 4: Solar 100 MW PV): findings and results

During the period of herpetological research on the territory of Sazagan, we discovered several species of reptiles. All of the discovered species are not rare and endemic and have a wide range. However, the period of research also did not coincide with the period of activity of Central Asian tortoise, and at that moment this species was in a state of aestivation. It is necessary in the future to conduct a targeted study in the project area for this species. The territory itself is under fairly strong anthropogenic pressure, it is used and used as agricultural land for growing wheat and barley, and part of the territory is used as pasture land (PS-1, PS-2).

Table 7: Primary data and the density of reptiles at the accounting points on Sazagan (Site 2: Nurobod Substation, Site 3: Nurobod Bess, Site 4: Solar 100 MW PV)

No	Species	Survey point/transect	No. of recorded animals	Population density on the site, inds/ha	Notes
1	*Trapelus sanguinolentus*	PS-1	1	0,9.	
2	*Ablepharus pannonicus*	PS-5	2	10,4.	
3	*Eremias arguta*	PS-1, PS-2	3,2	9,1; 8,3.	

3.2. Koshkuduk (Site 5: Solar 400 MW PV and pooling station, Site 6: Solar 500 MW PV): findings and results

During the period of herpetological research on the territory of Koshkuduk, we discovered several species of reptiles. All of the discovered species are not rare and endemic and have a wide range. However, the period of research did not coincide with the period of activity of Central Asian tortoise, and at that moment this species

was in a state of aestivation. It is necessary in the future to conduct a targeted study in the project area for this species.

Table 8: Primary data and the density of reptiles at the accounting points on Koshkuduk (Site 5: Solar 400 MW PV and pooling station, Site 6: Solar 500 MW PV)

No	Species	Survey point/transect	No. of recorded animals	Population density on the site, inds/ha	Notes
1	*Tenuidactylus fedtschenkoi*	P-4	4	3,8	
2	*Trapelus sanguinolentus*	P-4,P-5	1,2	0,6; 1.	
3	*Phrynocephalus helioscopus*	P-3,P-5	2,3	4,1; 2,1.	
4	*Eremias velox*	P-3, P-4, P-5	2,1,2	2,9; 1,6; 1,8.	

3.3. Karakul BESS: findings and results

On the territory of the construction of the BESS "Karakul" during the survey period, not a single species of reptiles was found. It should be noted that the weather conditions were optimal for most of the species, however, the territory is under strong anthropogenic pressure. Not far from the territory there is a municipal waste dump, a large amount of garbage was also found on the territory, as well as a dump of dead animals and ravines in the form of a quarry.

4. Key species descriptions

CLASS AMPHIBIA

FAMILY TOADS (BUFONIDAE)

TURAN TOAD

***Bufotes turanensis* (Hemmer, Schmidtler & Böhme, 1978)**

Figure 13. Turan toad. Photo by Abduraupov T.V

Body length with head up to 140 mm. It is light gray-olive or gray-green on the upper side with black spots or without them. The male has an internal vocal sac under the skin of the throat. During the breeding period, black calluses appear on the first two or three fingers of the front legs of the male. The inner edge of the prepollex has a longitudinal skin fold. The pupil is horizontal. The hind toes are partially connected by a webbed membrane. Parotid glands, well developed behind the eyes. The spawn is in the form of strings.

An economically significant species that destroys harmful insects in enormous quantities. Occasionally collected by the local population for preparing remedies in traditional medicine.

In February and March, toads lead a diurnal lifestyle. During this time, they bask in the sun or mate and lay eggs in furrows, puddles, and swamps. Then they switch to a nocturnal lifestyle, which continues until late autumn.

In the flat part of the range, the majority of toads go into hibernation at the end of October or the beginning of November, and they often appear on the surface as early as mid-February, but the mass emergence from hibernation occurs in early March.

The peak of activity for the green toad coincides with the spawning period, which begins at the end of February and lasts until the end of May.

The Turkestan toad is found in various locations. It can be found in river valleys, plains, foothills, fields of various crops, gardens, settlements, and even deserts where there are any sources of water, even temporary ones. They use the burrows of various rodents and cracks in the soil as shelters.

In the Samarkand region, in Ulus, Kattakurgan, and in the Zeravshan Valley, A. P. Fedchenko discovered these toads (Nikolsky, 1899a).

We observed this species near the village of Tim in 2011.

CLASS REPTILIA

FAMILY TORTOISES (TESTUDINIDAE)

CENTRAL ASIAN TORTOISE

***Testudo horsfieldii* (Gray, 1844)**

Figure 14. Central Asian tortoise. Photo by Abduraupov T.V

Steppe Tortoise - a vulnerable, declining Central Asian endemic species. Included in the IUCN Red List [VU] and the Red Book of the Republic of Uzbekistan 2(VU) (2019), as well as listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Apart from southern Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan, and Tajikistan, it is also found in northern and eastern Iran, Afghanistan, northwest China, and northern Pakistan (Ananjeva et al., 1998; Bogdanov, 1960, 1965).

Carapace length up to 286.4 mm. The carapace is flat with weakly serrated edges. The front edge notch is shallow. Front legs have four claws. The forelimbs are covered with six to seven transverse rows of shield-like scales. The hind thighs have several horn-like bumps arranged in a group. The horn scales of the shell are usually monochromatic, yellowish or brown-olive tones, sometimes with black wide spots, more pronounced on the plastron.

It inhabits deserts, both sandy and clay, plains, mountain slopes, depressions, valleys, gorges, and mountain steppes, reaching altitudes of up to 1150 m above sea level (Dahl, 1936, 1937). Occasionally settles in agricultural lands: on the outskirts of fields, orchards, gardens, and orchards. Avoids areas with dense grass cover and places with intense livestock grazing.

It has a strictly diurnal lifestyle. During hot weather, it is only active in the morning and before sunset. In the middle of the day, animals hide from the heat in temporary shelters under bushes, where they partially bury themselves in the soil, in rodent burrows, or their own burrows. In a day, tortoises can travel distances from 120 m to 2 km. At night, they bury themselves in shallow pits or sometimes stay on the surface.

After winter diapause, tortoises appear on the surface in March to early April, and in warm winters and in the southern part of their range, as early as February. Mating begins a few days after emerging. The breeding period extends from late March to the end of May. Hatchlings with a carapace length of 30-50 mm hibernate underground and usually emerge on the surface in the spring of the following year.

Growth is slow. Sexual maturity is reached at the age of 10-13 years with a carapace length of 11 cm. In the wild, they can live for at least 30 years.

In June, when ephemeral vegetation dries up, the Central Asian tortoise enters a period of estivation (summer dormant state), digging burrows up to 1 m long. They disappear from deserts by the end of May, but in the mountains or irrigated lands, individual specimens can still be found in June and even July. Estivation often transitions to hibernation (winter dormant period).

The population of tortoises undergoes significant fluctuations (Bogdanov, 1965), which depend on winter and spring meteorological conditions, as well as the productivity of the habitats where the animals live. Land cultivation, livestock grazing, and habitat disturbance have a significant impact on reducing the population.

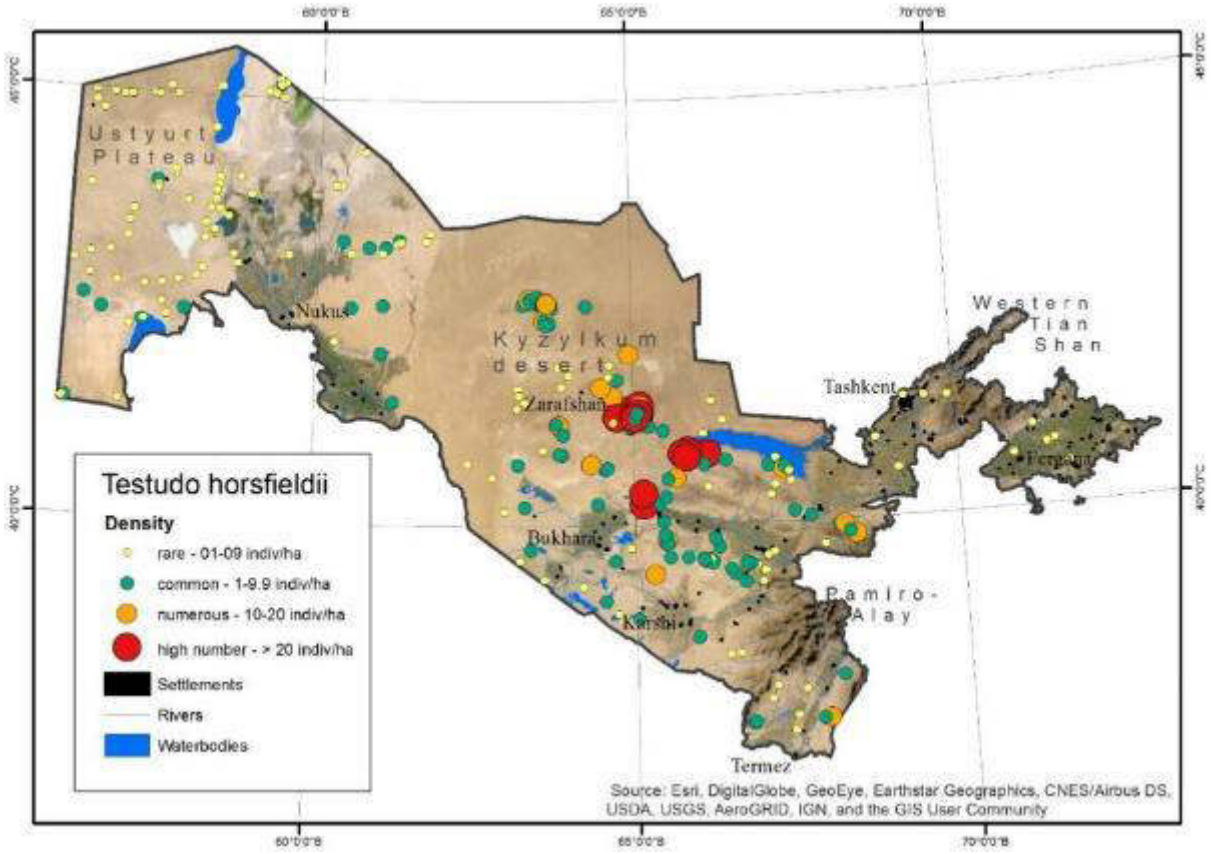

Figure 15. Map of the turtle population density in various regions of the Republic.

Distribution in Project region

Widely distributed in the Samarkand region, from the Karnabchul Steppe to the foothills of the Zeravshan and Nuratau Ranges. It is found in Karnabchul, north of the Shorsaysko-Dultalin Depression (Bondarenko, Peregoncev, 2017[5]), between the villages of Sepki and Tim (Dahl, 1937), on the gentle foothills of the Zirabulak Mountains, in the vicinity of the village of Tashkuduk (Bondarenko, Peregoncev, 2017[5]), and Tim (Abduraupov et al., 2021), in the area of Sengirbulak village (Dahl, 1937), in the southeast part of the Ziyadin Mountains, on loess-covered grassy-ephemeral foothills near the village of Karnab (Bondarenko, Peregoncev, 2017[5]). Observed 4 km west of the village of Sazagan, 39°31' N, 66°41' E (Bondarenko, Peregoncev, 2006); 3.5 km north of the village of Ibraimata, 39°30' N, 66°24' E (D.A. Bondarenko, V.G. Starkov, 2002, communication); 20 km south of the village of Karatepe (Bogdanov, 1962); and 3.5 km east of the village of Jam, 39°24' N, 66°31' E (Bondarenko, Peregoncev, 2006).

The population of tortoises undergoes significant fluctuations (Bogdanov, 1965), which depend on winter and spring meteorological conditions, as well as the productivity of the habitats where the animals live. Land cultivation, livestock grazing, and habitat disturbance have a significant impact on reducing the population.

Secondary data on Central Asian Tortoise density. In the Karnabchul Steppe north of the Shorsai-Dultalin Depression, the population of the Central Asian tortoise ranged from 7.9 to 11.5 individuals per hectare. Near Zirabulak Mountains, the loess plains give way to stony and clayey deposits, leading to a decrease in population density.

Between the villages Sepki and Tim S. K. Dal (1937) noted a population density of only 0.2 individuals per hectare.

On the gentle foothills of the eastern end of these mountains, in the vicinity of the village of Tashkuduk, the tortoise population density, according to our data, increased to 6.1±3.5 individuals per hectare. A similar value of 5.5 individuals per hectare was recorded in the Sengirbulak village area in the 1930s (Dal, 1937).

[5] Bondarenko D. A., Peregontsev E. A. Distribution of the Central Asian Tortoise Agrionemys horsfieldii (Gray, 1844) in Uzbekistan (Range, Regional and Lanrscape Distribution, Populations Density). Current Studies in Herpetology, 2017, vol. 17, iss. 3–4, pp. 124–146 (in Russian). DOI: 10.18500/1814-6090-2017-17-3-4-124-146.

Increased population density of the species was also observed in the southeastern part of the Ziadin Mountains. On the loess-covered ephemeral foothills near the village of Karnab, a density of 16.1±5.5 individuals per hectare was recorded[5].

The discussion on tortoise density on project area

As 400 MW PV plant is located in a plain steppe area with no foothills, it's important to consider the potential differences in habitat and ecological conditions compared to the areas where tortoise populations were previously recorded, such as Tashkuduk and Sengirbulak, which are mostly foothills of the mountains. Habitats vary significantly in terms of vegetation, climate, soil types, and other factors, which can influence tortoise populations.

In this case, it might not be appropriate to directly extrapolate the population density from the foothill areas to the plain steppe area.

Without specific data on tortoise populations in plain steppe areas of the region, it's challenging to accurately estimate the population density. Ideally, conducting surveys and studies in the plain steppe habitat during active season of the Central Asian tortoise would provide a more accurate understanding of the tortoise population in that specific area.

The discovery of three tortoise carapaces during a scoping site visit in July and August within the territories of the 400MW and 500MW PV plants, along with confirmation from local shepherds that tortoises inhabit the area, suggests the presence of a tortoise population in the region. The carapaces are indicative of tortoises being present in the past or currently within the vicinity.

Figure 16.Tortoise carapace. 2023-07-13 11:27 (N 39°27'1.46", E 65°57'50.17")

Figure 17. Tortoise carapace. .2023-08-18 (17:2N 39°24'57.88", E 65°55'55.65")

Figure 18. Tortoise carapace. 2023-08-18 17:17 (N 39°25'14.79", E 65°56'4.42")

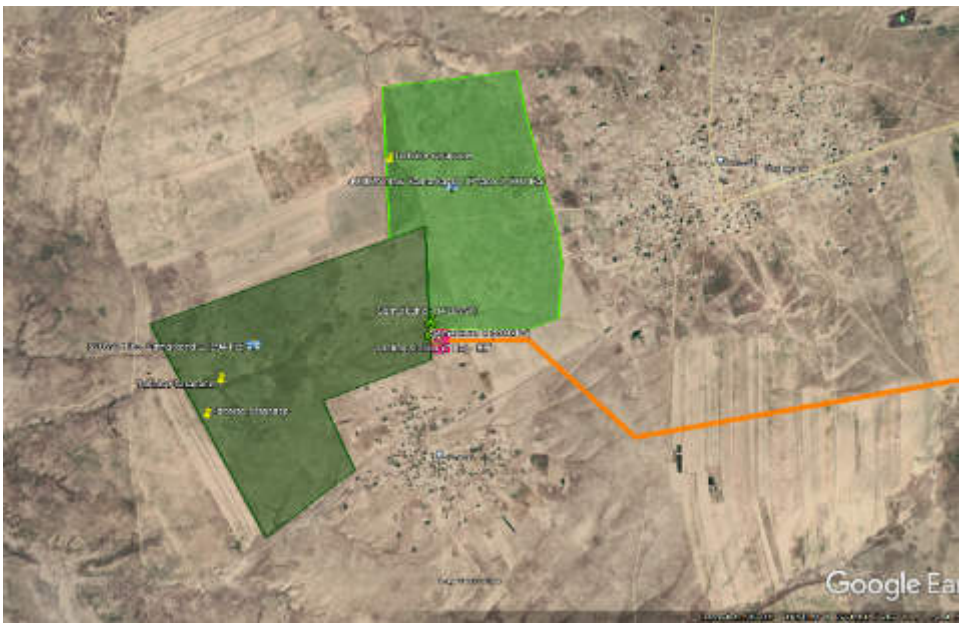

Figure 19. Points where tortoise carapaces were found.

However, it's important to note that carapaces alone might not provide a complete picture of the population size, distribution, or health. Tortoise populations can be influenced by various factors such as habitat suitability, food availability, predation, and human activities.

In situations where habitat conditions vary significantly, it's best to rely on direct observations and data collection within the specific habitat of interest to make more accurate population estimates.

FAMILY GEKKOS (GEKKONIDAE)

TURKESTAN THIN-TOED GECKO

***Tenuidactylus fedtschenkoi* (Strauch, 1887)**

Figure 20. Turkestan Thin-Toed Gecko. Photo by Abduraupov T.V

The body length including the head: newborns 24 mm, males up to 74 mm, females up to 75 mm. The head is pronounced, and the body is noticeably flattened from top to bottom. The upper side of the body is brownish with a grayish shade, featuring 4-5 dark irregular transverse stripes on the neck and body. The tail also has dark transverse stripes. The underside of the body is white without spots.

It emerges from hibernation in March, often in February. During this time, the Turkestan gecko can frequently be seen basking in the sun. In the hot period of the year, it switches to exclusively nocturnal activity. However, in the morning and evening hours, it comes out of its hiding place and takes sunbaths. During the day, it hides in shelters or in the shade on vertical surfaces. It hibernates in the same crevices where it hides during the daytime, burrowing to a depth of 20-30 cm. During hibernation, it forms clusters of 10-30 individuals in one place.

A bionomic species. In the wild, the Turkestan gecko is found on rocks in mountain gorges, on loess cliffs, and on cliffs of dried-up mountain rivers. It often settles in urban habitats - on the walls of houses, where it gathers insects near streetlights at night. Various crevices and cracks in rocks, loess cliffs, and gaps between bricks in buildings serve as shelter for this species.

M.V. Kaluzhina (1951) found it in the Zeravshan Range, near Ibragim-Ata, Kuchkurli, Zirabulak Heights, near the villages of Sypli, Guz, and Tym, at the Kermin station, and in the Katta-Kurgan Reservoir area. S.K. Dahl (1937) discovered the gecko between Kyrgyz-Bulak and Mount Karauz, near Lake Malikkul and in the vicinity of Sengir-Bulak.

We observed this species in karst niches of the Zirabulak Mountains, north of the village of Tim in 2011.

The status of the species in the territory of the Republic of Uzbekistan does not raise concerns.

FAMILY AGAMIDAE

STEPPE AGAMA

***Trapelus sanguinolentus aralensis* (Lichtenstein, 1823)**

Figure 21. Steppe agama. Photo by Abduraupov T.V

Steppe Agama, of medium size. The overall length of the Steppe Agama does not exceed 300 mm, with a body length including the head up to 120 mm, and the tail is 1.3 to 2 times longer than the body.

It inhabits sandy, clayey, and rocky deserts and semi-deserts, preferring areas with shrubby or semi-woody vegetation. It is also found on gentle rocky slopes in foothills, along the edges of loosely fixed sands, on riverbanks and in thickets, on the outskirts of settlements, and on roadsides. As shelters, it uses burrows of sand rats, ground

squirrels, small lizards, hedgehogs, and tortoises, as well as voids under rocks and cracks in the soil. During hot periods, agamas often climb onto the branches of shrubs, thus protecting themselves from overheating on the scorching ground. While perched on an elevation, males survey their territory, defending it against intruding rivals. After hibernation, they emerge in mid-February, March, or early April depending on the weather conditions of that period, with males emerging from winter shelters before females.

In Uzbekistan, it is widely distributed in arid zones. In the Samarkand region, it was noted by S.K. Dahl (1937) and M.V. Kaluzhina (1951) in the Zirabulak Heights. M.V. Kaluzhina (1951) also captured this species near Kattakurgan, in the desert between Kyzyl-Tepe and Malik, and in the vicinity of Kuljakyul, Bitkana, Dengi-Ali. A.P. Fedchenko (1870) observed steppe agamas between the settlements of Karasu and Kattakurgan.

The status of the species in the territory of the Republic of Uzbekistan does not raise concerns.

Sunwatcher toadhead agama

***Phrynocephalus helioscopus sergeevi* Solovyeva, Dunayev & Poyarkov, 2012**

Figure 22.Sunwatcher toadhead agama . Photo by Abduraupov T.V.

The body length including the head of newborns is 18–25 mm, males can reach up to 57 mm, and females up to 62 mm. The upper surface of the snout sharply transitions to the front part, sloping steeply towards the lips. Nostrils are not visible when viewed from above. The tail, flattened and wide at the base, narrows sharply and becomes round in cross-section. The body coloration and pattern vary greatly: from ash-gray to dark gray or brown-gray on top, with transversely arranged dark brown, brown, or black spots. These spots can be poorly developed or sometimes absent. On the upper surface of the neck, there are 2 small, more or less oval red or pink spots with blue or light blue borders. The upper tail and limbs often have transverse spots and stripes.

The first individuals of the sandy toadhead agama appear in early March after hibernation. The last ones were observed in November before going into hibernation. They are active throughout the warm season, during daylight hours.

Occasionally, they ascend to foothills up to 778 meters above sea level. They prefer solid ground with sparse vegetation.

An economically significant species.

S.K. Dahl (1937) noted the toadhead agama in the vicinity of Sengir-Bulak (eastern end of the Zirabulak Heights). A.P. Fedchenko (1870) encountered this lizard between Karasu and Kattakurgan. According to A.M. Nikolsky (1915), it was found in Ziatdin by G.V. Loudon.

We have repeatedly observed this species in previous field trips on the studied territory.

FAMILY ANGUIDAE

European glass lizard

***Pseudopus apodus* (Pallas, 1775)**

Figure 23. European glass lizard. Photo by Abduraupov T.V

A large legless lizard with a snake-like body, reaching lengths of 45-50 cm with a tail approximately one and a half times longer. The coloration of adults is olive-brown, dirty-yellow, or reddish-brown, sometimes with scattered irregular dark spots. Juveniles have a distinct coloration from adults. Their bodies are yellowish-gray with 16-22 transverse rows of brownish-brown zigzag-like stripes that continue along the tail as elongated spots. Similar stripes are present on the underside and on the sides of the head, forming a unique pattern on the upper part.

As the animal grows, the juvenile body color gradually fades, with traces of the transverse stripes sometimes remaining in individuals up to 200 mm in length, which is the age of up to three years.

It inhabits foothill plains and river valleys, populating sparse deciduous forests and tugai forests, forest clearings, shrubs, gullies, various types of thickets, and treeless foothill elevations. It is also found in mountainous semi-deserts and steppes, often in close proximity to water, where it can retreat when pursued, as it is a good swimmer. In some places, it is common in cultivated areas such as gardens, vineyards, and crops. In the mountains, it is known to exist up to an altitude of 2300 meters above sea level. It uses burrows, spaces under rocks, and spaces among shrub roots as shelters.

After wintering, it appears in March to mid-April. With the onset of summer heat, it is rarely seen on the surface, entering a summer dormant state, which in some places transitions to a winter dormant state. In July, its activity sharply decreases, and only individual specimens are observed at sunset and twilight, mostly in the mountains or river valleys.

It lays 6-10 eggs with an average size of 20 x 38 mm in mid-June to early July. Young individuals, about 100-125 mm in length (excluding the tail), appear from late July to September. Sexual maturity is reached at about four years of age with a body length of 310-320 mm.

An economically significant species. A. P. Fedchenko (1870) wrote that the yellow-bellied legless lizard is quite common in the Zeravshan Valley. M. V. Kaluzhina (1951) caught it on Miankal Island, in Ravatkhoja, Ziatdine, and Kattakurgan.

FAMILY: SKINKS (SCINCIDAE)

Schneider's skink

***Eumeces schneideri princeps* Eichwald, 1839**

Figure 24. Schneider's skink . Photo by Abduraupov T.V.

A large lizard, reaching a length of 165 mm, with a tail that is approximately twice as long and thickened at the base.

The upper part of the body is brown, brown-gray, brown-olive, or olive-gray in colour, with yellow-orange, orange, pinkish, pink-red, or brick-red spots scattered in more or less regular longitudinal or transverse rows; the number of these spots varies greatly, and sometimes they are absent; small dark brownish spots may also be present on the dorsal scales. From the fifth to the seventh upper labial scale, through the ear opening, and further along the sides of the body, there is an orange, pink-red, or red narrow stripe, usually extending onto the sides of the tail, where it becomes lighter. The underside of the body is yellowish or yellow-orange. In young individuals, the colour

stripes on the sides of the body are not well developed. In this subspecies, the coloured spots on the back do not form regular longitudinal or transverse rows.

It is closely associated with foothills and foothill plains, inhabiting both loamy and clayey soils, as well as rocky slopes with sparse semi-shrub and herbaceous vegetation. It is also found in thickets and ventures onto adjacent semi-fixed sands. It lives in gardens, vineyards, on the edges of cotton fields, embankments of ditches, and ruins. In the mountains, it is known up to elevations of 1200-1500 m. It uses gaps between rocks, soil fissures, burrows of burrowing animals, as well as its own burrows up to 2 m long and up to 60 cm deep as shelters. It can climb onto the lower branches of shrubs and low trees.

This lizard emerges from winter shelters in the foothills of the central part in late May. According to M. V. Kalugin (1951), it goes into hibernation at the end of September or beginning of October.

In spring and early summer, it is primarily active during the day, while in the hot summer months, it only emerges from shelters in the morning and evening and may enter a so-called "summer torpor," which sometimes transitions into winter torpor.

Economically significant species. However, in recent times, its population has sharply declined. This might be related to the use of insecticides targeting locusts. Practically in all habitats where it used to be a common species, it has become rare nowadays.

M. V. Kalugin (1951) observed this species in the area of the Ak-Tyube Ridge, on the southern slopes of the Zirabulak Heights, and in the vicinity of the Kattakurgan Reservoir.

FAMILY TRUE LIZARDS LACERTIDAE

Rapid racerunner

***Eremias velox velox* (Pallas, 1771)**

Figure 25. Rapid racerunner. Photo by Abduraupov T.V.

Length of body with head up to 84 mm, males up to 84 mm, females up to 81 mm. In young individuals, three straight black-brown or black stripes run along the back, with the middle stripe bifurcated at the neck. On the sides of the body, there is one stripe of the same color, with round light spots located on them. In adults (with the main color of the upper surface being gray or sandy, often with an olive or brown tint), these stripes break up into separate spots. On the sides of the body, there are light, black-bordered, rounded spots, which become blue in the front part of the body, especially in males. It should be noted that the pattern of this lizard is highly variable. The belly and throat are white. In young individuals, the underside of the tail and sometimes the small scales of the thighs and shins are red or reddish-orange.

Economically significant species. One of the most widespread and numerous lizard species in the Palearctic region. Widely distributed in Uzbekistan.

After winter hibernation, they appear in the second half of March. Mass emergence is observed in early April. They enter hibernation at the end of October to early November. During summer, these lizards are primarily active in the morning and evening hours.

In Uzbekistan, the swift runner lizard is a typical inhabitant of river valleys, where it is most numerous. However, this lizard is also found in various other habitats, and its distribution depends on the presence of other lizard species.

According to the observations of M. V. Kalugin (1951), this species of lizard is the most common in the Zeravshan valley, from Karakul to Pendjikent (near Bitkana, between Kyrgyz-Bulak and Dengi-Ali, in the area of Sengir-Bulak, in Dzhuma-Bazar, and Kattakurgan). S. K. Dal (1936, 1937) also reports the presence of the swift runner lizard in the same valley, having encountered it near Lake Karangi, in the vicinity of Arap-Khana, around Sengir-Bulak, at the lakes Kuljaku and Khodjcab, in the vicinity of Vaganz, in the Bitkona area, in the Malikkulya area, in the Zeravshan heights between the villages of Sypki and Tym.

This species has been observed multiple times in the studied territory.

Uzbek desert racer

***Eremias arguta uzbekistanica* Tschernow, 1934**

Figure 26. Uzbek desert racer. Photo by Abduraupov T.V.

The length of the body with the head is up to 95 mm, for males up to 95 mm, and for females up to 94 mm. The upper part of the body is gray in color with olive, brown, brownish, or greenish shades, along with irregular blackish or black transverse spots or stripes. The legs have light-colored circles surrounded by dark spots on top. The underside is white. The pattern of even very young lizards generally does not differ from that of adults.

It is found in the foothills and deserts of the Zeravshan Valley. It prefers soft loamy chestnut soils covered with dense vegetation and partially wormwood desert with soft soils, situated at the foot of mountains. Occasionally, it can be found on stabilized sands. Burrows of various rodents, soil cracks, and its own burrows, which the lizard often digs in soil piles, serve as shelters.

After winter hibernation, it appears in late February to early March. In the spring, the lizards are active during midday hours, during summer only in the morning and evening, and in the fall, activity is more pronounced in the second half of the day. It hibernates in October.

An economically important species, this lizard is one of the most widespread and numerous lizard species in the Palearctic region.

M.V. Kalugin (1951) observed the rainbow lizard near Kattakurgan, near Ibragim-Ata, and by Lake Khodja-Kab. S.K. Dal (1937) found it in the Zeravshan Heights between the villages of Sypki and Tym, between Kyr-Bulak (western part of Zeravshan Heights), and Mount Karaus, as well as in the area of Sengir-Bulak (southern end of the Zeravshan Heights).

FAMILY VARANIDAE

Desert monitor

***Varanus griseus caspius* (Eichwald, 1831)**

Figure 27. The desert monitor. Photo by Abduraupov T.V.

The declining population species has been listed in the Red Book of the Republic of Uzbekistan (2019) with a status of 2 (VU:D).

This species is the largest lizard in Uzbekistan and neighboring countries, with a body length of up to 520 mm. The upper side of the body is grayish-brown, yellowish-brown, or reddish-brown in color, adorned with numerous

dark spots and small markings. There are two to three longitudinal brown stripes on the upper side of the neck, and several similar colored transverse stripes are present on the back and tail. In young individuals, these stripes are very pronounced and are either black or almost black in color.

Following their winter hibernation, the first individuals appear relatively late, in early to mid-April. Throughout April, they remain active throughout the day. In May, they become active mainly during the morning and evening hours. They enter their winter hibernation period in September or October. Often, the gray monitor lizard undergoes a period of aestivation (summer dormancy) that transitions smoothly into hibernation (winter dormancy). During this process, they enter summer dormancy by the end of June or beginning of July.

These lizards primarily inhabit fixed and semi-fixed sandy, clayey, and stony-gravelly soils, as well as saline soils. They are occasionally found in foothills, with elevations of up to 1000 meters above sea level.

In the region of the Zeravshan Mountains, they are encountered near the village of Tim (Abduraupov, 2013; Abduraupov et al., 2021), and also in the vicinity of the village of Ibroghim-Ata (Kaluzhina, 1951).

Family: Boidae

Eastern sand boa

***Eryx tataricus tataricus* (Lichtenstein, 1823)**

Figure 28. Eastern sand boa. Photo by Abduraupov T.V.

The Eastern Sand Boa (Eryx tataricus tataricus) is a medium-sized snake species. Females can reach lengths of up to 1050 mm with a tail length of 60-70 mm, while the length of smaller males can be around 950 mm with a tail length of 70-80 mm. Female individuals are usually slightly longer than males by 5-10 cm. The tail is blunt and rounded.

This subspecies of Eastern Sand Boa is closely related to vulnerable species. It's listed in the Red Book of the Republic of Uzbekistan (2019) with a status of 3 (NT), indicating it's near threatened. It's also included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

These snakes inhabit clayey and loamy deserts, semi-deserts, foothills, hill slopes with ephemeral vegetation, stony-gravel foothills with shrub thickets, open wormwood-saline steppe areas. They can also be found on sandy soils, in depressions between rows of sand dunes, on loosely consolidated mounds, and occasionally on scattered sands. They are sometimes found in cultivated lands such as gardens and fields. In mountainous areas, they can be found up to altitudes of 1500-1600 meters above sea level.

Eastern Sand Boas are active from March to early April until October to early November. During hot months, they adopt a nocturnal and crepuscular lifestyle, hiding during the day in burrows of rodents, turtles, and other burrowing animals, as well as in the spaces at the base of shrub saplings and under roots. They are capable of burrowing into dry sand and moving significant distances within it. Mating occurs in late March to April. In July to August, females give birth to 10-21 offspring, which can reach up to 20 cm in length. They feed on lizards, rodents, small passerine birds, and insects.

The population of Eastern Sand Boas is believed to be low in the studied region. Currently, their population is decreasing due to intensified poaching for traditional medicine use, excessive export for trade, and land development activities.

In the vicinity of the studied area, Eastern Sand Boas have been observed near the village of Yangiaryk (Nikolsky, 1899), in the valley between the western end of the Zirabulak Mountains and Mount Karaus (Dahl, 1937), at the Churkindi well (Fedchenko, 1870, 1950), near the village of Kattakurgan (Nikolsky, 1905; 1916), near the village of Khairov (Nikolsky, 1908), and around the Kattakurgan reservoir (Didusenko, 1956).

FAMILY COLUBRIDAE

Spotted whip snake

***Hemorrhois ravergieri* (Menetries, 1832)**

Figure 29. Spotted whip snake . Photo by Abduraupov T.V.

The length of the body with the head reaches up to 1180 mm; ventral shields in males are 202–213, in females 207–224; subcaudal scales in males are 90–103, in females 86–99. The head is clearly differentiated from the neck, with a bluntly rounded snout. The upper part of the body is gray in color, with a brown or yellowish hue. Along the back, there is a series of dark (almost black) transverse stripes or spots, with smaller spots in between on the sides of the body. Diagonal dark stripes are present on the sides of the head from the eyes to the corners of the mouth, and additional stripes are found beneath the eyes. The belly is light-colored, often with scattered small spots. In Central Asia, alongside the typically colored individuals, there are black-headed specimens (both males and females) and almost black individuals. There are also individuals with nearly monochromatic bodies, lacking spots or stripes. They are among the most variable in coloration among the snakes of Central Asia.

After winter hibernation, they emerge in the second decade of March. During this time, they are observed on the surface only around midday. In April and May, the multicolored ratsnake becomes active during the morning and evening hours. In September, they are active again around midday. They enter hibernation in October.

Typical habitats for this species include foothills with ravines or rodent colonies, as well as cliffs bordering river valleys and human settlements in the foothills and mountains. They are occasionally found in the submontane clay deserts.

An economically significant species, it is one of the most numerous and widely distributed snake species in Uzbekistan. In the vicinity of the studied area, it was noted by P. V. Khorev and Ya. M. Finkelstein (Nikolsky, 1908) near the Nagornaya railway station (near Kattakurgan).

Steppe ribbon racer

***Psammophis lineolatus* (Brandt, 1838)**

Figure 30. Steppe ribbon racer. Photo by Abduraupov T.V.

The length of the body with the head reaches up to 840 mm, males up to 840 mm, females 710 mm. The number of ventral scales ranges from 181 to 204, and subcaudal scales from 83 to 105 pairs. The body is slender. The upper surface of the snout is concave, with a longitudinal groove. The body is olive-gray or sandy-gray in color, with the edges of the scales lighter than their centers. There are four dark stripes starting on the head and running along the body, although in some individuals, only traces of these stripes may remain in the form of dark or black streaks along the scales. Sometimes, the pattern on the body is absent. The belly is white with grayish, brownish, or olive-gray spots, which are larger in the front part of the body.

Single individuals may appear as early as February after winter hibernation. Mass emergence is observed at the end of March to early April. During this time, the snake is active throughout the day. In May, they switch to activity in the morning and evening hours. They enter winter hibernation in October-November.

The stripe-bellied sand snake inhabits plains and extends into foothills up to an altitude of 1100-1200 meters above sea level. However, it prefers more stabilized and mobile sands, gravel plains, mountains, and broken gray soils near settlements. The stripe-bellied sand snake is often found in places where dense vegetation areas alternate with open patches. Therefore, in areas with dense vegetation cover, it can always be found on small cliffs, mounds, and the like.

A.P. Fedchenko (1870, 1950) encountered the stripe-bellied sand snake near the Churkanchi well to the south of Kattakurgan. S.K. Dale (1937) found it in the desert from Kyrgyz-Bulak (western part of the Zirabulak Heights) to Mount Karaus and in the area of Malikquli.

FAMILY ELAPIDAE

CENTRAL ASIAN COBRA

***Naja oxiana* (Eichwald, 1831)**

Figure 31. Central Asian cobra. Photo by Abduraupov T.V.

A closely related, mosaic-distributed species. The species is listed as Data Deficient (DD) by the IUCN and is included in the Red Book of the Republic of Uzbekistan (2019) with a status of Near Threatened (NT).

It is a large snake, with a body length including tail usually reaching 1600-1800 mm. The pupil is round.

The coloration of the body varies greatly, ranging from flesh-colored and yellowish to olive, dark brown, brown, or black. There is no pattern resembling spectacles on the widening part of the body. Young Naja oxiana have dark (black) transverse stripes along the body, the anterior of which also extends onto the lower surface. In adults, the belly is usually light and without spots.

It inhabits foothills, clayey and gravelly lowlands, rock formations, and mountains up to 2000 m above sea level, river floodplains, and oases, occasionally in deserts and semi-deserts. It is often found among shrubs and is frequently encountered in abandoned structures. It lives in tugai forest belts, as well as in reed beds, Arundo and camelthorn thickets. The snake uses non-inhabited rodent burrows, cracks and fissures in clay cliffs, and small crevices in the soil as shelters. It settles in embankments along irrigation canals, gardens, orchards, and fallow lands. It is encountered in fallow fields and is common among sown crops of millet.

During the hot season, it only emerges to the surface in the morning and evening hours. Cobras appear on the surface after overwintering in late March to April, and their period of activity continues until the end of October.

When disturbed, the cobra raises the front part of its body, expands its hood, and hisses. It is highly venomous, but cases of human bites are extremely rare. The venom is neurotoxic and is used in the production of medicinal preparations.

In the Samarkand region, the Central Asian cobra is mainly found in the foothills and lowlands of the Zarafshan Range, specifically on the Katratepin Mountain Range. It is less frequently found in the submontane plain and foothills of the Zirabulak Mountains (Abduraupov, Fundukchiev, 2013). It has also been discovered in the Zirabulak Mountains near the village of Tim (Abduraupov, Fundukchiev, 2013; Abduraupov et al., 2021).

Annex A. Amphibian and Reptile Check lists

Site 1: Khalka substation and 360 km 550 kV OHTL (Samarkand 2 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 9: List of reptile species potentially inhabiting Khalka substation and 360 km 550 kV OHTL

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Turan toad* *Bufotes turanensis*	+		Common	UZ, TJ, TM			
2	Eurasian marsh frog *Pelophylax ridibundus*	+		Common				
3	Central Asian Tortoise *Testudo horsfieldii*	+		Common		2 (VU)	VU	II
4	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+		Common	UZ, TJ, TM, KZ			
5	Steppe Agama *Trapelus sanguinolentus*	+		Common				
6	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+		Not numerous				
7	Glass lizard *Pseudopus apodus*	+		Not numerous				
8	Rapid Racerunner *Eremias velox*	+		Common				
9	Steppe racerunner *Eremias arguta*	+		Not numerous				
10	Tatary sand boa *Eryx tataricus*	+		Rare		3 (NT)		II
11	Sand racer *Psammophis lineolatus*	+		Common				
12	Spotted whip snake *Hemorrhois ravergieri*	+		Common				
13	Dice snake *Natrix tessellata*	+		Common				

Notes to Table 9: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

Site 2: Nurobod substation (Samarkand 2 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 10: List of amphibian and reptile species potentially inhabiting Nurobod substation (Samarkand 2 project)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Turan toad* *Bufotes turanensis*	+		Common	UZ, TJ, TM			

2	Central Asian Tortoise *Testudo horsfieldii*	+		Common		2 (VU)	VU	II
3	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+		Common	UZ, TJ, TM, KZ			
4	Steppe Agama *Trapelus sanguinolentus*	+	+	Common				
5	Asian snake-eyed Skink *Ablepharus pannonicus*	+	+	Common				
6	Schneider's skink *Eumeces schneideri*	+		Not numerous				
7	Glass lizard *Pseudopus apodus*	+		Not numerous				
8	Rapid Racerunner *Eremias velox*	+	+	Common				
9	Steppe racerunner *Eremias arguta*	+		Not numerous				
10	Tatary sand boa *Eryx tataricus*	+		Rare		3 (NT)		II
11	Sand racer *Psammophis lineolatus*	+		Common				
12	Spotted whip snake *Hemorrhois ravergieri*	+		Common				
13	Central Asian cobra *Naja oxiana*	+		Rare	UZ, TM, TJ, IR, AF, PK	3 (NT)	DD	II

Notes to Table 10: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

Site 3: Nurobod BESS (Samarkand 1 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 11: List of amphibian and reptile species potentially inhabiting the Nurobod BESS (Samarkand 1 project)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Turan toad* *Bufotes turanensis*	+		Common	UZ, TJ, TM			
2	Central Asian Tortoise *Testudo horsfieldii*	+		Common		2 (VU)	VU	II
3	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+		Common	UZ, TJ, TM, KZ			
4	Steppe Agama *Trapelus sanguinolentus*	+	+	Common				
5	Asian snake-eyed Skink *Ablepharus pannonicus*	+	+	Common				
6	Schneider's skink *Eumeces schneideri*	+		Not numerous				
7	Glass lizard *Pseudopus apodus*	+		Not numerous				
8	Rapid Racerunner *Eremias velox*	+	+	Common				
9	Steppe racerunner *Eremias arguta*	+		Not numerous				

10	Tatary sand boa *Eryx tataricus*	+		Rare		3 (NT)		II
11	Sand racer *Psammophis lineolatus*	+		Common				
12	Spotted whip snake *Hemorrhois ravergieri*	+		Common				
13	Central Asian cobra *Naja oxiana*	+		Rare	UZ, TM, TJ, IR, AF, PK	3 (NT)	DD	II

Notes to Table 11: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

Site 4: Solar 100 MW PV plant (Samarkand 1 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 12: List of amphibian and reptile species potentially inhabiting the Solar 100 MW PV plant (Samarkand 1 project)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Turan toad* *Bufotes turanensis*	+		Common	UZ, TJ, TM			
2	Central Asian Tortoise *Testudo horsfieldii*	+		Common		2 (VU)	VU	II
3	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+		Common	UZ, TJ, TM, KZ			
4	Steppe Agama *Trapelus sanguinolentus*	+	+	Common				
5	Asian snake-eyed Skink *Ablepharus pannonicus*	+	+	Common				
6	Schneider's skink *Eumeces schneideri*	+		Not numerous				
7	Glass lizard *Pseudopus apodus*	+		Not numerous				
8	Rapid Racerunner *Eremias velox*	+	+	Common				
9	Steppe racerunner *Eremias arguta*	+		Not numerous				
10	Tatary sand boa *Eryx tataricus*	+		Rare		3 (NT)		II
11	Sand racer *Psammophis lineolatus*	+		Common				
12	Spotted whip snake *Hemorrhois ravergieri*	+		Common				
13	Central Asian cobra *Naja oxiana*	+		Rare	UZ, TM, TJ, IR, AF, PK	3 (NT)	DD	II

Notes to Table 12: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

Site 5: Solar 400 MW PV plant and pooling station (Samarkand 1 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 13: List of amphibian and reptile species potentially inhabiting the Solar 400 MW PV plant and pooling station (Samarkand 1 project)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Turan toad* *Bufotes turanensis*	+		Common	UZ, TJ, TM			
2	Central Asian Tortoise *Testudo horsfieldii*	+		Common		2 (VU)	VU	II
3	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+	+	Common	UZ, TJ, TM, KZ			
4	Steppe Agama *Trapelus sanguinolentus*	+	+	Common				
5	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+	Not numerous				
6	Rapid Racerunner *Eremias velox*	+	+	Common				
7	Steppe racerunner *Eremias arguta*	+		Not numerous				
8	Caspian Monitor *Varanus griseus caspius*	+		Rare		2 (VU:D)		I
9	Tatary sand boa *Eryx tataricus*	+		Rare		3 (NT)		II
10	Sand racer *Psammophis lineolatus*	+		Common				
11	Spotted whip snake *Hemorrhois ravergieri*	+		Not numerous				
12	Spotted desert racer *Platyceps karelinii*	+		Not numerous				

Notes to Table 13: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

Site 6: Solar 500 MW PV plant (Samarkand 2 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 14: List of amphibian and reptile species potentially inhabiting the Solar 500 MW PV plant (Samarkand 2 project)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	*Turan toad* *Bufotes turanensis*	+		Common	UZ, TJ, TM			

2	Central Asian Tortoise *Testudo horsfieldii*	+		Common		2 (VU)	VU	II
3	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+	+	Common	UZ, TJ, TM, KZ			
4	Steppe Agama *Trapelus sanguinolentus*	+	+	Common				
5	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+	Not numerous				
6	Rapid Racerunner *Eremias velox*	+	+	Common				
7	Steppe racerunner *Eremias arguta*	+		Not numerous				
8	Caspian Monitor *Varanus griseus caspius*	+		Rare		2 (VU:D)		I
9	Tatary sand boa *Eryx tataricus*	+		Rare		3 (NT)		II
10	Sand racer *Psammophis lineolatus*	+		Common				
11	Spotted whip snake *Hemorrhois ravergieri*	+		Not numerous				
12	Spotted desert racer *Platyceps karelinii*	+		Not numerous				

Notes to Table 14: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

Site 7: Karakul BESS (Samarkand 2 project) - AMPHIBIAN AND REPTILE CHECK LIST

Table 15: List of reptile species potentially inhabiting the Karakul BESS (Samarkand 2 project)

№	Species	Species presence acc. to literary sources	Species noted during surveys	Abundance	Endemism	Conservation status		
						UzRDB	IUCN	CITES
1	Caspian thin-toed gecko *Tenuidactylus caspius*	+		Common			LC	
2	Steppe Agama *Trapelus sanguinolentus*	+		Common			LC	
3	Rapid racerunner *Eremias velox*	+		Common			LC	
4	Arrow snake *Psammophis lineolatus*	+		Common			LC	
5	Saw-scaled viper *Echis carinatus*	+		Not numerous			LC	

Notes to Table 15: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF – Afghanistan; CN – China; KZ – Kazakhstan; IR – Iran; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

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Bird survey report 2023: VP monitoring on OHTLs

Environmental and Social Impact Assessment (ESIA) for the development of a solar power project in Samarkand Region, Uzbekistan

Client: 5Capitals

Date: 18 December 2023

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1. Introduction

In accordance with the Resolutions of the President of the Republic of Uzbekistan No. PP-207 dated July 4, 2023, "On measures for the implementation of the investment project 'Construction of a 500 MW Solar Photovoltaic Power Station, a 334 MW Electric Energy Storage System, and a Substation to support its operation in the Nurabad District of the Samarkand Region — Sazagan Solar 1'," and No. PP-208 dated July 4, 2023, "On measures for the implementation of the investment project 'Construction of a 500 MW Solar Photovoltaic Power Station, a 334 MW Electric Energy Storage System, and a Substation to support its operation in the Nurabad District of the Samarkand Region — Sazagan Solar 2'," investment agreements were signed on April 19, 2023, between the Ministry of Investments, Industry, and Trade of the Republic of Uzbekistan, the company "ACWA Power Company" (Investor), and the companies "ACWA Power Sazagan Solar 1" and "ACWA Power Sazagan Solar 2" (hereinafter referred to as the "Project Companies") (Figure 1).

Under the aforementioned investment agreements, the Project Companies are implementing the projects "Sazagan Solar 1" and "Sazagan Solar 2," within which three solar photovoltaic power stations with a total capacity of 1000 MW and a substation with a capacity of 500/220 kV will be constructed in the Nurabad District of the Samarkand Region. Additionally, two energy storage systems will be built — one in the Nurabad District of the Samarkand Region and another in the Karakul District of the Bukhara Region. Furthermore, two parallel overhead power transmission lines with a voltage of 220 kV and a length of 70 km will be constructed to connect the main project facilities. 360 km overhead transmission line will also connect stations located in Samarkand region with the Khalka substation, located in Tashkent region.

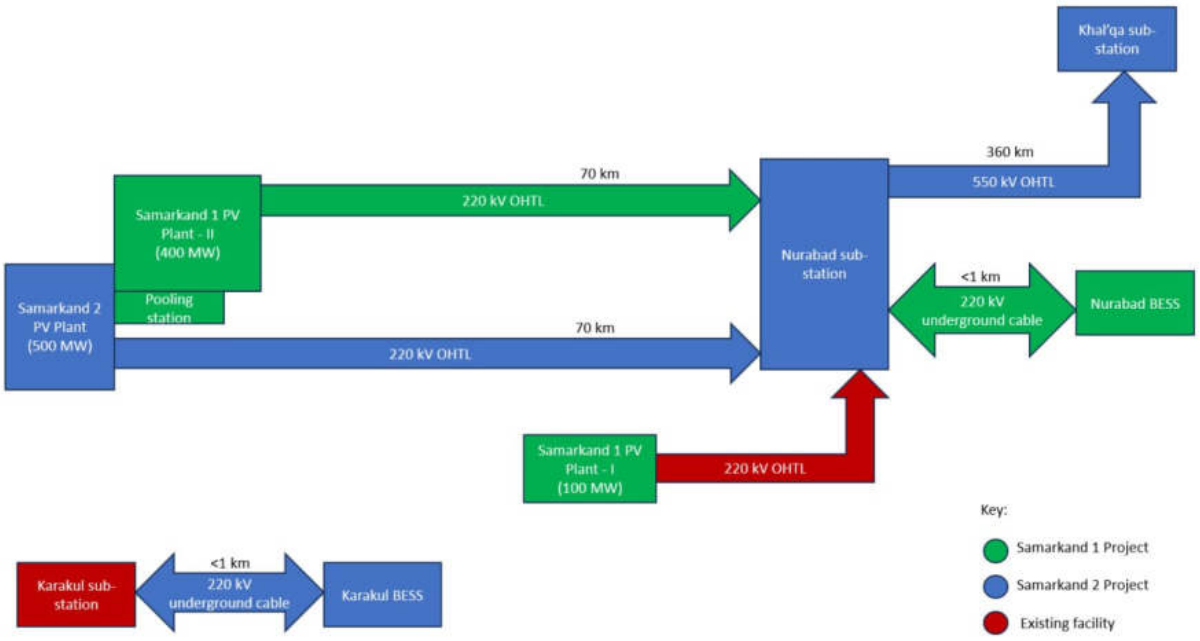

Figure 1: The scheme of project sites

The report presents data and materials from both field and desktop bird surveys:

1. VP Autumn bird migration surveys on OHTL 360 km were conducted
2. The bird survey was conducted after breeding season.

Additional Great bustard winter survey, Asian Houbara (incl. other breeding bird survey), Raptor nest search and VP Spring bird migration survey are planned for 2024.

This report details the findings of the 2023 autumn migration survey period, which included VP surveys conducted between 13 September – 12 November 2023.

2. Materials and methods

Vantage Point (VP) bird monitoring on OHTLs (360km, 70 km and 4.9 km)

The OHTL "Nurabad SS-Khalka SS" (360 km), OHTLs "Pooling station – Nurabad SS" (70 km), OHTL 4.9 km with a total length of 435 km mainly lay on agrolandscape, but the route crosses Syrdarya and Zarafshan rivers, Djizak pass (between Koitash and Malguzar ridges), slopes of Gobduntau mounts, Agalyk plain, foothills near Djam settlement, Karnabchul steppe near Tym settlement (modern Koshrabad).

Along all these areas, the 18 VPs were located:

Figure 2: Proposed routes of OHTL "Khalka SS-Nurabad SS" 360 km (red line) and OHTLs "Nurobod SS – pooling station" 70 km (yellow line) and Vantage points/VP (green dots). 15 VPs (VP01-VP15) distributed along 360 km OHTL line, and 3 VPs (VP16-VP18) along 70 km OHTLs line. VP15 covered also next facilities – Nurabad SS, Nurabad BESS, 4.9 km OHTL

Table 1: VP locations

№	VP	Project part	N	E	Location
1	VP01	Nurabad SS-Khalka SS	40.937088	69.033505	Agrolandscape
2	VP02	Nurabad SS-Khalka SS	40.819372	68.826185	Syrdarya river
3	VP03	Nurabad SS-Khalka SS	40.798054	68.79279	Agrolandscape with ponds
4	VP04	Nurabad SS-Khalka SS	40.544184	68.602296	Agrolandscape near ponds
5	VP05	Nurabad SS-Khalka SS	40.361165	67.947682	Agrolandscape
6	VP06	Nurabad SS-Khalka SS	40.144112	67.69065	Djizzak pass-1. Northern slopes of Koitash ridge
7	VP07	Nurabad SS-Khalka SS	40.096298	67.61901	Djizzak pass-2. Rain fed fields
8	VP08	Nurabad SS-Khalka SS	40.072616	67.593899	Djizzak pass-3. Rain fed fields
9	VP09	Nurabad SS-Khalka SS	39.903015	67.523184	Djizzak pass-4. Rain fed fields

10	VP10	Nurabad SS-Khalka SS	39.81531	67.363407	Southern slopes of Gobduntau-1. Rain-fed fields.
11	VP11	Nurabad SS-Khalka SS	39.838152	67.216359	Southern slopes of Gobduntau-2. Gardens
12	VP12	Nurabad SS-Khalka SS	39.904251	67.013635	Southern slopes of Gobduntau-3. Rain-fed fields.
13	VP13	Nurabad SS-Khalka SS	39.776289	66.791105	Riparian vegetation and Zarafshan river
14	VP14	Nurabad SS-Khalka SS	39.69826	66.552972	Agrolandscape
15	VP15	Nurabad SS-Khalka SS	39.577843	66.742028	Sazagan_1. Clay desert
16	VP16	Pooling station-Nurabad SS	39.532496	66.509101	Clay hills with rain fed fields
17	VP17	Pooling station-Nurabad SS	39.431038	66.131799	Djam-1. Clay hills with rain fed fields
18	VP18	Pooling station-Nurabad SS	39.427017	65.976201	Tym. Clay desert. Solar site

Data Recording Methods

The following data is recorded on the survey forms:

- The location of a VP used
- Date of survey
- Surveyor name
- Start and end time of a VP session
- Weather conditions
- Bird species, number,
- For threatened species, including raptors, cranes, geeses and pelicans- time of record,flight altitude and direction

Notes

- Equipment
- The equipment utilized to complete these surveys included:
- Field notebook and writing implements;
- Field survey sheets;
- Weatherproof clipboard;
- Compass / GPS unit;
- Binoculars (at or over 8x magnification);
- Telescope (at or over 80 mm x60) with tripod;
- Digital camera 300mm;

Weather

In general, the weather conditions during the survey period were suitable for bird observation.

Time schedule

Autumn season surveys were conducted between September 13 and November 12, 2023. The following number of days (or hours) was completed during the season:

- 14 VPs (VP01…VP15), minimum 50 days for the OHTL “Nurabad SS-Khalka SS” (360 km), 21 hours per VP per season.
- 1 VP (VP15) for the 4.9 km OHTL, 21 hours per VP per season.

- 3 VPs (VP16...VP18), minimum 10 days for the OHTL "Pooling station – Nurabad SS" (70 km), 21 hours per VP per season.

Table 2: Dates of observations during Autumn 2023

DATE	Sept,11	Sept,12	Sept,13	Sept,14	Sept,15	Sept,16	Sept,19	Sept,20	Sept,21	Sept,22	Sept,23	Sept,24	Sept,25	Sept,26	Sept,27	Sept,28	Sept,29	Sept,30	Oct,3	Oct,4	Oct,5	Oct,6	Oct,7	Oct,8	Oct,9	Oct,10	Oct,11	Oct,12	Oct,13	Oct,14	Oct,15	Oct,16	Oct,30	Oct,31	Nov,1	Nov,2	Nov,3	Nov,4	Nov,6	Nov,7	Nov,8	Nov,9	Nov,10	Nov,11	Nov,12	TOTAL hours
VP01	3						3											3	3												3	3												2	20
VP02	3						3											3	3												3	3												3	21
VP03	3						3											3	3												3		3											3	21
VP04		3						3									3			3										3			3										2		20
VP05		3						3									3			3										3			3										3		21
VP06		3						3									3			3										3				3									3		21
VP07						3			3							3					3								3					3							3			21
VP08						3			3							3					3								3					3							3			21
VP09						3			3							3					3								3						3							3			21
VP10			3							3			3									3				3									3						3			21
VP11			3							3			3									3				3									3						3			21
VP12			3							3			3									3				3										3						3			21
VP13				3								3			3										3				3							3					3				21
VP14				3								3			3										3				3							3					3				21
VP15				3								3			3										3				3								3					3				21
VP16					3						3			3									3				3										3					3	3				21
VP17					3						3			3									3				3										3					3	3				21
VP18					3						3			3									3				3															3	3					21

3. RESULTS

This section provides information on the data obtained as a result of the study, focusing on species that are potentially sensitive to adverse impacts from powerlines (collision, electrocution), and species that have elevated redlist status on the national and/or IUCN global redlists. In total of 113 bird species were observed, 23 listed in the Red Book of Uzbekistan (2019), 11 are included in the IUCN Red List (2023-1) (Table 3).

Detailed field data in presented in Excel file attached to this report – 'Samarkand OHTL-Autumn VP bird_FieldDB.xlsx'.

Table 3: List of birds observed during the Autumn VP Monitoring 2023.

№	**Species**	**Common name**	**IUCN RL**	**UzRDB**
1	*Phasianus colchicus*	Common Pheasant		NT
2	*Anser anser*	Greylag Goose		
3	*Anas crecca*	Common Teal		
4	*Anas platyrhynchos*	Mallard		
5	*Netta rufina*	Red-crested Pochard		
6	*Microcarbo pygmaeus*	Pygmy Cormorant		NT
7	*Phalacrocorax carbo*	Great Cormorant		
8	*Egretta garzetta*	Little Egret		**VU:D**
9	*Ardea alba*	Great White Egret		
10	*Ardea cinerea*	Grey Heron		
11	*Ardea purpurea*	Purple Heron		
12	*Ciconia nigra*	Black Stork		**VU:R**
13	*Ciconia ciconia*	White Stork		NT
14	*Plegadis falcinellus*	Glossy Ibis		**VU:D**
15	*Falco naumanni*	Lesser Kestrel		NT
16	*Falco tinnunculus*	Common Kestrel		
17	*Falco subbuteo*	Eurasian Hobby		
18	*Falco peregrinus*	Peregrine Falcon		**VU:R**
19	*Falco peregrinoides*	Barbary Falcon		**VU:R**
20	*Pandion haliaetus*	Osprey		**VU:R**
21	*Milvus migrans*	Black Kite		
22	*Gyps fulvus*	Griffon Vulture		**VU:D**
23	*Aegypius monachus*	Cinereous Vulture	NT	NT
24	*Gypaetus barbatus*	Bearded Vulture	NT	**VU:R**
25	*Neophron percnopterus*	Egyptian Vulture	**EN**	**VU:D**
26	*Circus aeruginosus*	Western Marsh Harrier		
27	*Circus cyaneus*	Hen Harrier		
28	*Circus macrourus*	Pallid Harrier	NT	NT
29	*Accipiter badius*	Shikra		
30	*Accipiter nisus*	Eurasian Sparrowhawk		
31	*Buteo buteo*	Eurasian Buzzard		

№	Species	Common name	IUCN RL	UzRDB
32	*Buteo japonicus*	Japanese Buzzard		
33	*Buteo rufinus*	Long-legged Buzzard		
34	*Buteo lagopus*	Rough-legged Buzzard		
35	*Clanga clanga*	Greater Spotted Eagle	**VU**	**VU:R**
36	*Aquila nipalensis*	Steppe Eagle	**EN**	**VU:D**
37	*Aquila heliaca*	Eastern Imperial Eagle	**VU**	**VU:D**
38	*Aquila chrysaetos*	Golden Eagle		**VU:R**
39	*Hieraaetus pennatus*	Booted Eagle		**VU:D**
40	*Grus grus*	Common Crane		
41	*Rallus aquaticus*	Western Water Rail		
42	*Otis tarda*	Great Bustard	**EN**	**CR**
43	*Tetrax tetrax*	Little Bustard	NT	**VU:D**
44	*Burhinus oedicnemus*	Eurasian Thick-knee		
45	*Himantopus himantopus*	Black-winged Stilt		
46	*Vanellus vanellus*	Northern Lapwing	NT	
47	*Charadrius dubius*	Little Ringed Plover		
48	*Tringa nebularia*	Common Greenshank		
49	*Tringa ochropus*	Green Sandpiper		
50	*Tringa glareola*	Wood Sandpiper		
51	*Actitis hypoleucos*	Common Sandpiper		
52	*Calidris minuta*	Little Stint		
53	*Glareola pratincola*	Collared Pratincole		
54	*Larus canus*	Mew Gull		
55	*Larus cachinnans*	Caspian Gull		
56	*Larus ridibundus*	Black-headed Gull		
57	*Hydroprogne caspia*	Caspian Tern		
58	*Pterocles orientalis*	Black-bellied Sandgrouse		
59	*Columba livia*	Rock Pigeon		
60	*Columba palumbus*	Common Wood-pigeon		
61	*Streptopelia turtur*	European Turtle-dove	**VU**	**VU:D**
62	*Streptopelia decaocto*	Eurasian Collared-dove		
63	*Spilopelia senegalensis*	Laughing Dove		
64	*Cuculus canorus*	Common Cuckoo		
65	*Coracias garrulus*	European Roller		
66	*Alcedo atthis*	Common Kingfisher		
67	*Merops persicus*	Blue-cheeked Bee-eater		
68	*Merops apiaster*	European Bee-eater		
69	*Upupa epops*	Common Hoopoe		
70	*Jynx torquilla*	Eurasian Wryneck		
71	*Melanocorypha calandra*	Calandra Lark		
72	*Calandrella brachydactyla*	Greater Short-toed Lark		

№	Species	Common name	IUCN RL	UzRDB
73	*Calandrella rufescens*	Lesser Short-toed Lark		
74	*Eremophila alpestris*	Horned Lark		
75	*Galerida cristata*	Crested Lark		
76	*Alauda arvensis*	Eurasian Skylark		
77	*Riparia riparia*	Collared Sand Martin		
78	*Hirundo rustica*	Barn Swallow		
79	*Cecropis daurica*	Red-rumped Swallow		
80	*Anthus campestris*	Tawny Pipit		
81	*Anthus trivialis*	Tree Pipit		
82	*Motacilla flava*	Yellow Wagtail		
83	*Motacilla personata*	Masked Wagtail		
84	*Motacilla cinerea*	Grey Wagtail		
85	*Motacilla alba*	White Wagtail		
86	*Luscinia svecica*	Bluethroat		
87	*Saxicola maurus*	Siberian Stonechat		
88	*Oenanthe oenanthe*	Northern Wheatear		
89	*Oenanthe pleschanka*	Pied Wheatear		
90	*Oenanthe isabellina*	Isabelline Wheatear		
91	*Muscicapa striata*	Spotted Flycatcher		
92	*Phylloscopus collybita*	Common Chiffchaff		
93	*Sylvia curruca*	Lesser Whitethroat		
94	*Parus bokharensis*	Bukhara tit		
95	*Sitta tephronota*	Eastern Rock Nuthatch		
96	*Lanius collurio*	Red-backed Shrike		
97	*Lanius excubitor*	Great Grey Shrike		
98	*Oriolus oriolus*	Eurasian Golden Oriole		
99	*Pica pica*	Eurasian Magpie		
100	*Corvus monedula*	Eurasian Jackdaw		
101	*Corvus frugilegus*	Rook		
102	*Corvus corone*	Carrion Crow		
103	*Corvus cornix*	Hooded crow		
104	*Corvus corax*	Common Raven		
105	*Acridotheres tristis*	Common Myna		
106	*Pastor roseus*	Rosy Starling		
107	*Sturnus vulgaris*	Common Starling		
108	*Passer hispaniolensis*	Spanish Sparrow		
109	*Passer montanus*	Eurasian Tree Sparrow		
110	*Fringilla coelebs*	Common Chaffinch		
111	*Spinus spinus*	Eurasian Siskin		
112	*Emberiza calandra*	Corn Bunting		
	Total		11	23

VP data

The analysis of bird species distribution across various VPs presented in Table 4 underscores the significance of these locations for migrating bird species. The dataset reveals that bird migration occurs across a broad front.

The distribution of threatened bird species is presented on Table 5.

Table 4: The distribution of bird species on VPs

N	VP	Number of records	Number of species	IUCN	UzRDB	Threatened and sensitive species	Status
1	VP01	132	36	2	3	Steppe Eagle	IUCN EN, UzRDB VU
						Northern Lapwing	IUCN NT
						Pygmy Cormorant	UzRDB NT
						White Stork	UzRDB NT
2	VP02	179	43	2	5	White Stork	UzRDB NT
						Greater Spotted Eagle	IUCN VU, UzRDB VU
						Little Egret	UzRDB VU
						Pygmy Cormorant	UzRDB NT
						Osprey	UzRDB VU
						Northern Lapwing	IUCN NT
3	VP03	179	42	1	5	White Stork	UzRDB NT
						Greater Spotted Eagle	IUCN VU, UzRDB VU
						Lesser Kestrel	UzRDB NT
						Booted Eagle	UzRDB VU
						Pygmy Cormorant	UzRDB NT
4	VP04	169	34	0	5	White Stork	UzRDB NT
						Little Egret	UzRDB VU
						Lesser Kestrel	UzRDB NT
						Pygmy Cormorant	UzRDB NT
						Glossy Ibis	UzRDB VU
5	VP05	150	33	3	3	Cinereous vulture	IUCN NT, UzRDB NT
						Greater Spotted Eagle	IUCN VU, UzRDB VU
						White Stork	UzRDB NT
						Northern Lapwing	IUCN NT
6	VP06	57	26	3	5	Steppe Eagle	IUCN EN, UzRDB VU
						Greater Spotted Eagle	IUCN VU, UzRDB VU
						Cinereous vulture	IUCN NT, UzRDB NT
						Lesser Kestrel	UzRDB NT
						Griffon Vulture	UzRDB VU
7	VP07	49	19	4	5	Steppe Eagle	IUCN EN, UzRDB VU
						Cinereous vulture	IUCN NT, UzRDB NT
						Bearded Vulture	IUCN NT, UzRDB VU
						Griffon Vulture	UzRDB VU
						Egyptian vulture	IUCN EN, UzRDB VU

8	VP08	87	30	3	6	Steppe Eagle	IUCN EN, UzRDB VU
						Egyptian vulture	IUCN EN, UzRDB VU
						Greater Spotted Eagle	IUCN VU, UzRDB VU
						Griffon Vulture	UzRDB VU
						Barbary Falcon	UzRDB VU
						Black Stork	UzRDB VU
9	VP09	112	25	2	2	Greater Spotted Eagle	IUCN VU, UzRDB VU
						Lesser Kestrel	UzRDB NT
						Northern Lapwing	IUCN NT
10	VP10	59	19	1	2	Griffon Vulture	UzRDB VU
						Pallid Harrier	IUCN NT, UzRDB NT
11	VP11	80	22	2	4	Cinereous vulture	IUCN NT, UzRDB NT
						Steppe Eagle	IUCN EN, UzRDB VU
						Griffon Vulture	UzRDB VU
						Golden Eagle	UzRDB VU
12	VP12	125	30	1	3	Pallid Harrier	IUCN NT, UzRDB NT
						Peregrine Falcon	UzRDB VU
						Zaravshan Pheasant (sub sp.)	UzRDB NT
13	VP13	180	48	1	6	Black Stork	UzRDB VU
						White Stork	UzRDB NT
						Little Egret	UzRDB VU
						Pygmy Cormorant	UzRDB NT
						European Turtle-dove	IUCN VU, UzRDB VU
						Zaravshan Pheasant (sub sp.)	UzRDB NT
14	VP14	139	28	1	2	Steppe Eagle	IUCN EN, UzRDB VU
						Zaravshan Pheasant (sub sp.)	UzRDB NT
						Common crane	-
15	VP15	50	21	2	1	Steppe Eagle	IUCN EN, UzRDB VU
						Northern Lapwing	IUCN NT
16	VP16	79	24	5	6	Little Bustard	IUCN NT, UzRDB VU
						Cinereous vulture	IUCN NT, UzRDB NT
						Steppe Eagle	IUCN EN, UzRDB VU
						Great Bustard (oral data)	IUCN EN, UzRDB CR
						Black Stork	UzRDB VU
						Eastern Imperial Eagle	IUCN VU, UzRDB VU
17	VP17	34	19	3	3	Steppe Eagle	IUCN EN, UzRDB VU
						Egyptian vulture	IUCN EN, UzRDB VU
						Little Bustard	IUCN NT, UzRDB VU
						Greylag goose	-
18	VP18	62	15	1	1	Pallid Harrier	IUCN NT, UzRDB NT

Table 5: The distribution of threatened bird species on VPs

№	**Species**	**Common name**	**IUCN RL**	**UzRDB**	**VP 01**	**VP 02**	**VP 03**	**VP 04**	**VP 05**	**VP 06**	**VP 07**	**VP 08**	**VP 09**	**VP 10**	**VP 11**	**VP 12**	**VP 13**	**VP 14**	**VP 15**	**VP 16**	**VP 17**	**VP 18**	**Number of records**
1	*Phasianus colchicus*	Common Pheasant		NT																			
2	*Microcarbo pygmaeus*	Pygmy Cormorant		NT	1	3	6	4									3						**17**
3	*Egretta garzetta*	Little Egret		VU:D		3		1									2						**6**
4	*Ciconia nigra*	Black Stork		VU:R								1					1			1			**3**
5	*Ciconia ciconia*	White Stork		NT	8	4	13	3	3								13						**44**
6	*Plegadis falcinellus*	Glossy Ibis		VU:D				1															**1**
7	*Falco naumanni*	Lesser Kestrel		NT			1	1		2			2										**6**
8	*Falco peregrinus*	Peregrine Falcon		VU:R												1							**1**
9	*Falco peregrinoides*	Barbary Falcon		VU:R								1											**1**
10	*Pandion haliaetus*	Osprey		VU:R		2																	**2**
11	*Gyps fulvus*	Griffon Vulture		VU:D						1	1	1		1	1								**5**
12	*Aegypius monachus*	Cinereous Vulture	NT	NT					1	2	1				1					1			**6**
13	*Gypaetus barbatus*	Bearded Vulture	NT	VU:R							1												**1**
14	*Neophron percnopterus*	Egyptian Vulture	EN	VU:D							1	1									1		**3**
15	*Circus macrourus*	Pallid Harrier	NT	NT										1		1						1	**3**
16	*Clanga clanga*	Greater Spotted Eagle	VU	VU:R		1	2		1	1		1	1										**7**

№	Species	Common name	IUCN RL	UzRDB	VP 01	VP 02	VP 03	VP 04	VP 05	VP 06	VP 07	VP 08	VP 09	VP 10	VP 11	VP 12	VP 13	VP 14	VP 15	VP 16	VP 17	VP 18	Number of records
17	*Aquila nipalensis*	Steppe Eagle	EN	VU:D	1					2	2	2			1			1	1	3	1		**14**
18	*Aquila heliaca*	Eastern Imperial Eagle	VU	VU:D																1			**1**
19	*Aquila chrysaetos*	Golden Eagle		VU:R											1								**1**
20	*Hieraaetus pennatus*	Booted Eagle		VU:D			1																**1**
21	*Otis tarda*	Great Bustard	EN	CR																(1)			**(1)**
22	*Tetrax tetrax*	Little Bustard	NT	VU:D																1	1		**2**
23	*Vanellus vanellus*	Northern Lapwing	NT		1	2			1				1						1				**6**
24	*Streptopelia turtur*	European Turtle-dove	VU	VU:D													1						**1**
Total number of records					**11**	**16**	**23**	**10**	**6**	**8**	**6**	**7**	**4**	**2**	**4**	**2**	**20**	**1**	**2**	**7**	**3**	**1**	
Number of rare species			**11**	**23**	**4**	**6**	**5**	**5**	**4**	**5**	**5**	**6**	**3**	**2**	**3**	**2**	**5**	**1**	**2**	**5 (1)**	**3**	**1**	

4. Key species descriptions

- **Pygmy cormorant (*Phalacrocorax pygmaeus*) - UzRDB: 3 (NT)**

Status: Near threatened, migratory and nesting, occasionally wintering species.

Distribution: In the past, this species nested on the islands of the Aral Sea in Uzbekistan, but it has since disappeared from there. It has extended its range to new habitats in the Amu Darya and Syr Darya river basins. Until 2000, 30-35% of the world population nested in the Amu Darya interfluve and Syr Darya. In the Samarkand region, it is observed in the river basin of Zeravshan and on the Kattakurgan reservoir. Autumn migration occurs in October, with wintering from October to March. S.E. Fundukchiev and B.Sh. Muhammadiev (2018) have repeatedly observed it in the winter and early spring months at the Kattakurkansky reservoir [1].

Habitats: The species predominantly occupies plain lakes, reservoirs, and irrigation system. Due to a shortage of food resources in wintering grounds, it has been observed in recent years on canals and large collectors. The little cormorant feeds on small fish and nests in colonies on reeds and flooded bushes.

- **Little egret (*Egretta garzetta garzetta*) - UzRDB: 2 (VU:D)**

Status: Vulnerable, decreasing, migratory nesting nominate subspecies.

Distribution. In Uzbekistan it is found in the southern Aral Sea region and the middle reaches the Amu Darya River, the valley of the Chirchik River and in the middle reaches of the Syr Darya River. In the Samarkand region it is observed during nesting and during migration valley of the Zeravshan river. Autumn migration is noted in September-October.

Habitats: It predominantly inhabits salty flat reservoirs with reed thickets.

- **Asian white stork (*Ciconia ciconia asiatica*) - UzRDB: 3 (NT)**

Status: near threatened, partially settled Turkestan subspecies of migratory species.

Distribution: in Uzbekistan, the main part of the population is concentrated in the plains parts of the Chirchik-Akhangaran interfluve, the middle reaches of the Syr Darya River and in the Fergana Valley. Within 10 years it spreads the flat part of the Jizzakh region. This population is resident.

Single nests have been preserved in the foothills of the Turkestan Range and along the Kashkadarya River, where previously the stork was common. Part of the population winters in the middle reaches of the river Syr Darya. In the Samarkand region it is found in the valley of the Zeravshan River to Ziadine. Stork nesting along the middle reaches of Zarafshan was noted at the following points: Samarkand city, surroundings of Samarkand, villages of Chardzhi, Laish, Tailak, Iski Dzhambay, Bagrinkul, Urgut, Karatepa, Daul, Guz, surroundings of Kattakurgan. The largest number of nests are now observed in the territory of Kattakurgan (12 nests), Pakhtachinsky (7 nests), Akdarinsky (6 nests), Ishtykhansky (5 nests), Narpaisky (4 nests), Pasdargomsky (3 nests) districts.

Habitats: River banks, moist, swampy areas along irrigation canals within agricultural lands and fish farms. As nesting sites uses power lines.

[1] Abduraupov et al., Samarkand Cadastre rare animals 2021

Figure 1: White stork in Zarafshan river, VP13, 27.09.2023. Photo by Relisa Granovskaya.

- **Black stork (*Ciconia nigra*) - UzRDB: 2 (VU:R)**

Status: vulnerable, this species is naturally rare and migratory.

Distribution: During nesting, it is primarily found in the mountainous regions of Uzbekistan, specifically on the Western Tien Shan and Western Pamir-Alai. During migration and wintering, it visits lowland and low-mountain regions of the republic. The black stork nests in the mountainous parts of the Samarkand region. It descends to flat water bodies after nesting period and during seasonal migrations. In years with warm, little snow winters, a small portion of the black stork population may remain for the winter on the Zeravshan River.

Habitats: During the nesting period, the Black stork inhabits mountain valleys, after the nesting period and during migration, it can be found near lowland reservoirs and rivers.

Figure 2: The group of Black storks (50 birds) was observed outside of VP surveys in 10 km from VP07 at October 14, 2023. Photo by Relisa Gronovskaya.

- **Glossy ibis (*Plegadis falcinellus*) -UzRDB: 2 (VU:D)**

Status: Classified as vulnerable and decreasing, this species represents a nesting migratory nominate subspecies of the cosmopolitan species.

Distribution: In Uzbekistan, it nests in the lower reaches of the Amu Darya and Zeravshan rivers. In other reservoirs and the valleys of the Amu Darya and Syr Darya rivers, it is observed as a migratory species. Few sightings have been recorded in the Samarkand region, with instances of mining near the village of Dagbet (1948, 1950) and near the settlement Ravathuzha (1956).

Habitats: The species prefers shallow flat reservoirs with reed thickets. Spring migration occurs in April-May, while autumn migration is noted in July-September.

- **Osprey (*Pandion haliaetus*) - UzRDB: 2 (VU:R)**

Status: Classified as vulnerable, this naturally rare migratory nominative subspecies belongs to the cosmopolitan species.

Distribution: In Uzbekistan, it is found throughout as a migratory species. Irregular nesting has been registered in the Khorezm region. Within the territory of the Samarkand region, an osprey has been observed at the Kattakurgan reservoir and near Samarkand, with the latest recording made on December 23, 1925. Additionally, an osprey was noted in the middle reaches of the river Zarafshan, in the protective zone of the Zeravshan National Natural Park, and on Dzhambai lakes.

Habitats: The species predominantly inhabits plain and foothill reservoirs with clear water. Migrating birds often use power transmission poles as resting spots.

- **Bearded vulture (*Gypaetus barbatus*) -UzRDB: 2 (VU:R); IUCN: NT**

Status: Classified as a vulnerable, naturally rare, sedentary, locally widespread species.

Distribution: In Uzbekistan, it nests on various mountain ridges, including Kugitang, Babatag, Gissarki, Nuratau, Zeravshan, Turkestan, Chatkal, Kuramin, Pskem, and Ugamsky. Occasionally, during the non-

breeding period, individuals migrate to the flat regions of the republic. Sightings of the bearded vulture have been reported on the Zeravshan ridge, in the Karatepinsky mountains, upper reaches of Agalyksai, on Aman-Kutan, and the Takhta-Karacha Pass by several ornithologists. Near Samarkand, a bearded vulture was observed on the Siab canal. Rarely, bearded vultures have been noted near Samarkand during winter (1956).

Habitats: The species primarily inhabits the middle and upper mountain belt at altitudes of 1,000-4,300 meters above sea level. It nests on rocky cliffs. Periodically, during the non-breeding season, certain individuals exhibit migration to flat regions.

- **Egyptian vulture (*Neophron percnopterus*) - UzRDB: 2 (VU:D); IUCN: EN**

Rare breeding bird. Found at lower altitudes in the mountains and in depressions throughout Uzbekistan. Most of the birds leave the country for winter, with just occasional individuals staying. Nests in the niches and cavities of rocks, on precipitous loess and sandstone slopes, more rarely on rock ledges (where also prefers some kind of rock projection above the nest as a shelter), often not far from the breeding sites of other raptors (vultures, kites, buzzards), as well as storks and ravens.

The breeding begins in April and lasts until early August. Individual clutches, probably, second ones, are made until late May. The clutch consists of 2 eggs, more rarely 1. Chicks emerge in late May—early June and fledge in mid-July—August. Autumn migration mid August – September. The diet is based on reptiles and dead small animals. Often feeds on the carcasses of large animals and forages in dumps near human settlements and slaughterhouses.

Figure 3: Egyptian vulture. Photo by Evgeniy Akhatov

- **Griffon vulture (*Gyps fulvus fulvus*) - UzRDB: 2 (VU:D)**

Status: Vulnerable, decreasing, sedentary, with a mosaic common nominative subspecies.

Distribution: The species is found in the mountainous part of the Republic, nesting on rocks in groups or colonies. Its seasonal movements are throughout Uzbekistan. During nesting, birds gather on the northern slopes of the Turkestan ridge and in the river basin of Zeravshan (Dal, 1936; Bogdanov, 1956; Mitropolsky et al., 1987). Near Samarkand, and within the city of Samarkand itself, sightings have been reported by A.N. Bogdanov (1956). Meetings in different years have been recorded on the Zeravshan ridge near the village of Kushtut, in the upper reaches of the river Agalyksaya, Ettiuyli saya, and on Aman-Kutan[1].

Habitats: The species inhabits the lower and middle mountain belts at altitudes of 700-2500 meters above sea level and plains, including cultivated lands.

Figure 4: Griffon vulture, VP06, 4.10.2023. Photo by Relisa Granovskaya

- **Cinereous vulture (*Aegypius monachus*) - UzRDB: 2 (VU:D); IUCN: NT**

Status: Classified as near threatened, sedentary, and a mosaic widespread species.

Distribution: The species is found in the Western Tien Shan, Western Pamir-Alai, mountains of Bukantau, and Tamdytau. It is a sedentary species characterized by regular seasonal short-distance migrations. In the Samarkand region, it is found in the foothills and mountainous parts of Zeravshan, Turkestan, and Nurata ridges, including their spurs. It is rare in the western part of the Zeravshan range where it nests, if at all (Bogdanov, 1956; Mitropolsky et al., 1987). The species is regularly seen along the wooded northern slopes of the Turkestan ridge (Abdusalyamov, 1971; Mitropolsky et al., 1987). During the non-breeding period, sightings of vultures in the vicinity of Samarkand and near Samarkand have been reported by N.V. Marmazinskaya (2011) and S.E. Fundukchiev (2018).

Habitats: It primarily occupies the lower and middle mountain belt and feeds on carrion from ungulates.

- **Pallid harrier (*Circus macrourus*) - UzRDB: 3 (NT); IUCN: NT**

Status: Near threatened, migratory species.

Distribution: The species migrates through Uzbekistan for wintering in Africa, Iraq, South Iran, India, and Pakistan. During migration, it is found in Kyzylkum, the valleys of the Amu Darya, Syr Darya, Zeravshan, and Surkhandarya. In warm, little-snowy winters, a small quantity remains for the winter in the southern part of the republic. There are historical records, such as the killing of a steppe harrier on February 13, 1949, in the Samarkand region (Bogdanov, 1956). Near Samarkand, during autumn migration, single harriers were observed on September 8, 1929, September 18, 1948, and September 23, 1931 (Bogdanov, 1956). Another harrier was caught on February 13, 1949, in the territory of the Dzhambai district by I.M. Ananyev. [1]

Habitats: The species is associated with plains.

- **Steppe eagle (*Aquila nipalensis*) - UzRDB: 2 (VU:D); IUCN: EN**

Status: Vulnerable, decreasing species. There are two subspecies present in Uzbekistan: the eastern (1) and migratory European (2).

Breeds only in the northern part of the Karakalpak part of the Ustyurt Plateau. Occasional wintering individuals were recorded in the Golodnaya Steppe, near Samarkand, in the Kyzylkum desert, the lower reaches of the Zeravshan and in Kashkadarya and Surkhandarya Provinces. During migration widespread in the lowlands[1].

Habitats: lowlands and low mountains. Spring migration: March—April. Autumn migration: September—November. Wintering: December—February. Individual birds or groups of 2-3 individuals are recorded during migration, with up to several hundred individuals observed on some days.

- **Greater spotted eagle (*Aquila clanga*) - UzRDB: 2 (VU:R); IUCN: VU**

Status: Vulnerable, naturally rare, migratory species.

During migration recorded throughout Uzbekistan[1]. There is very little information on wintering.

Spring migration: February—May. Autumn migration: October—November. During migration flies individually or in groups of 2-3 birds. Diet: small mammals, semi-aquatic birds, frogs and snakes6.

- **Eastern Imperial eagle (*Aquila heliaca*) - UzRDB: 2 (VU:D); IUCN: VU**

Ustyurt Plateau, northern part of the Kyzylkum desert (breeding). During seasonal migrations occurs throughout Uzbekistan.

Inhabits lowlands and foothills. Spring migration occurs in February—April, when birds fly individually or form groups of up to 15 individuals. Eggs are laid in February—May. The clutch consists of 1-2 eggs. Both parents take part in the incubation, which lasts 43 days. Chicks fledge in July—August. The diet consists of rodents, hedgehogs, tortoises and carrion. Autumn migration: October—November[1].

- **Golden eagle (*Aquila chrysaetos*) - UzRDB: 2 (VU:R)**

Status: The golden eagle is classified as vulnerable, naturally rare, and sedentary, with locally widespread distribution, including Southern European (1) and Central Asian (2) subspecies.

Distribution: The golden eagle is distributed in Uzbekistan from the Usturt plateau to the north-eastern part of the Kyzylkum desert (Southern European subspecies) and in mountainous areas (Central Asian subspecies). The species has always been present in small numbers. In the Samarkand region, golden eagles nest in the Karatepa Mountains near the city of Samarkand. N.A. Bogdanov (1956) found a golden eagle nest with two chicks in the Agalyk mountains. In the Zeravshan Range, it is found in Agalyk, on Aman-Kutan, and Takhta-Karach. During winter, it descends to the floodplain of the Zeravshan River, Karasu, and Kattakurgan reservoir.

Habitats: Golden eagles inhabit remnant mountains of deserts, loess cliffs of foothills, and rock formations in the middle and upper mountain zones. They build nests on rocks, cliffs, trees, and structures like power transmission line supports.

- **Booted eagle (*Hieraaetus pennatus*) - UzRDB: 2 (VU:D)**

Status: Vulnerable, decreasing, breeding, and migratory Central Asian subspecies.

Distribution: The Booted eagle is found in the Western Tien Shan, Western Pamir-Alai, and the Syr Darya River basin within the territory of Uzbekistan. Nesting sites have been registered in these regions. Nests are typically located on perennial trees. In other areas, it is observed during migration. In recent years, several individuals have been noted to remain for the winter in the Chirchik River valley. Specific locations within the Samarkand region where the species has been observed include the Zeravshan ridge near Aman-Kutan pass, the Karatepa Mountains, the Agalyk region, the valley of

the river Ettiuyli sai, Ilonsay, Hazrat Dawood, the vicinity of the villages of Jam and Chindon (the middle reaches of the Zeravshan River), and in the vicinity of Samarkand and Zeravshan National Natural Park.

Habitats: The Booted eagle primarily inhabits mountain and lowland floodplain forests.

Figure 5: Booted Eagle, VP03, 3.10.2023 (photo by Relisa Granovskaya)

- **Lesser kestrel (*Falco naumanni*) - UzRDB: 3 (NT)**

Status: Near threatened, migratory species.

Distribution: This species is widespread, and its migration occurs throughout the entire territory of the Republic of Uzbekistan. It breeds in various regions, including the Western Tien Shan, Western Pamir-Alai, remnant mountains of the Kyzylkum desert, lower reaches of the Amu Darya River, and the river valley of Zeravshan. In the Samarkand region, the Lesser kestrel is known to nest in the Zeravshan River valley, and sightings have been reported in Urgut, Guz, Aman-Kutan, and Takhta-Karache. A.N. Bogdanov noted the species near Samarkand in different years (1956), and it is often found in Urgut, Guz, and on Aman-Kutan and Takhta-Karache according to Marmazinskaya (2011). Additionally, there have been reports of sightings in the valley of the Zeravshan River by Kreutzberg (2019).

Population decline: The world population of this species declined in the second half of the twentieth century, possibly due to factors such as habitat destruction in cliffs and rock niches.

Habitats: The Lesser kestrel primarily inhabits plain, foothill, and low mountain areas.

Figure 6: The pair of Lesser kestrels was observed on VP9, 28.09.2023 (photo by Relisa Granovskaya)

- **Peregrine falcon (*Falco peregrinus peregrinus*) - UzRDB: 2 (VU:R)**

Status: Vulnerable, naturally rare.

Distribution: In the Samarkand region, the Peregrine Falcon's autumn migration is noted at the end of October. Sightings have been reported near Samarkand during this period. Occasionally observed in the Samarkand region during winter. Peregrine Falcons are known to hunt waterfowl in the Zeravshan River basin, specifically around the Dzhambay Lakes.

Habitats: Settlements, plains, and foothills.

- **Barbary falcon (*Falco pelegrinoides babylonicus*) - UzRDB: 2 (VU:R)**

Status: Vulnerable, naturally rare, semi-sedentary subspecies.

Distribution: In Uzbekistan it nests in the Western Tien Shan, Western Pamir-Alai and in the mountains of the Kyzylkum desert. In the southern region of Uzbekistan, isolated individuals remain for the winter. Has always been small in number. Barbary falcon is very rare bird in the Zeravshan Valley. This species was recorded on Dargom in 1956. About the meeting of the Shahin in the vicinity of Samarkand on the Zirabulak Heights between the village Ishtykhan and the city of Narta are reported in 2011. On the Zeravshan ridge (Aman-Kutan, Takhta-Karacha) recorded in 2019. We celebrated one individual Barbary falcon in the winter of 2020 on the shore of the Sabirsay reservoir.

Habitats: Loess cliffs, rocks of low mountains and outlier mountains. Nests on rocks and cliffs.

- **Zaravshan Ring-necked pheasant (Phasianus colchicus) - UzRDB: 3 (NT)**

Status: Close to the vulnerable, sedentary Zeravshan subspecies.

Distribution: Endemic subspecies living in Uzbekistan and Tajikistan. A sedentary species, common in the valley of the Zeravshan River and in Kashkadarya oasis. Found in Samarkand, Bukhara, Navoi and Kashkadarya areas. Distributed throughout the Samarkand region, including in the floodplain the Zeravshan River. In 1960-1970 bird numbers sharply decreased and disappeared in the south of its range. After 1990 due to the reduction in area cotton crops and replacing them with grain and vegetable crops, pheasant widely settled in agricultural landscapes, where it became a common species.

Habitats: Tugai forests, coastal reed thickets and agricultural landscape.

Figure 7: Zaravshan Ring-necked pheasant, VP13, 27.09.2023. Photo by Relisa Granovskaya

- **Great bustard (*Otis tarda tarda*) - UzRDB: 1 (CR); IUCN: EN**

Status: Critically endangered, migratory European subspecies.

Distribution: In Uzbekistan, on migration they are found on the Usturt plateau, in the South-Western Kyzylkum, the valleys of the Syr Darya, Zeravshan rivers, the lower reaches of the Surkhandarya, Sherabaddarya rivers, in the Golodnaya and Dalverzinskaya steppes, at the foot of the ridge. Nuratau (winter in past - nesting). On rainfed fields, in the foothills of the northern part of the Samarkand region the Central Asian winters population.

The important wintering aggregation was found along OHTL near Gallaaral town in 20200-2021, which was estimated as 450-500 birds[2]. To reduce the impact the route of 360 km OHTL was changed (first option crossed the main wintering site) and now it goes along the border of this site. *The additional winter survey is planning in winter season along OHTLs in winter 2023-2024.*

[2] Kashkarov R. D., Ten A., Mitropolskaya Y. O., Soldatov V. (2023). Changes In The Modern Range Of The Great Bustard Otis Tarda In Uzbekistan Under The Influence Of Agricultural Transformation Of Landscapes And Climate. Geography, Environment, Sustainability, 1(16), 140-149 https://DOI-10.24057/2071-9388-2022-091

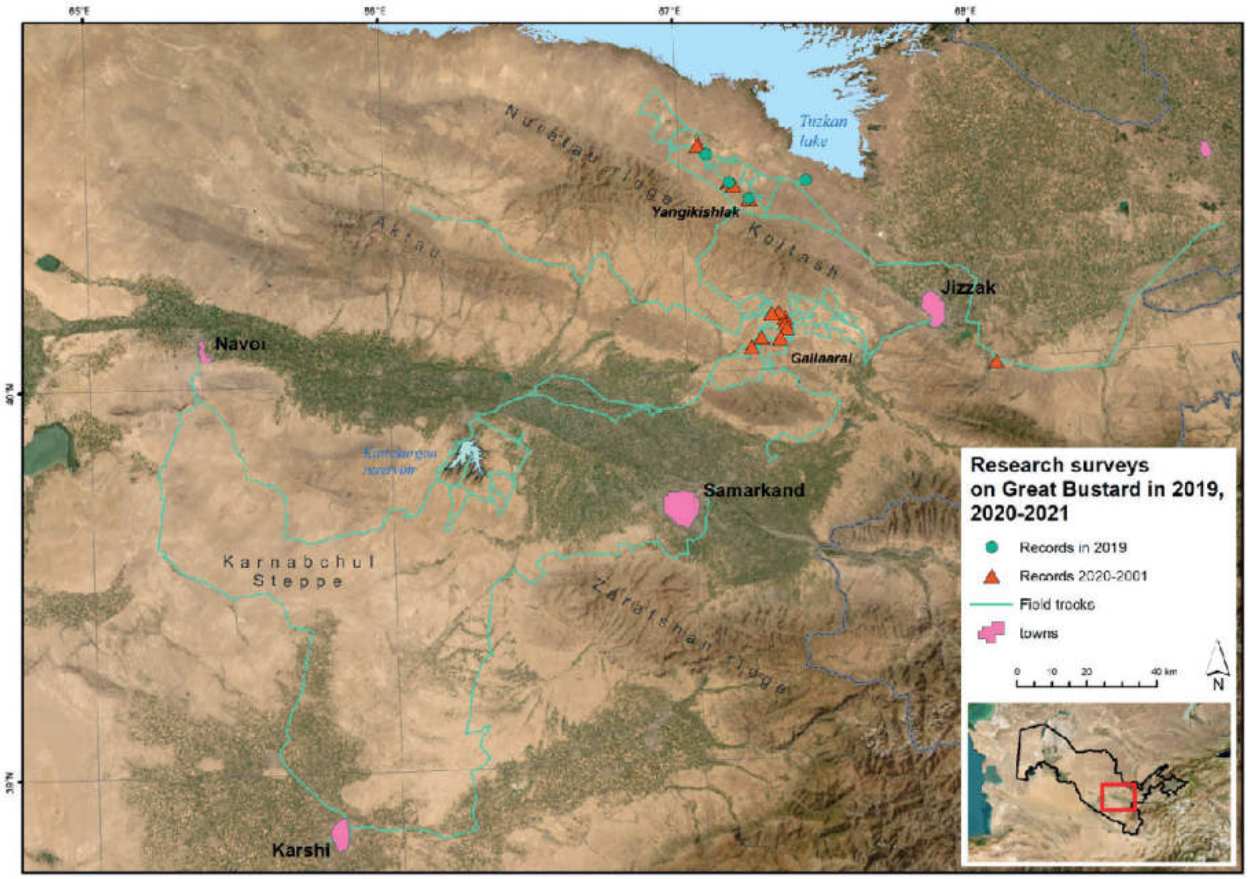

Figure 8: Great bustard aggregations (Kashkarov et al., 2023[3])

Habitats: Foothill plains with tall grass vegetation, semi-deserts, rainfed wheat fields and alfalfa.

- **Little bustard (*Tetrax tetrax*) - UzRDB: 2 (VU:D); IUCN: NT**

Status: Vulnerable, decreasing, migratory and wintering species.

Distribution: Breeds in the central and southern regions of Uzbekistan. They regularly winter in the south, flying across the plains regions of the republic. Winters in small numbers in the foothills of Turkestan ridge. On migration it is occasionally found in the flat part of the Samarkand region.

Habitats: Areas of deserts, semi-deserts, foothill plains with sparse herbaceous and shrub vegetation. Winter crops, alfalfa fields (wintering)[1].

- **Turtle dove (*Streptopelia turtur*) - UzRDB: 2 (VU:D); IUCN: VU**

Status: Vulnerable, decreasing, migratory, nesting Asian (2) and migratory (1) subspecies.

Distribution: In Uzbekistan inhabits the lowlands of the Western Tien Shan, Western Pamir-Alai, valleys of the Syr Darya, Amu Darya, Zeravshan, Kashkadarya, Sherabaddarya rivers and Surkhandarya (breeding), on migration the plains and foothills of the republic, including deserts and steppes. In the past it was common throughout Samarkand region. Nested in natural and developed biotopes, met even in city parks. In the last 30 years, the number has sharply decreased and the species has become rare.

Habitats: Trees and shrubs, grain fields. Low mountain valley and lowland tugai forests, areas developed for agriculture, populated points.

Limiting factors: Loss of nesting and feeding sites, intense hunting on the flight paths[1].

5. Summary

- Autumn season surveys were conducted between September 11 and November 12, 2023 , covering the entire Autumn migration period.
- In total of 113 bird species were observed, 23 listed in the Red Book of Uzbekistan (2019), 11 are included in the IUCN Red List (2023-1).
- Analysis of bird distribution on Vantage Points (VP) indicates that bird migration occurs across a broad front.
- The equipment of planned TL in sensitive parts with the bird flight deflectors, diverters, and other devices will help birds to detect TL poles and wires.

6. References

- Abduraupov et al., Samarkand Cadastre rare animals 2021
- Kashkarov R. D., Ten A., Mitropolskaya Y. O., Soldatov V. (2023). Changes In The Modern Range Of The Great Bustard Otis Tarda In Uzbekistan Under The Influence Of Agricultural Transformation Of Landscapes And Climate. Geography, Environment, Sustainability, 1(16), 140-149 https://DOI-10.24057/2071-9388-2022-091
- Uzbekistan Red data book. 2019/ Vol. II. Animals. Tashkent: Chinor ENK, 2019.

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Bat Roost Survey Report

Environmental and Social Impact Assessment (ESIA) for the development of a solar power project in Samarkand Region, Uzbekistan

5 Capitals

Juru

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Contents

1. Introduction

In accordance with the Resolutions of the President of the Republic of Uzbekistan No. PP-207 dated July 4, 2023, "On measures for the implementation of the investment project 'Construction of a 500 MW Solar Photovoltaic Power Station, a 334 MW Electric Energy Storage System, and a Substation to support its operation in the Nurabad District of the Samarkand Region — Sazagan Solar 1'," and No. PP-208 dated July 4, 2023, "On measures for the implementation of the investment project 'Construction of a 500 MW Solar Photovoltaic Power Station, a 334 MW Electric Energy Storage System, and a Substation to support its operation in the Nurabad District of the Samarkand Region — Sazagan Solar 2'," investment agreements were signed on April 19, 2023, between the Ministry of Investments, Industry, and Trade of the Republic of Uzbekistan, the company "ACWA Power Company" (Investor), and the companies "ACWA Power Sazagan Solar 1" and "ACWA Power Sazagan Solar 2" (hereinafter referred to as the "Project Companies") (Figure 1).

Under the aforementioned investment agreements, the Project Companies are implementing the projects "Sazagan Solar 1" and "Sazagan Solar 2," within which three solar photovoltaic power stations with a total capacity of 1000 MW and a substation with a capacity of 500/220 kV will be constructed in the Nurabad District of the Samarkand Region. Additionally, two energy storage systems will be built — one in the Nurabad District of the Samarkand Region and another in the Karakul District of the Bukhara Region. Furthermore, two parallel overhead power transmission lines with a voltage of 220 kV and a length of 70 km will be constructed to connect the main project facilities. 360 km overhead transmission line will also connect stations located in Samarkand region with the Khalka substation, located in Tashkent region.

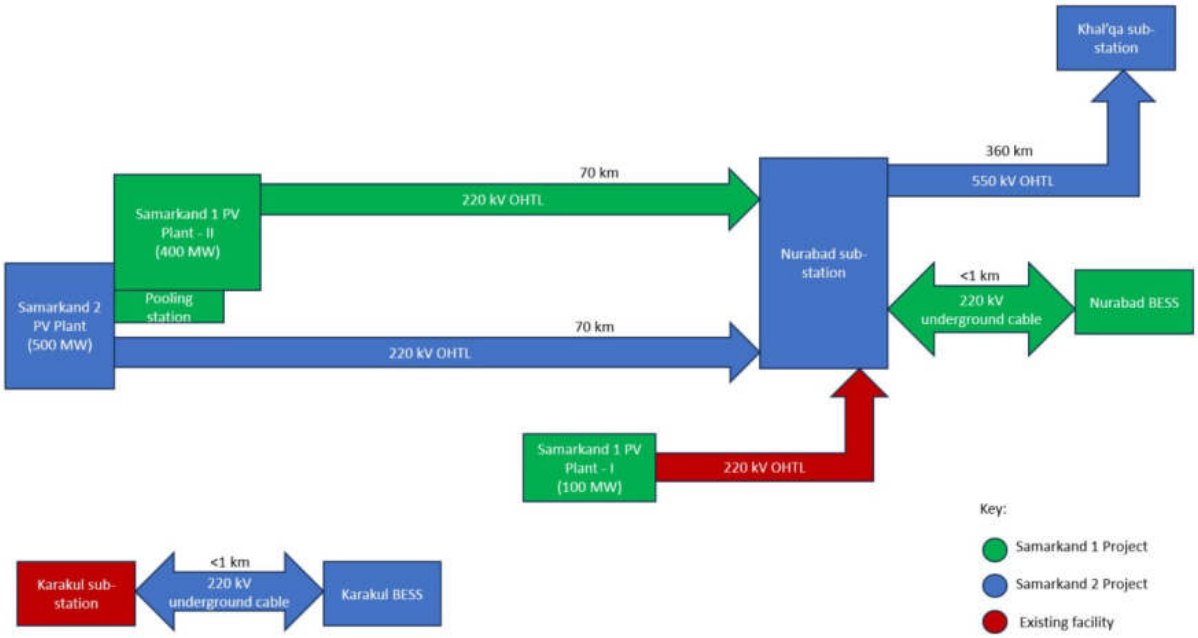

Figure 1: The scheme of project sites

The report presents data and materials from both field and desktop bat roost survey.

Field visit was carried out on February 08.02.-11.02.2024 in Jizzakh and Samarkand regions, March 12 and 13 in Samarkand and Bukhara regions, and on March 20-21 in Samarkand regions.

The main purpose of the survey was to confirm the presence/absence of potential roosting places of bats identified based on map and a direct survey of the area.

2. Literature review

Below is a list of bats indicated in literature sources as inhabiting mostly adjacent areas near the project site (The list below includes 12 species of bats that can potentially be recorded in the Jizzakh region and 17 in the Samarkand region of the project area, with references to the source of the information.

Table 1). Studies on Jizzakh region are limited, in Samarkand region more related to the city itself or mountainous areas. The list therefore includes those species that may not form colonies near power lines, but may be observed during migrations / movements.

The list below includes 12 species of bats that can potentially be recorded in the Jizzakh region and 17 in the Samarkand region of the project area, with references to the source of the information.

Table 1. List and status of bats species potentially can be recorded in the project area

ID	Species	IUCN Red list	UzRDB (2019)	CMS	Status	Source
Jizzakh region						
1	Greater Horseshoe Bat *(Rhinolophus ferrumequinum*)	LC	-	II	widespread species in suitable habitats	Meklenburtsev, 1935; 1935; Bogdabov, 1950; Bogdabov, 1953; Bogdabov, 1956;
2	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	LC	2(VU:D)	II	sporadic records in the country	included in the list based on own observations
3	Lesser Mouse-eared Bat *(Myotis blythii*)	LC	-	II	widespread species in suitable habitats	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953;
4	Geoffroy's Bat (*Myotis emarginatus*)	LC	-	II	widespread small number species	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953
5	*David's myotis (Myotis davidii)*, (previously incorrectly reported in the literature as *Myotis mystacinus*	LC	-	-	widespread species, numerous in some places	Bogdabov, 1950; Bogdabov, 1953
6	Long-tailed Bat (*Myotis bucharensis*)	DD	1(CR)	-	a rare, poorly studied species. There are several current records in the country	included in the list based on own observations and conclusions

7	Asian Barbastelle (*Barbastella leucomelas*)	LC	-	II	widespread species, but poorly studied	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953; Vologeninov, 1978
8	Long-eared Bat (*Plecotus strelkovi*)	LC	-	-	widespread species in suitable habitats	Ognev S.I., 1928; Bobrinsky N.A., 1931; Bogdabov, 1953;
9	Noctule Bat (*Nyctalus noctula*)	LC	-	II	widespread species	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953
10	Common pipistrelle bat *(Pipistrellus pipistrellus*)	LC	-	II	widespread species, numerous	Meklenburtsev, 1935; Bogdabov, 1953; Korelov, 1956; Vologeninov, 1978
11	Serotine Bat (*Eptesicus serotinus)*	LC	-	II	widespread species	Satunin K.A., 1909; Bobrinsky N.A.,1925; Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953
12	Particoloured Bat (*Vespertilio murinus)*	LC	-	II	widespread species	Bogdabov, 1950; Bogdabov, 1953; Vologeninov, 1978
Samarkand region						
1	Greater Horseshoe Bat *(Rhinolophus ferrumequinum*)	LC	-	II	widespread species in suitable habitats	Meklenburtsev, 1935; 1935; Bogdabov, 1950; Bogdabov, 1953; Bogdabov, 1956; Gritsina et al, 2013 (a); Tadjibaeva, Khabilov, 2017
2	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	LC	2(VU:D)	II	sporadic records in the country	Bogdabov, 1953; Bogdabov, 1956; Gritsina et al, 2013 (b); Tadjibaeva, Khabilov, 2017
3	Buchara Horseshoe Bat (*Rhinolophus bocharicus*)	LC	-	II	AF, IR, TM, KZ, KY, TJ, UZ	Bogdabov, 1956; Tadjibaeva, Khabilov, 2017
4	Blyth's Horseshoe Bat (*Rhinolophus lepidus*)	LC	-	-	poorly studied species. There are several current records in the country	Benda et al, 2016; Tadjibaeva, Khabilov, 2017; Khabilov et al, 2018
5	Lesser Mouse-eared Bat *(Myotis blythii*)	LC	-	II	widespread species in suitable habitats	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953; Tadjibaeva, Khabilov, 2017
6	Geoffroy's Bat (*Myotis emarginatus*)	LC	-	II	widespread small number species	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953; Tadjibaeva, Khabilov, 2017

7	*Myotis davidii* (previously incorrectly reported in the literature as *Myotis mystacinus* Kuhl, 1817	LC	-	-	widespread small number species	Bogdabov, 1950; Bogdabov, 1953; Tadjibaeva, Khabilov, 2017
8	Long-tailed Bat (*Myotis bucharensis*)	DD	1(CR)	-	a rare, poorly studied species. There are several current records in the country	Bogdabov, 1960; Kazakov et al, 2020; Khabilov, Tadjibaeva, ,2020
9	Asian Barbastelle (*Barbastella leucomelas*)	LC	-	II	widespread species, but poorly studied	Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953; Vologeninov, 1978; Tadjibaeva, Khabilov, 2017
10	Noctule Bat (*Nyctalus noctula*)	LC	-	II	widespread species	Meklenburtsev, 1935; Bogdabov, 1953; Korelov, 1956; Vologeninov, 1978
11	Common pipistrelle bat *(Pipistrellus pipistrellus*)	LC	-	II	widespread species, numerous	Meklenburtsev, 1935; Bogdabov, 1953; Korelov, 1956; Vologeninov, 1978; Gritsina et al, 2013; Tadjibaeva, Khabilov, 2017
12	Long-eared Bat (*Plecotus strelkovi*)	LC	-	-	widespread species in suitable habitats	Ognev S.I., 1928; Bobrinsky N.A., 1931; Tadjibaeva, Khabilov, 2017; own observations
13	Serotine Bat (*Eptesicus serotinus)*	LC	-	II	widespread species	Satunin K.A., 1909; Bobrinsky N.A., 1925; Meklenburtsev, 1935; Bogdabov, 1950; Bogdabov, 1953;
14	Botta's serotine (*Eptesicus ognevi*)	LC	-	-	numerous in suitable habitats	Kashkarov, Mitropolskaya 2004
15	Savi's Pipistrelle (*Hypsugo savii*)	LC	-	II	a poorly studied species in the country	Khabilov, 1992; Tadjibaeva, Khabilov, 2017
16	Particoloured Bat (*Vespertilio murinus)*	LC	-	II	widespread species	Bogdabov, 1950; Bogdabov, 1953; Vologeninov, 1978; Khabilov, 1992
17	Hemprich's Long-eared Bat (*Otonycteris hemprich*i)	LC	2(VU:R)	-	is a difficult species to study due to the specifics of its biology. Few sightings have been recorded. However, it is likely to be much more widespread	Bogdabov, 1956; Khabilov, 1992

[1] **Endemism:** AF-Afghanistan, IR- Iran, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

As shown in the table, one species, Long-tailed Bat is included in the IUCN Red List with DD status and 3 species (Long-tailed Bat, Long-tailed Bat and Hemprich's Long-eared Bat) are included in the Red Data Book of the Republic of Uzbekistan. One species – Bukhara Horseshoe Bat is endemic of Central Asia and 11 species are included in II Appendix of CMS.

3. Materials and methods

The survey methodology consisted of two stages:

Desktop preparation, which was an analysis of detailed topographic maps of the area (scale: 1:100 000, 1:200 000) and *Google Earth* satellite images. The maps identified the locations (GPS coordinates) of potential bat roosts – mostly buildings. Those locations were then transferred to the *LocusPro* smartphone application for further use in the field.

Field work included a survey of potential roosts identified during the desktop stage. The buffer zone was 500 m from the transmission line. When a roost was found, it was thoroughly examined, both for the presence of bats themselves, and for signs of their presence – excrement, food remains (insect wings, legs, etc.). All suitable bat habitat has been surveyed. Near the project area there are settlements with residential houses, which were not surveyed. Each surveyed object was mapped, photographed; its brief description was made, including notes on the suitability of the objects for bats.

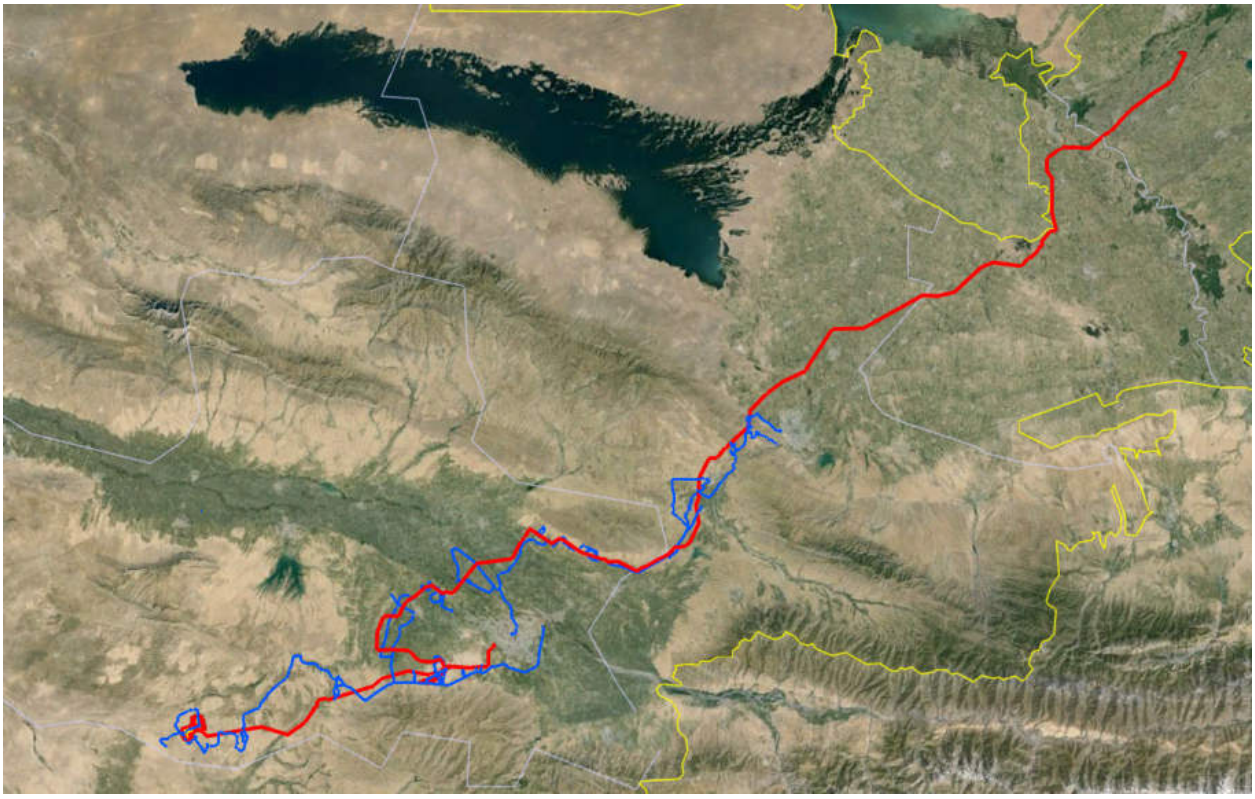

Figure 2: Survey tracks along project main and interconnection facilities (Jizzakh and Samarkand regions)

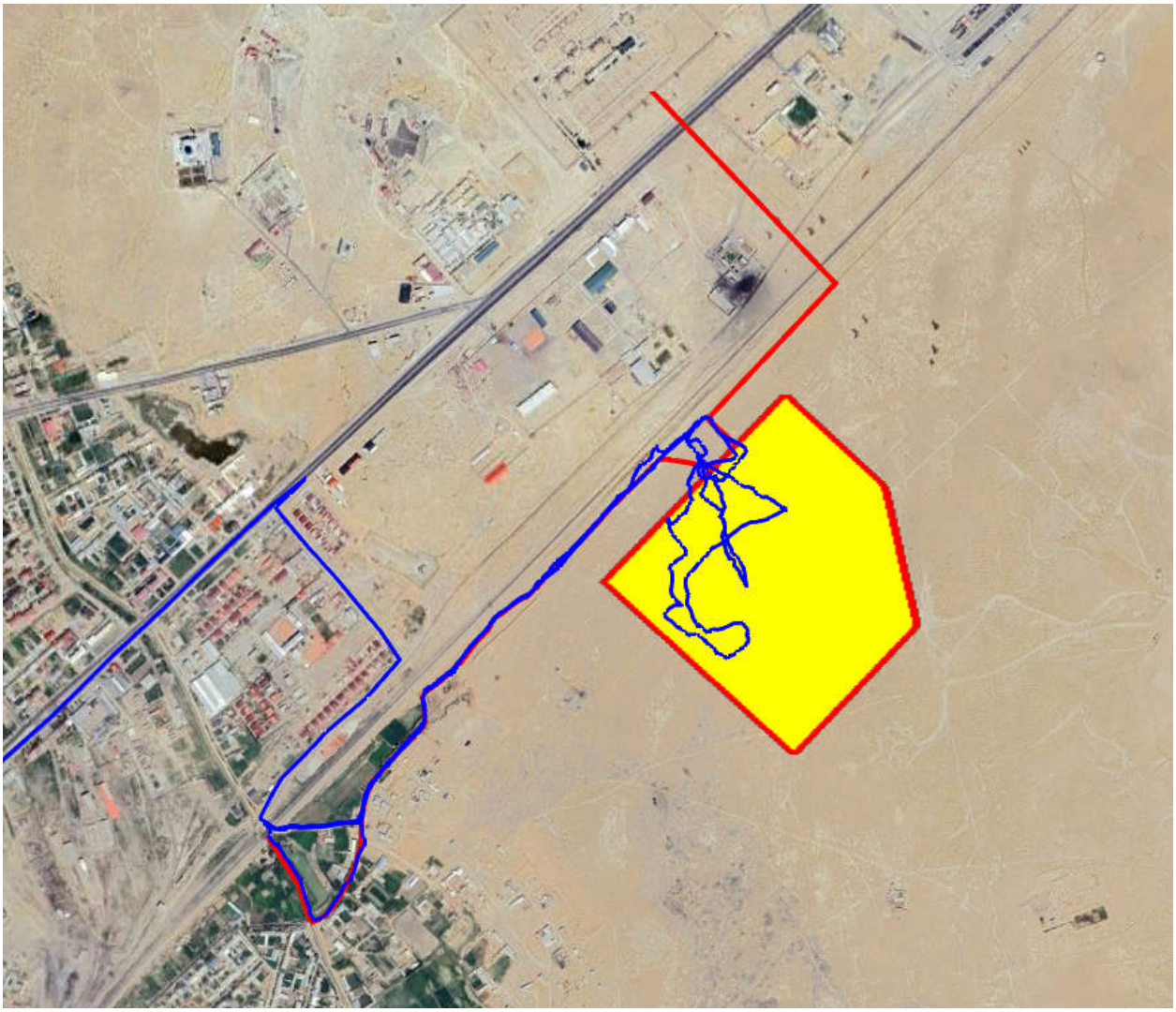

Figure 3: Survey tracks along project main and interconnection facilities (Bukhara regions)

Equipment

To navigate the terrain and record tracks, a smartphone (*BV9900E*) was used with the *LocusPro* application installed, with preloaded *Google Hybrid* map. Photographing was carried out using smartphones (*BV9900E*).

The following equipment was taken into the field for the examination of bat roosts: a torch (1), thick gloves (1), a tape measure (1).

All the collected information was recorded in a notebook, the surveyed roosts and bats registration locations were mapped in the LocusPro smartphone application.

4. Results

Survey of the Koytash ridge

The mountainous part of the project area is represented by rocky areas (Figure 4), sloping hills (Figure 5), agricultural fields (Figure 6) and loess (clayey) walls of ravines/"says" (Figure 7).

Figure 4: Rocky areas

Figure 5: Sloping hills

Figure 6: Agricultural fields

Figure 7: Loess (clayey) walls of ravines/"says"

Potential habitats are represented by natural refuges – cliffs and loess (clayey) walls of ravines/ «*says*». There are shepherd's huts in the area that could also be used as bat roosts, but they are all more than 1 km from the proposed power line.

At the points (40.166503° 67.688440°, 40.149875 67.688555, 40.09827 67.63789) local shepherds were interviewed and according to them there are no caves or galleries in the area. There are only a few small, shallow grottos. No bat colonies were observed.

Four grottos have been found and surveyed (Figure 8, Figure 9, Figure 10). Each has slits of varying depth. No bat faeces were found. These grottos are definitely not hibernation or breeding sites for bat colonies. They may be temporary shelters for migrating bats or summering individuals.

Figure 8: Grot № 1

Figure 9: Grot № 3

Figure 10: Grott № 4. The sign on the rock says "no bats."

At the western foot of the Koytash Ridge, a small artificial pond is located 500 metres from the power line (Fig. 11. 40.167523° 67.688251). This site is ideal for watering bats in the vicinity of the project area. It is worth recording and mist netting here.

Figure 11: Artificial pound

Plain part of Jizzakh region

The territory is mainly represented by agricultural fields, among which there are shallow ravines. The territory is crossed by the "Afrosiab" high-speed train railway, which is closed on both sides by a fence. There are also small areas of old railway lines that are not enclosed by fences.

17 potential bat habitats were surveyed and identified: 13 drainages under the railway and 4 car passages under the railway. Habitat options are shown in Fig. 12-18. The drainages under the Afrosiab train railway are regularly maintained, so the slits are in most cases thoroughly sealed, or in places the cement has fallen off but is likely to be sealed again soon (6 drainages). In other cases, slits are present, but there is no evidence of large breeding colonies. Probably used occasionally by single individuals during migration and summering periods. Car crossings with slits, but due to the height of the structures (above 3 metres) it was not possible to investigate them. It would therefore be most appropriate to conduct mist netting in summer period.

Figure 12: Car passage under the railway

Figure 13: Car crossing under the railway

Figure 14: Drainage under the railway «Afrosiab»

Figure 15: Drainage under the railway «Afrosiab» with no access

Figure 16: Double drainage under the railway

Figure 17: Stone drainage from the time of Turkestan

Figure 18: Most of the drainage is made up of stone masonry, 5 metres from concret

Plain and foothill parts of Samarkand region

Samarkand region is more diverse in landscapes in the project area. In addition to agricultural fields, there are extensive ravines 5-7 metres high (Fig. 20,21) and clay cliffs with walls up to 15 metres high (Fig. 22,23). In along the foothill uplands, there are also ravines with vertical walls (Fig. 23). This makes it important to survey these areas for grottoes and caves.

Figure 19: Ravine

Figure 20: Ravine

Figure 21: Dargom channel

Figure 22: Dargom channel

Figure 23: Ravine in the western part of the territory

3 concrete bridges across the canals (Fig.24,25), one drainage under the car road (Fig.26), one clay house (Fig.27) with no suitable slits for bats were investigated. Two caves were found. One of them may have been a habitat for bats in the past, now it's a mine (Fig.28).

The most interesting is a narrow cave on the Dargom canal (Fig.29). A cave with an entrance of 2, 5 metres. The first 4 metres can be visually inspected, further on it is very narrow. Probably a breeding site. Need mist netting in summer.

All ravines and canals within the buffer zone of the transmission line have been carefully inspected.

Figure 24 Bridge over the canal

Figure 25: Bridge over the canal

Figure 26 Drainage under the car road

Figure 27: Old House

Figure 28: A cave in a clay cliff (mining area)

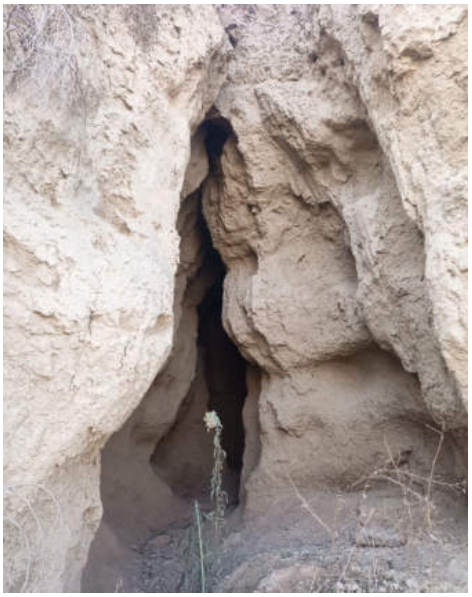

Figure 29: Clay cave on the Dargom canal

LILO 11 km

On the project site near the planned power line route, there are attics of utility buildings and residential houses, which are potential roosting and hibernation sites for bats. However, the species of bats that may inhabit there are not rare or endemic and do not require protection. On the banks where bats could potentially dwell, sand extraction works are taking place, making it unlikely for bats to inhabit the area.

Figure 30: Utility buildings and residential houses

Figure 31: Seasonal watercourses

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There are several natural and anthropogenic structures within the buffer zone of the project area that may serve as refuges for bats. First of all, these are attics of warehouses and residential buildings located at a distance of 10-500 m from the access road.

In addition, bats can live in the natural cavities of the loamy slope created during the construction of the railway. However, given the constant disturbance from trains passing less than 1 m from the slope, the use of these cavities as refuges by bats is unlikely.

Less than 10 m from the access road there are small water bodies that can be used by bats as a drinking resource. This fact increases the likelihood of bats living in the 500 m buffer zone and the likelihood of a negative impact on chiroptera fauna.

Figure 32. Loamy slope with cavities

Figure 33. Canal near the access road

Figure 34. Waterbody along the access road

Table 2: List of Roosting sites

ID	Type of roost	Region	N	E	Comments
1	Grot	Jizzakh	40.16121	67.68598	temporary summer roost, or during migrations. There are some pretty deep crevices. No faeces. Depth 2 meters, width 5
2	Grot	Jizzakh	40.16259	67.68387	temporary summer roost, or during migrations. There are some pretty deep crevices. No faeces. Depth 2,5 meters, width 4
3	Grot	Jizzakh	40.15724	67.59568	temporary summer roost, or during migrations, no deep cracks. No faeces. Depth 2,5 meters, width 2
4	Grot	Jizzakh	40.08909	67.64925	temporary summer roost, or during migrations. It says "no bats" on the grotto wall. There are narrow, deep crevices. No faeces. Definitely not a breeding site. Possible records of single individuals during migrations and summering. Depth 6 meters, height from 0.5 to 1.75 m
5	Car passage under the railway	Jizzakh	39.99498	67.52488	width 5 metres, height 3 metres, length 23 metres. The slit are completely sealed.
6	Car passage under the railway	Jizzakh	40.02308	67.54617	Height 3 metres, length 24 metres. Distance to the power line is 900 metres. Crevices are present, no inspection possible. Only mist netting in summer
7	Drainage under the railway	Jizzakh	39.95061	67.50812	1.80-2 metres high. Length 35 metres. All slits are thoroughly sealed
8	Drainage under the railway	Jizzakh	39.952046	67.509325	1.80-2 metres high. Length 35 metres. All slits are thoroughly sealed
9	Drainage under the railway	Jizzakh	39.957185	67.511900	1.80-2 metres high. Length 35 metres. All slits are thoroughly sealed
10	Drainage under the railway	Jizzakh	39.949151	67.506998	1.80-2 metres high. Length 35 metres. All slits are thoroughly sealed
11	Drainage under the railway	Jizzakh	39.947504	67.505487	1.80-2 metres high. Length 35 metres. All slits are thoroughly sealed
12	Drainage under the railway	Jizzakh	39.92770	67.49547	access is impossible: it's fenced in with a grid. There is water on both sides.
13	Drainage under the railway	Jizzakh	39.916232	67.498391	double drinage. Length 18 m. Height 1.20. Slits are present, but not deep. No sign of breeding colony. Possibly used as a temporary roost
14	Drainage under the railway	Jizzakh	39.90855	67.49841	2 metres high. Length 35 metres. All slits are thoroughly sealed
15	Drainage under the railway	Jizzakh	39.89254	67.48979	double drinage. Length 48 m. Height 2. Slits are present, but not deep (apparently regularly stained). No sign of breeding colony. Possibly used as a temporary roost

16	Drainage under the railway	Jizzakh	39.86596	67.46660	2 metres high. Length 65 metres. There are slits, but not many. No feaces.
17	Drainage under the railway	Jizzakh	39.86595	67.46540	1,5 metres high. Length 80 metres. There are slits, but no feaces.
18	Car passage under the railway	Jizzakh	39.86596	67.46660	6 metres high. Length 26 metres. Presence/absence of bats can be verified by mist netting in summer. However, no typical traces of a large breeding colony were observed near the slits.
19	Drainage under the railway	Jizzakh	39.86193	67.45800	from 2 metres to 2,5 high. Length 35 metres. Most of the drainage is made up of stone masonry, 5 metres from concrete. There are slits, but not many
20	Drainage under the railway	Jizzakh	39.86460	67.45767	from 2 metres to 2,5 high. Length 35 metres. Most of the drainage is made up of stone masonry, 5 metres from concrete. There are slits, but not many
21	Car passage under the railway	Jizzakh	39.845299	67.450099	6 metres high. Length 65 metres. Slits are present, no inspection possible. Only mist netting in summer
22	Bridge over the canal	Samarkand	39.802562	67.340403	concrete bridge, no suitable slits
23	Abandoned building	Samarkand	39.825972	67.247992	concrete building, but there are no slits
24	Drainage under the car road	Samarkand	39.875008	67.094883	1,5 metres high. Length 7 metres. There are no slits
25	A cave in a clay cliff	Samarkand	39.879939	66.988801	it's now a mine. Possibly former bat habitat, now absent.
26	Clay house	Samarkand	39.757012	66.735650	no slits
27	Clay cave	Samarkand	39.756347	66.735695	a cave with an entrance of 2, 5 metres. The first 4 metres can be visually inspected, further on it is very narrow. Probably a breeding site. Need mist netting in summer
28	Bridge over the canal	Samarkand	39.706929	66.583477	no suitable slits
29	Bridge over the canal	Samarkand	39.503545	66.399669	no suitable slits