Bash 500MW Wind Farm
Republic of Uzbekistan

Environmental and Social Impact Assessment

Volume 4 – Appendices: Part C

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APPENDIX C-1: OHTL TERRESTRIAL ECOLOGY REPORT

BASH TO KARAKOL OHTL – BIODIVERSITY REPORTS – DIGITAL APPENIDIX

Contents:

Juru Energy

Botanical survey report

Report Title	Botanical survey
Scope	BOTANY
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL / BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Juru Energy

Botanical survey

BASH WIND FARM PROJECT

DZANKELDY WIND FARM PROJECT

CLIENT: 5 CAPITALS

Date: June 2021

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Contents

1. Aims and objectives

In accordance with TOR, the main tasks of expert-botanist are following:

- carrying out a field botanical survey at springtime and summer (April and early June) and processing of field data; particular attention should be given to the proposed turbine locations and any areas where new roads can be constructed;
- analysis of any previous botanical surveys and other available data (publications, reports, etc.) compared with the results of the field survey conducted in 2021;
- detailed description and GIS-based mapping of habitat types present within the project sites, compilation of Habitat map and LULC (Land Use – Land Cover) map;
- compilation of the check-list of plant species recorded within the project site (in particular, threatened species included in the Red Data Book of Uzbekistan and/or the IUCN Red List);
- reporting.

2. Background

2.1. Project area

The project area is situated in south-western part of the desert Kyzylkum, in Gizhduvan and Peshku administrative districts of the Bukhara Province of Uzbekistan, and consists of two sites and power lines between these two sites and Karakul substation (Figure 1). The distance between two sites is about 90 km. The 1st project site named “Dzhankeldy” covers an area of 26x20 km in the western part of insular low mountains Kuldzhuktau, in surroundings of the village Dzhankeldy. Within this area, preliminary locations of 125 wind turbines and 10 vantage points for the ornithological survey have been selected (Figure 2). The 2nd site named “Bash” is located in surroundings of depression Ayakagytma, to the east of the lake Ayakagytma, and covers an area of 18x18 km; locations of 105 wind turbines and 9 bird survey plots have been selected there (Figure 3).

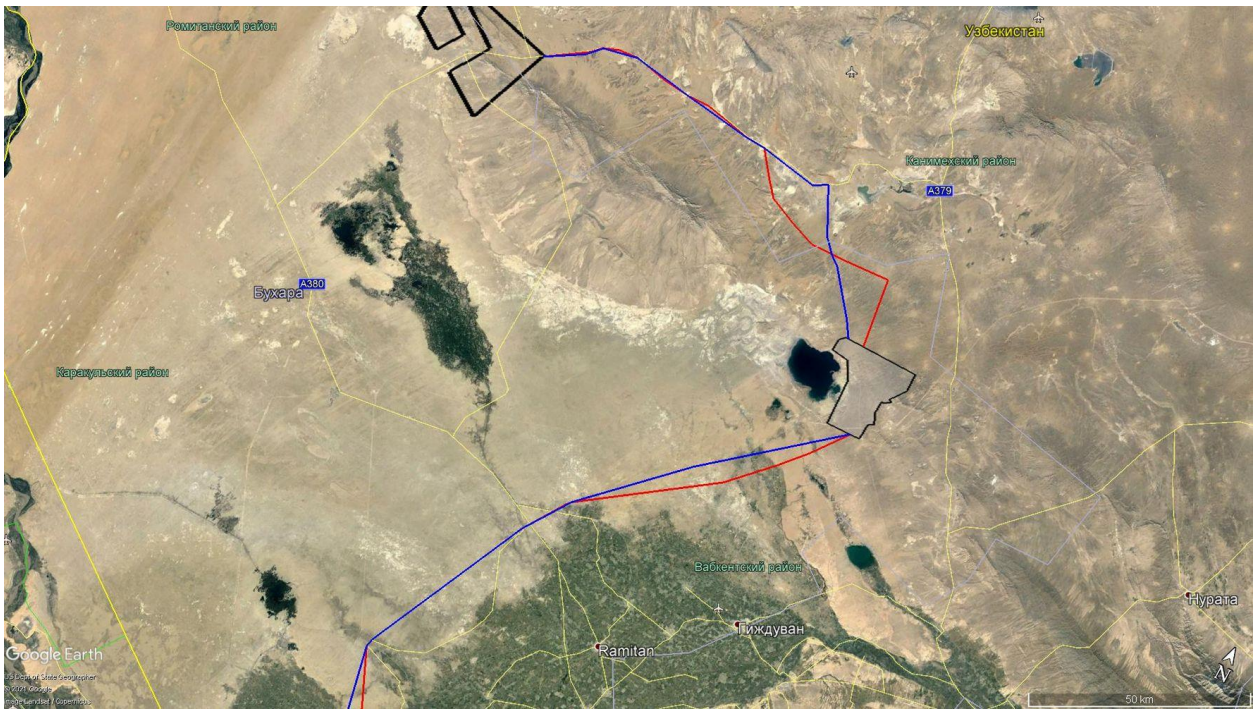

Figure 1. Project sites and proposed power lines

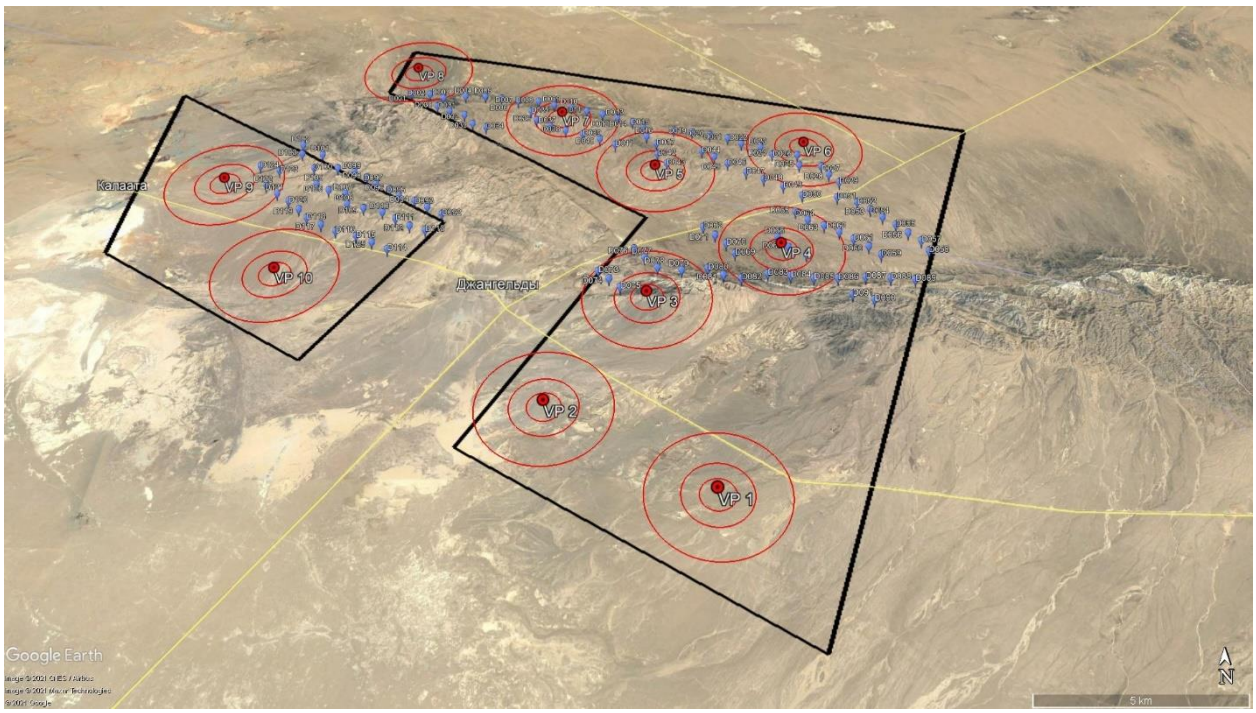

Figure 2. Project site “Dzhankeldy”. Symbols: VP 1–VP 10 – ornithological vantage poins, D001–D125 – proposed turbine locations.

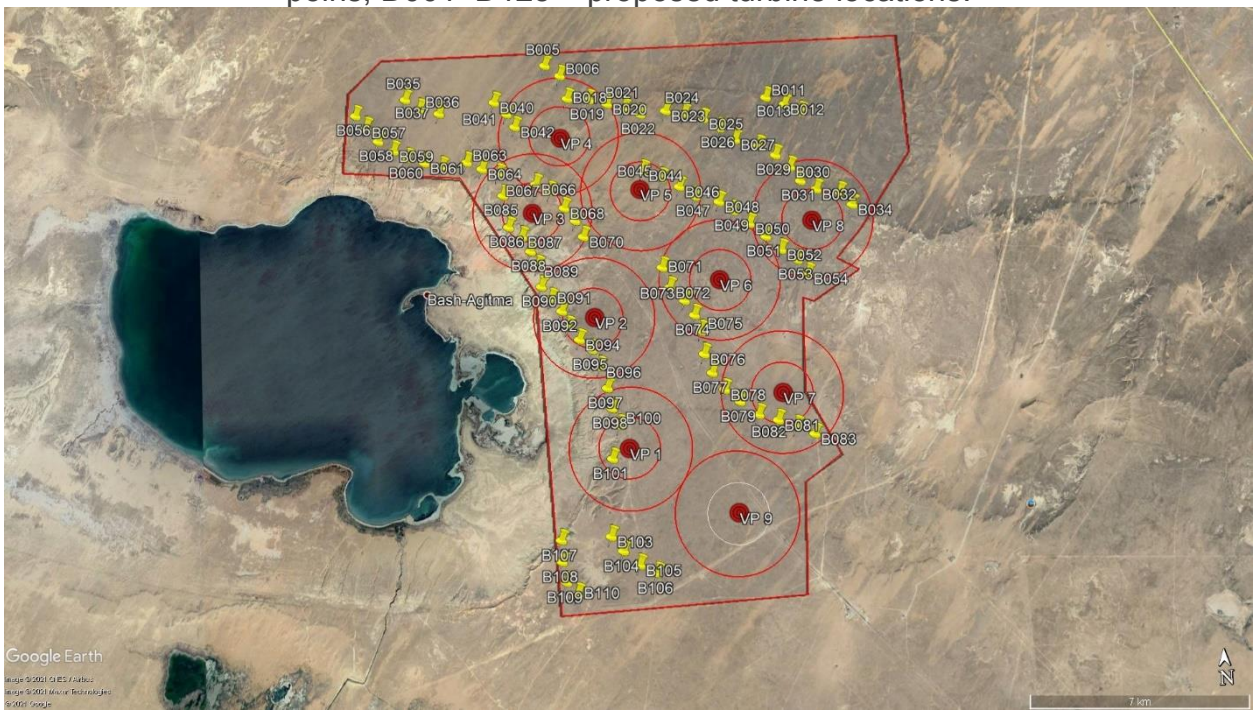

Figure 3. Project site “Bash”. Symbols: VP 1–VP 9 – ornithological vantage poins, B005–B110 – proposed turbine locations.

2.2. Literature review

The flora of the south-western Kyzylkum has been well studied. The history of botanical research in this region has about 200 years. The first scientific data on landscapes and plant diversity of this region have been obtained in the 19th Century by European and Russian naturalists who took part in several Russian diplomatic missions to Bukhara Khanate (E.A. Ewersmann and G. von Meyendorff in 1820–1821, and A. Lehmann in 1841–1842, A.P. Khoroshkhin in 1872, M.N. Bogdanov and F.I. Lobysevich in 1873, N. Barbot-de-Marni in 1874, and others). In 1887–1903, Russian botanist

Vladimir Lipsky performed large-scale expeditions in Central Asia, including surroundings of Bukhara, and provided one of the first scientific descriptions of the flora and vegetation, as well as published detailed history of botanical research in this region in the 19th Century and early 20th Century in his work “Flora of Central Asia, i.e. Russian Turkestan and Bukhara and Khiva Khanates” (1902–1905). Many naturalists and officials of Russian Empire, who worked in Central Asia or visited this region in the late 19th and early 20th Century, also collected herbarium specimens and contributed to the accumulation of floristic data. E.g., Nikolay Korolkow, general of Russian army and naturalist-amateur collected herbarium, living plants, seeds and bulbs on the way from Tashkent to Khiva during the Khivan campaign of 1873, and sent these materials to the Imperial Botanical Garden in Saint Petersburg. Herbarium collections made by above mentioned pioneers of the study of Central Asian flora laid the basis for our contemporary knowledge on the plant diversity of the great desert Kyzylkum.

In 1908–1917, the Migration Department of Russian government organized a number of expeditions for investigation of soils and vegetation of Central Asia within the framework of colonization of this region. Thus, in 1913–1916, zoologist N.A. Zarudny and botanists E.P. Korovin and M.G. Popov studied some areas of the south-western Kyzylkum. As a result of these large-scale surveys, a huge amount of herbarium was collected, numerous new taxa and a diversity of plant communities were described for the first time, the first geobotanical maps were compiled, and the outlines of the theory of the genesis of Central Asian flora and vegetation were laid.

In 1918, the Turkestan State University was established in Tashkent (it was given a name of Central Asian State University from 1923 to 1960, Tashkent State University in 1960–2000, and National University of Uzbekistan since 2000). Several prominent botanists including M.G. Popov, E.P. Korovin, M.V. Kultiasow and A.I. Vvedensky began to work there since 1920. The department of botany and geography headed by Mikhail Popov, the herbarium headed by Aleksei Vvedensky and the Institute of Soil Science and Geobotany headed by Nikolay Dimo have been created at the university in the initial period. Since early 1920s, botanists of the University performed field surveys covering the entire territory of Central Asia and focused mainly on the inventory of the flora, investigation of the vegetation cover and identification of plant resources. In the 1930–1940s, geobotanical studies (first of all, survey of pastures) were also carried out in different regions of Uzbekistan by special expeditions of the Committee of Sciences (which in 1940 was reorganized into the Academy of Sciences of Uzbekistan); the results were used for creation of the first geobotanical map of Uzbekistan. As a result of these expeditions, dozens of new species and genera were found and described from different regions of Central Asia.

In 1934–1936, the Kenimekh complex expedition led by prominent expert in phytosociology I.I Granitov explored the south-western part of Kyzylkum, Kenimekhchul and the western piedmonts of the Nuratau Mountains. The mission of this expedition was a comprehensive study the climate, soil, vegetation, flora and fauna of this region. The Kenimekh expedition collected extensive data were on the natural conditions and biodiversity of the territory, including a huge amount of herbarium (currently kept at the National Herbarium of Uzbekistan, TASH).

After the completion of the Kenimekh expedition, I.I. Granitov continued studies of the flora and vegetation of south-western Kyzylkum; the results of his long-term research have been summarized in a 2-volume monograph “Vegetation cover of the South-Western Kyzylkum” (1964, 1967). II Granitov provided the list of flora with 580 species from 290 genera and 55 families (272 species of them were reported for relic mountains Kuldzhuktau). Until now, this work remains the most fundamental publication on the plant diversity of south-western Kyzylkum. The monograph contains an essay of the history of botanical research, description of the physiographical and environmental conditions of

the region, provides the analysis of the flora and vegetation, and a scheme of phytogeographical division of the territory, as well as the assessment of the influence of humans and wildlife on the vegetation.

A significant amount of material was collected by the subsequent geobotanical expeditions of the 1950–1970s focused mainly on the investigation of rangelands. At that period, the specialists of the Institute of Botany of the Academy of Sciences of the Uzbek SSR experimented there with different methods of pastures restoration and improvement. Several prominent botanists from Uzbekistan and Russia, as T.A. Adylov, V.P. Botschantzev, R.V. Kamelin, E.V. Kljuykov, M.G. Pimenov, U.P. Pratov, M.I. Pryakhin, A.I. Vvedensky, I.F. Momotov, A.D. Lee, P.K. Zakirov and others performed numerous field expeditions in Kyzylkum. These scientists made a significant contribution to the knowledge of the flora and vegetation of this region.

The most important publications of the second half of the 20th Century containing the data on flora and vegetation of the south-western Kyzylkum also are the two-volume monograph by K.Z. Zakirov “Flora and vegetation of the Zeravshan River basin” (1955, 1961) and the monograph of his son P.K. Zakirov “The botanical geography of Nuratau Range and low mountains of Kyzylkum” (1971). K.Z. Zakirov compiled a summary checklist (with reference to herbarium collections) of 2588 plant species recorded for the entire Zeravshan River basin covering several phytogeographical regions of Mountain Central Asian and Turan provinces, among them, 320 species have been cited for lower reaches and ancient delta of Zeravshan River with adjacent areas of south-western Kyzylkum. PK Zakirov published a detailed description of the vegetation and a summary checklist of the flora of all relic mountains of Kyzylkum and the range Nuratau; it contains 983 species of vascular plants belonging to 312 genera and 65 families, 679 species of them recorded for relic mountains. Among them, 452 species from 233 genera and 46 families have been listed for the all insular low mountains of Central and South-Western Kyzylkum, including Kuldzhuktau.

“Weed vegetation of the Bukhara region and measures of its control” (Guzairov, 1951, 1968), I.F. Momotov "Theoretical foundations and methods of phytomelioration of desert pastures in south-western Kyzylkum" (Momotov, 1973) and “Guide to a botanical excursion to the southern edge of Western Kyzylkum” (Saidov et al., 1975) should also be mentioned among the important publications on the flora and vegetation of this area.

Several new botanical studies have been performed in the south-western Kyzylkum and Bukhara Oasis since 2000 (Tojibaev, Beshko, 2007; Khassanov et al., 2011; Esanov, 2017, 2019; Abduraimov, 2017; Akhmedov, 2018; Shomurodov et al., 2018; Shomurodov, 2018, etc.). In particular, F.O. Khassanov et al. (2011) estimated the entire flora of the Kyzylkum desert to be no less than 1043 species with 41 endemic and 11 sub-endemic species and noted that most of endemic species are localized in the relic mountains. However, the most actual data show that some species previously considered to be endemic to Kyzylkum have been found in neighboring areas and should be regarded as sub-endemics (Tojibaev et al., 2017).

The most important results of botanical research in the project region are summarized in recently published monographs, “Coenopopulations of rare and endangered plant species of remnant low mountains of Kyzylkum” (Shomurodov et al., 2018) which contains detailed data on populations of 12 threatened species, “Inventory of the flora of Uzbekistan: Navoi Province” (Tojibaev et al., 2019), and “Inventory of the flora of Uzbekistan: Bukhara Province” (Tojibaev et al., 2020). The “Inventory of the flora of Uzbekistan: Bukhara Province” contains a checklist of 764 species vascular plants growing in the wild in this large administrative region. The following information for each species is provided: life form, habitat, distribution within the Bukhara Province, conservation status, and economic use. Among them, 543 species are listed for the desert plain of Kyzylkum, 546 species – for lower reaches and ancient delta of Zeravshan

River (Bukhara Oasis), and 463 species are recorded for the remnant low mountains Kuldzhuktau; 25 species are red-listed at the national level (15 of them grow in the Kuldzhuktau Mountains); descriptions, photographs and distribution maps for threatened plant species are included.

Fundamental taxonomical treatments, as “Flora of the U.S.S.R.” (1934–1964, in 30 volumes), “Flora of Kazakhstan” (1956–1966, in 9 volumes), 1st edition of the “Flora of Uzbekistan” (1941–1962, in 6 volumes), “Conspectus Florae Asiae Mediae” (1963–2015, in 11 volumes), and recently published first three volumes of the 2nd edition of the “Flora of Uzbekistan” (2016, 2017, 2019), should also be mentioned among the most important sources of information on the plant diversity of the project zone. In the new “Flora of Uzbekistan” the treatment of 15 families with 58 genera and 375 species performed to date (8.6% of the national flora); for each species, herbarium specimens are cited and a distribution map based on their georeferencing is given. “Vegetation of Central Asia and South Kazakhstan” by E.P. Korovin (1934; 1961, 1962), “Vegetation cover of Uzbekistan and the ways of its practical use” (1971–1984, in 4 volumes), “Rangelands of the arid and semi-arid zones in Uzbekistan” (Gintzburger et al., 2003) and “Botanical geography of Kazakhstan and Middle Asia” by E.I. Rachkovskaya et al. (2003) also contains useful data about the flora and vegetation of the south-western Kyzylkum and their genesis. In particular, the general patterns of vegetation and a description of the main plant communities of Kyzylkum are given in the 2nd volume of the “Vegetation cover of Uzbekistan” (1973). The “Botanical Geography of Central Asia and Kazakhstan” by Rachkovskaya et al. (2003) describes in the main plant formations of the whole desert zone of Central Asia.

A huge amount of herbarium material collected from the south-western Kyzylkum and Bukhara Oasis during about two centuries is kept mainly in the National Herbarium of Uzbekistan in Tashkent (TASH), Herbarium of the Komarov Botanical Institute in St. Petersburg (LE), Herbarium of the Lomonosov Moscow State University (MW).

The list of plants of the Bukhara Province included in the Red Data Book of Uzbekistan (2019) and a map of their distribution in the project region (Figure 4) is presented below.

1. *Acanthophyllum cyrtostegium* Vved. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains.

2. *Astragalus adylovii* F.O. Khass., Ergashev & Kadyrov. UzbRDB Category 1. The Kuldzhuktau Mountains. National endemic, endemic to Kuldzhuktau Mountains.

3. *Calligonum matteianum* Drobow. IUCN EN B2ab(iii,v). UzbRDB Category 1. Sundukli Sands. Endemic to sandy deserts of southern part of Central Asia.

4. *Calligonum molle* Litv. IUCN EN B2ab(iii,v). UzbRDB Category 2. Sundukli Sands. Endemic to southern Central Asian deserts.

5. *Calligonum paletzkianum* Litv. IUCN (VU B2ab(iii,v). UzbRDB Category 3. Sundukli Sands. Endemic to Irano-Turanian deserts.

6. *Calligonum zakirovii* (Khalk.) Czerep. UzbRDB Category 1. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

7. *Climacoptera amblyostegia* (Botsch.) Botsch. UzbRDB Category 2. Lower reaches and ancient delta of Zeravshan River.

8. *Climacoptera merkulowiczii* (Zakirov) Botsch. UzbRDB Category 2. Lower reaches and ancient delta of Zeravshan River. National endemic.

9. *Eremosparton flaccidum* Litv. UzbRDB Category 2. Sands of Kyzylkum. Endemic to sandy deserts of Central Asia.

10. *Eremostachys eriolarynx* Pazij & Vved. UzbRDB Category 1. South-western Kyzylkum, southern piedmonts of insular low mountains Kokchatau. National endemic, endemic to Kyzylkum.

11. *Ferula kyzylkumica* Korovin. UzbRDB Category 3. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains.

12. *Iris hippolyti* (Vved.) Kamelin. UzbRDB Category 1. Insular low mountains Kokchatau. National endemic, endemic to Kokchatau.

13. *Jurinea psammophila* Iljin. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

14. *Lagochilus inebrians* Bunge. UzbRDB Category 3. The Kuldzhuktau and Kokchatau Mountains and their piedmonts. Endemic to western Pamir-Alay and adjacent areas including Kyzylkum, Karshi Steppe, valley of the river Zeravshan and Fergana valley.

15. *Lagochilus vvedenskyi* Kamelin & Zukerw. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

16. *Lepidium subcordatum* Botsch. & Vved. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum and plateau Ustyurt.

17. *Oligochaeta vvedenskyi* (Popov) Tscherneva. UzbRDB Category 3. South-western Kyzylkum, Karnabchul. National endemic, endemic to Kyzylkum, Sundukli Sands and Karshi Steppe.

18. *Onobrychis tavernierifolia* Stocks ex Boiss. UzbRDB Category 1. The Kuldzhuktau Mountains and their piedmonts. Very rare species with fragmented range in Iran, Afghanistan and the Kuldzhuktau Mountains in Uzbekistan.

19. *Phlomoides aralensis* (Bunge) Salmaki (Paraeremostachys aralensis (Bunge) Adylov, Kamelin & Makhm.). UzbRDB Category 2. South-western Kyzylkum. National endemic, endemic to Kyzylkum desert.

20. *Phlomoides transoxana* (Bunge) Salmaki (Paraeremostachys transoxana (Bunge) Adylov, Kamelin & Makhm.). UzbRDB Category 2. South-western Kyzylkum. National endemic, endemic to Kyzylkum desert.

21. *Silene tomentella* Schischk. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum.

22. *Stipa aktauensis* Roshev. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum.

23. *Tulipa korolkowii* Regel. UzbRDB Category 3. Insular low mountains Kokchatau. Rare species of south-western Tien Shan and Pamir-Alay, Kokchatau is the most western site of distribution of this species.

24. *Tulipa lehmanniana* Merckl. UzbRDB Category 3. The Kuldzhuktau and Kokchatau Mountains and their piedmonts, south-western Kyzylkum, Karnabchul. Vulnerable species of Irano-Turanian deserts with decreasing range and populations.

25. *Tulipa micheliana* Th. M. Hoog. UzbRDB Category 3. Insular low mountains Kokchatau. Vulnerable species of Western Pamir-Alay and Kopetdag with decreasing range and populations.

Following species are endemic to the Kyzylkum desert: *Allium oxianum* F.O. Khass. et Tojibaev, *Allium rinae* F.O. Khass., Shomuradov & Tojibaev, *Astragalus adylovii* F.O.Khass., Ergashev & Kadyrov, *Astragalus centralis* Sheld., *Astragalus holargyreus* Bunge, *Astragalus kuldzhuktauense* F.O.Khass., Shomur. & Esankulov, *Astragalus leiophysa* Bunge, *Astragalus remanens* Nabiev, *Bryonia melanocarpa* Nabiev, *Calligonum zakirovii* (Khalk.) F.O. Khass., *Cleome quinquenervia* DC., *Convolvulus affanasevii* Luferov, *Cousinia juzepczukii* Tscherneva, *Cousinia dolichoclada* Juz.,

Cousinia sylvicola Bunge, *Cousinia umbilicata* Juz., *Diarthron macrorhachis* (Pobed.) Kit Tan (*Dendrostellera macrorhachis* Pobed.), *Eremostachys eriolarynx* Pazij & Vved., *Eremurus korolkowii* Regel, *Evax arenaria* Smoljan., *Gagea deserticola* Levichev, *Jurinea psammophila* Iljin, *Lagochilus vvedenskyi* Kamelin & Tzukerv., *Lappula aktaviensis* Popov & Zakirov, *Lappula parvula* Nabiev & Zakirov, *Phlomoides aralensis* (Bunge) Salmaki, *Phlomoides transoxana* (Bunge) Salmaki, *Psylliostachys x androssovii* Roshkova, *Salsola androssovii* Litv., *Salsola angusta* Botsch., *Salsola deserticola* Iljin, *Scorzonera gageoides* Boiss., *Silene tomentella* Schischk., *Scrophularia rudolfii* F.O. Khass., Serekeeva & Kadyrov, *Stipa aktauensis* Roshev.

Sub-endemic species reported for south-western Kyzylkum are *Allium karakense* Regel, *Allium kysylkumi* Kamelin and *Ferula kyzylkumica* Korovin (fragmented range in relic mountains of Kyzylkum and western part of the Nuratau Mountains), *Calligonum matteianum* Drobow, *Calligonum molle* Litv. and *Eremosparton flaccidum* Litv. (sandy deserts of southern part of Central Asia), *Halimocnemis latifolia* Iljin (Kyzylkum and Karshi Steppe), *Cousinia sogdiana* Bornm. and *Oligochaeta vvedenskyi* (Popov) Tscherneva (Kyzylkum, Sundukli Sands and Karshi Steppe), *Lepidium subcordatum* Botsch. & Vved. (fragmented range in relic mountains Kyzylkum and plateau Ustyurt), *Jurinea derderioides* C. Winkl. and *Tulipa sogdiana* Bunge (Central Asian deserts), etc.

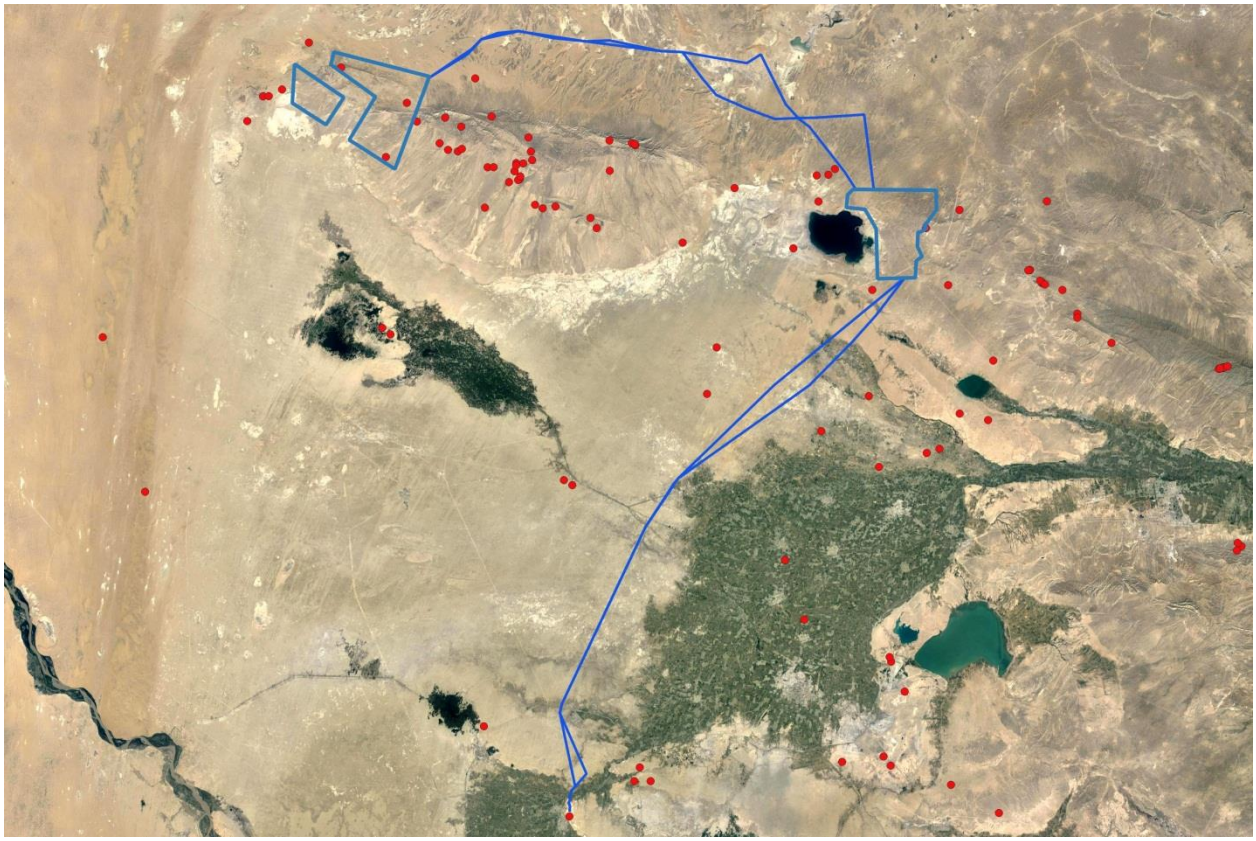

Figure 4. Distribution of nationally red-listed plants in the project region (according to “Inventory of the flora of Uzbekistan: Navoi Province”, 2019, and “Inventory of the flora of Uzbekistan: Bukhara Province”, 2020). Known locations of rare plants showed by red dots.

Since a number of threatened, endemic and restricted range plant species occurs in the project area, the Critical Habitat Assessment is required, according to IFC Performance Standard 6 (PS6) and EBRD Performance Requirement 6 (PR6).

An analysis of published data shows, that similar assessments of areas with high biodiversity conservation significance have been performed in Uzbekistan within the framework of UNDP-GEF project “Strengthening Sustainability of the National Protected

Area System by Focusing on Strictly Protected Areas" and CEPF project "Mountains of Central Asia Biodiversity Hotspot". According to results of the first project published in the "Recommendations for protected areas system development in Uzbekistan" (Ismatov, 2013), 17 sites important for plant diversity were identified within Uzbekistan, among them, the insular range Kuldzhuktau was qualified as one of priority areas for conservation of diversity of natural landscapes, flora and fauna, and recommended for protected area. The second international project has been focused on the assessment of Key Biodiversity Areas within Mountains of Central Asia Global Biodiversity Hotspot using the KBA standards, and the region of south-western Kyzylkum was not included in this analysis (Mountains of Central Asia Biodiversity Hotspot, 2017).

At the global level, the screening of critical habitats was performed by UNEP-WCMC (2017) and Brauneder et al. (2018). For Uzbekistan, potential critical habitats have been identified by authors mainly on the basis of assessment of Important Bird Areas (2008).

3. Materials and methods

The field studies were conducted 9–11 April, 12–20 May and 18–30 June 2021 by traditional methods of botanical survey commonly used for sampling and mapping of native non-forest vegetation, recognition of floristic composition and spatial patterns of plant communities (Field geobotany, 1959–1976; Granitov, 1980; Kent, 2011). All vantage points (bird survey circles) and the majority of proposed turbine locations within two project sites were inspected, as well as a strip about 100 m in width along the planned electric lines. The check-lists of plant species recorded for each project site were compiled.

Plant species were identified using special literature, as “Conspectus Florae Asiae Mediae” (1963–1993), “Flora of Uzbekistan” (1941–1963, 2016, 2017, 2019) and “Flora of USSR” (1934–1964). Avaiable publications and online databases (Nikitin, 1983; IUCN/ISSG, 2014; CABI, 2017; Sennikov et al., 2018) were used for identification of alien species, while the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009, 2019) and the IUCN Red List (www.iucnredlist.org) were used for identification of threatened species. Other relevant published data on flora and vegetation of the region also has been analyzed (listed below in References).

In the general check-lists and check-lists compiled for survey plots and habitat types, species are arranged in alphabetic order. Accepted names of species are provided in accordance with the online global databases Plants of the World Online (www.plantsoftheworldonline.org/), International Plant Names Index (www.ipni.org) and Catalogue of Life (www.catalogueoflife.org), as well as with recently published treatments of different taxonomical groups of the flora of Uzbekistan (Sennikov, 2016, 2017, 2019).

The draft habitat maps for “Bash” and “Dzhankeldy” project sites were created on the basis of visual interpretation of free satellite imagery from USGS Earth Explorer (https://earthexplorer.usgs.gov/), Google Earth and Bing Maps, a topographic map (1:100,000, available online for free at http://loadmap.net/) and a soil map of the Bukhara Province (Geographical atlas of Uzbekistan, 2012). QGIS 3.18 free software was used for habitat mapping. During the field survey, all habitat types were inspected; their descriptions, boundaries and character of land use have been clarified and corrected.

The structure of vegetation communities was described on 50x50 m geobotanical sample plots (squares) chosen in an area with homogeneous vegetation, representative for each habitat type, as well as in proposed turbine locations. For each sample plot, photographs of the landscape and vegetation were taken using a digital camera, and following data were recorded: location and physical environment (including GPS coordinates, elevation, topography, and soil type), state of vegetation, landuse type and disturbance factors (grazing, roads, etc.), plant association, canopy cover (%), canopy height, all plant species present at the plot, their cover and abundance, phenological stage and height.

Coordinates of populations of endemic, redlisted or alien plant species, number of individuals and area occupied by population also were recorded.

Species cover and abundance was determined using the Braun-Blanquet cover-abundance scale (1965) widely used in geobotanical and ecological studies as rapid visual assessment technique, but robust and highly repeatable, minimizing among-observer differences:

+ – occasional and less than 1% cover of the sample plot area;

1 – abundant with low cover, or less abundant but with higher cover, 1–5% of the sample plot area;

2 – abundant with >5–25% of the sample plot area, irrespective of the number of individuals;

3 – >25–50% cover of the sample plot area, irrespective of the number of individuals;

4 – >50–75% cover of the sample plot area, irrespective of the number of individuals;

5 – >75% cover of the sample plot area, irrespective of the number of individuals.

The relative abundance of each species also was assessed using the DAFOR scale: D = Dominant; A = Abundant, F = Frequent, O = Occasional, R = Rare.

The conservation status of plant species is given according the Red Data Book of Uzbekistan (2019). National categories of threatened plants are follows: 0 (probably extinct species) – corresponds to EX or EW categories of the IUCN Red List (www.iucnredlist.org), 1 (endangered, disappearing species) – meets CR or EN categories of IUCN, 2 (rare species) – meets VU category of IUCN and 3 (vulnerable, declining species) – corresponds to NT category of IUCN. To date, 5 editions of the Red Data Book of Uzbekistan have been published. The first (1984) included 163 plant species, the second (1998) – 301, the third (2006) – 302, the fourth (2009) – 321, and an actual, fifth edition (2019), includes 314 plant species.

IUCN Red List (www.iucnredlist.org) is unapplicable in our case because currently only 236 taxa (5.4%) of more than 4380 species recorded for the flora of Uzbekistan were assessed by IUCN, 16 species of them were included in the IUCN Red List as threatened (CR, EN and VU categories), and only 5 of them are red-listed at the national level. The rest 94.6% of species have not yet been assessed by IUCN and belong to NE category – Not Evaluated. 350 plant species of 112 genera are national endemics of Uzbekistan (including all endemics of relic low mountains of Kyzylkum), 137 of them are red-listed at the national level, and none of them assessed as threatened (CR, EN, VU) in the IUCN Red List.

As defined by the International Finance Corporation (IFC) Performance Standard 6 (PS6) and EBRD Performance Requirement 6 (PR6), critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. Numerical thresholds have been defined for the first four critical habitat criteria (i.e., CR/EN species; endemic/restricted-range species; migratory/congregatory species; threatened and unique ecosystems); these tresholds are based on these published by IUCN in “A Global Standard for the Identification of Key Biodiversity Areas” (2016) and “IUCN Red List Categories and Criteria” (2012). For Criterion 5, there are no numerical thresholds.

Criterion 1 is triggered by species listed as CR or EN on the IUCN Red List, and nationally/regionally listed species assessed using similar criteria. Criterion 2 is triggered by habitats of significant importance for endemic or restricted-range species. Criterion 3 (migratory species) in unapplicable for plants. As for Criterion 4, unfortunately, the officially approved national list of highly threatened and/or unique ecosystems and habitats does not exist in Uzbekistan. But the National Biodiversity Conservation Strategy (1998), National reports on biodiversity conservation (2006, 2015) and other documents (Ismatov, 2013) indicated that the problem of conservation of all types of forest ecosystems (including shrublands) is a very critical issue in Uzbekistan. A specific legislation, management and forest protection measures are present at the national level. Forests and shrublands are key habitats for the conservation of many rare animals and plants in Central Asia. In the sandy desert, psammophilous shrublands and saxaul stands have essential importance for sand fixation and combat desertification. But these ecosystems are under serious threat from over-exploitation and over-grazing. Therefore, natural and planted desert “forests” must be taken into account.

4. Results of the field survey
4.1. Bash site

A total check-list of vascular plants recorded within the project site "Bash" during the field survey in April and June includes 49 species (Appendix 1). In June, the same species were found in each survey area, the only difference was their phenological stage (all ephemers and ephemeroids were fruiting or dried). Following habitat types (map units) were identified for the "Bash" site:

4.1.1. Sandy and sandy-loamy desert plain

The field survey showed that the main habitat type in the western part of "Bash" area (to the west of railway) is sandy and sandy-loamy desert plain with flat and flat-wavy terrain, covered with native ephemeroid-sagebrush (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale (Salsola orientalis)*) on sandy desert soil and sabulous-loamy grey-brown desert soil. *Ferula foetida* and *Iris songarica* are subdominants on local areas. There is no clear boundary between sandy and sandy-loamy desert plain, and between ephemeroid-sagebrush and saltwort-ephemeroid-sagebrush communities; thus, they can be combined into one type of habitat.

The plant species diversity is low (8 to 18 species). The canopy cover is 20–50%. The vegetation is more or less uniform (with local abundance of saltworts, *Ferula foetida* and *Iris songarica*). One moss species (*Tortula desertorum*) has been found in all plots; on some local areas it covers up to 5%. One nationally red-listed species, *Tulipa lehmanniana,* occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. Tulips were recorded mainly in April. In middle May and June, only solitary specimens were recorded because they finished the vegetation, and their aboveground part completely withered away.

The main type of land use is pasture; an impact of grazing is medium; several shepherds houses are situated in this territory. Local impact is connected with several ground roads, and with an underground gas pipeline that runs across the southern part of the project site.

Within this habitat type, following geobotanical sample plots were described.

B027, B028, B029, B030

40.671945 – 40.662653° N, 64.70655 – 64.727453° E, 315–333 m.s.l. Sandy desert plain with hilly-wavy terrain and native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (Photo 1–3). 13 plant and 1 moss species were recorded (Table 1), none of them are red-listed or alien. The canopy cover is 25–30%. The differences between these 4 survey plots are negligible, species diversity is very low, and the vegetation cover is uniform.

Table 1. Check-list of plants recorded in survey plots B027–B030

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	D	2–3	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation

Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Holosteum umbellatum	annual	6–8	R	+	flowering
Hypecoum pendulum	annual	12–15	R	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation

Photo 1. Plot B027 (above). Sandy plain with hilly-wavy terrain and ephemeroid-sagebrush vegetation

Photo 2. Plot B030 (below). Sandy plain with hilly-wavy terrain and ephemeroid-sagebrush vegetation

Photo 3. Sagebrush (*Artemisia diffusa*), a dominant plant of ephemeroid-sagebrush communities of the south-western Kyzylkum

B035

40.690406° N, 64.576697° E, 271 m.s.l. Wavy sandy-stony desert plain with native ephemeroid-sagebrush-saltwort vegetation (*Xylosalsola arbuscula*, *Caroxylon orientale, Artemisia diffusa, Poa bulbosa, Carex physodes*) (Photo 4–5). 20 plant and 1 moss species were recorded (Table 2). The canopy cover is 35–40%. 6 generative and 17 pre-

generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square.

Photo 4. Plot B035. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

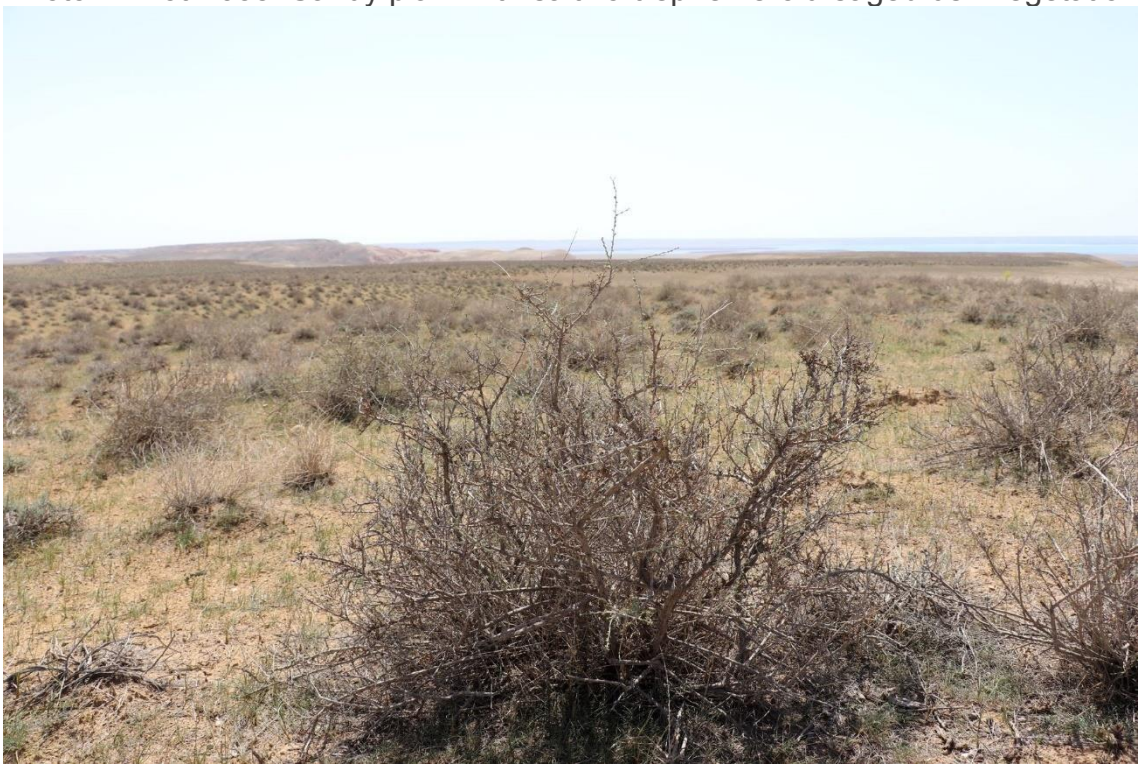

Photo 5. *Xylosalsola arbuscula (Salsola arbuscula),* or white saltwort

Table 2. Check-list of plants recorded in survey plot B035

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering

Artemisia diffusa	semishrub	15–20	A	1	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex physodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	R	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Streptoloma desertorum	annual	6–7	R	+	flowering
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

B036, B037

40.68719 – 40.685428° N, 64.582273 – 64.589908° E, 270–272 m.s.l.

Sandy plain with native ephemeroid-sagebrush-saltwort (*Xylosalsola arbuscula, Caroxylon orientale, Artemisia diffusa, Poa bulbosa, Carex physodes*) (photo 6–7); 18 plant and 1 moss species were recorded (Table 3). The canopy cover is 30–40%. 11 generative and 78 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the B037 survey square, and solitary pre-generative specimens were found within the B036 plot. Alien plants are absent. The terrain is somewhat wavy.

Photo 6. Plot B037. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

Photo 7. Plot B036 (below). Sandy plain with saltwort-ephemeroid-sagebrush vegetation

Table 3. Check-list of plants recorded in survey plots B036–B037

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	O	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	A	1	vegetation

Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex physodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia resinosa	Perennial	30–35	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Ixiolirion tataricum	Perennial	12–15	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

B061, B062, B063, B064, B065

40.665857 – 40.670540° N, 64.612417 – 64.583322° E, 260–267 m.s.l. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Caroxylon orientale*) on sandy desert soil (photo 8); 23 plant and 1 moss species were recorded (Table 4), including nationally red-listed *Tulipa lehmanniana* (numerous mainly pre-generative specimens occurs sporadically within and between survey plots). The canopy cover is 40–50%. Alien plants are absent. The differences between these 5 plots are negligible. The terrain is somewhat hilly-wavy.

Photo 8. Plot B065. Sandy plain with saltwort-ephemeroid-sagebrush vegetation. In the foreground – *Ferula foetida.*

Table 4. Check-list of plants recorded in survey plots B061–B065

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	O	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Halothamnus subaphyllus	semishrub	40–45	O	1	vegetation
Haplophyllum sp.	Perennial	10–15	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation

Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation
Xylosansola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

B066

40.662056° N, 64.626846° E, 255 m.s.l.

Sandy plain with native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Caroxylon orientale*) (photo 9); 23 plant and 1 moss species were recorded (Table 5), including nationally red-listed *Tulipa lehmanniana* (solitary mainly pre-generative specimens). The canopy cover is 50%. Alien plants are absent.

Table 5. Check-list of plants recorded in survey plot B066

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum microcarpum	shrub	50–70	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	40–50	D	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation

Photo 9. Plot B066. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

B069

40.650226 ° N, 64.641662 ° E, 263 m.s.l.

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Xylosalsola arbuscula, Caroxylon orientale, Ferula foetida*) (photo 10); 18 plant and 1 moss species were recorded (Table 6). The canopy cover is 40%. 23 generative and 131 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square. Alien plants are absent. The the terrain is somewhat wavy.

Table 6. Check-list of plants recorded in survey plot B069

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation

Phlomoides desertotum	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	30–40	R	+	Dried
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	2	vegetation

Photo 10. Plot B069. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

B070

40.645274 ° N, 64.644478 ° E, 260 m.s.l.

This survey plot is situated near the border of flat sandy desert plain and steep slopes of saline depression. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale, Ferula foetida*) (photo 11); 16 plant and 1 moss species were recorded (Table 7). The canopy cover is 40%. 25 generative and 121 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square. Alien plants are absent. The the terrain is somewhat wavy.

Table 7. Check-list of plants recorded in survey plot B070

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus rubromarginatus	perennial	12-15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering

Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	20-25	R	+	Dried
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	R	+	flowering
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Holosteum umbellatum	annual	6–8	R	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation

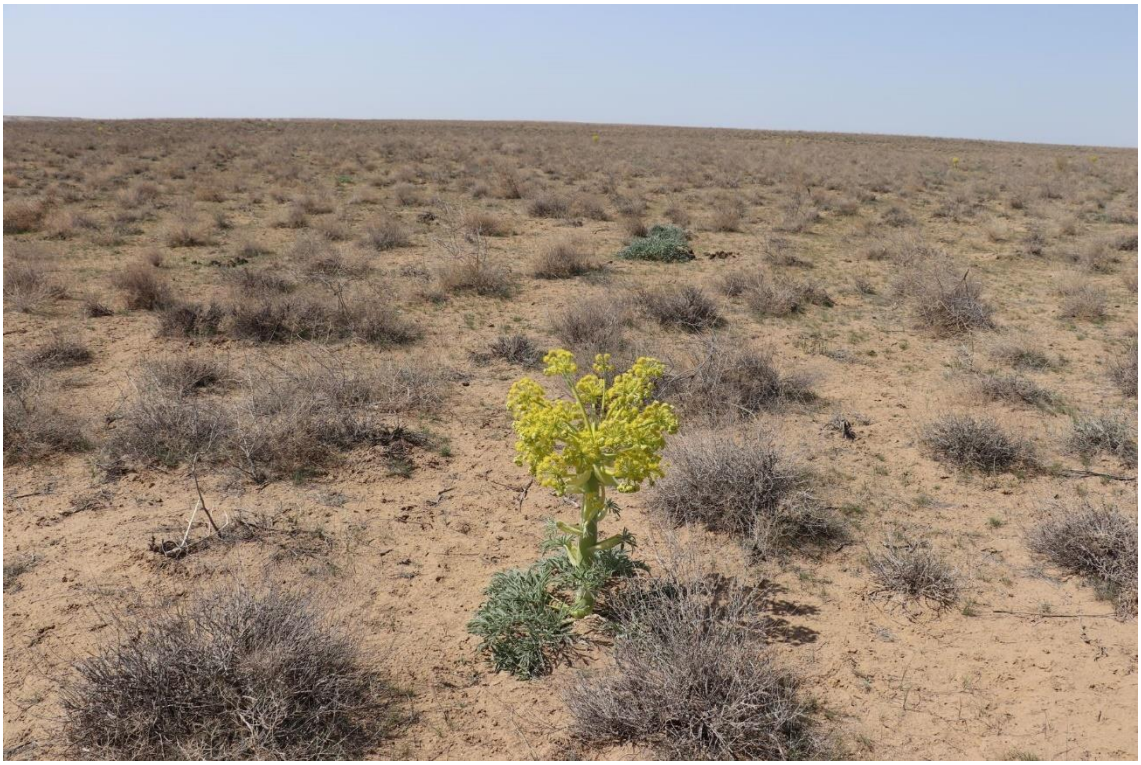

Photo 11. Plot B070. Sandy plain with saltwort-ephemeroid-sagebrush vegetation. In the foreground – *Ferula foetida.*

B085

40.659246° N, 64.613665° E, 230 m.s.l. A flat sandy desert plain, near the border of saline depression. Native ephemeroid-saltwort community with canopy cover of 30% on sandy desert soil (Photo 12). 17 plant and 1 moss species were recorded (Table 8), includins 3 generative and 18 pre-generative specimens of nationally red-listed *Tulipa lehmanniana*. Alien plants are absent.

Table 8. Check-list of plants recorded in survey plot B085

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	

Acanthophyllum elatius	Perennial	35-40	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	20–25	D	2	vegetation
Astragalus rubromarginatus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcate	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	30–35	O	+	flowering
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Hypecoum pendulum	annual	12–15	O	+	flowering
Ixiolirion tataricum	Perennial	12–15	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation

Photo 12. B085. Flat sandy desert plain with ephemeroid-saltwort vegetation, near the edge of the cliffs of saline depression

VP2

40.623187° N, 64.648509° E, 264 m.s.l. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale, Ferula foetida*) on sabulous soil (photo 13); 11 plant and 1 moss species were recorded (Table 9). 9 pre-generative specimens of red-listed *Tulipa lehmanniana* were found. Alien plants are absent.

Table 9. Check-list of plants recorded in survey plot VP2

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	40–50	O	1	Vegetation, flowering
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation

Photo 13. Plot VP2. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

B092, B093, B094, B095, B096

40.606105 – 40.623301° N, 64.648188 – 64.634463° E, 264 m.s.l. The same native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) was described on 4 survey plots situated along the border of flat sandy desert plain and steep slopes of saline depression (photo 14–15); the differences between these areas are negligible. 12 plant and 1 moss species were recorded (Table 10), includins solitary specimens of red-listed *Tulipa lehmanniana*. The second tulip species, *Tulipa sogdiana,* has been included in first, second and third editions of the Red Data Book of Uzbekistan (1984, 1998, 2006). As a result of field surveys performed during the last 20 years, it has been revealed that *Tulipa sogdiana* is common in desert zone of Uzbekistan, and it has been removed from the national Red Data Book. Alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is flat.

Table 10. Check-list of plants recorded in survey plots B092–B096

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	30–35	O	+	Vegetation, flowering
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–5	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 14. B096. Flat sandy desert plain with ephemeroid-sagebrush vegetation

Photo 15. B093. Flat sandy desert plain with ephemeroid-sagebrush vegetation

B097

40.599784° N, 64.650479° E, 262 m.s.l.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 16); 11 plant and 1 moss species were recorded (Table 11). 3 specimens of red-listed *Tulipa lehmanniana* were found. Alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is somewhat hilly-wavy.

Table 11. Check-list of plants recorded in survey plot B097

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	O	+	vegetation
Caroxylon scleranthum (*Salsola sclerantha*)	annual	20-25	R	+	Dried
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation

Photo 16. B097. Hilly-wavy sandy desert plain with ephemeroid-sagebrush vegetation

B098

40.593737° N, 64.651792° E, 259 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 17); 11 plant and 1 moss species were recorded (Table 12), red-listed and alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is somewhat wavy.

Table 12. Check-list of plants recorded in survey plot B098

Species	Life form	Height, cm	Abundance	Phenol. stage

			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Peganum garmala	Perennial	15-20	O	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 17. B098. Sandy desert plain with ephemeroid-sagebrush vegetation

B101

40.57905° N, 64.65094° E, 259 m.s.l.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 18); 8 plant and 1 moss species were recorded (Table 13), red-listed and alien plants are absent. The soil is sabulous and somewhat gravelly. The same vegetation is in the center of bird monitoring point VP1.

Table 13. Check-list of plants recorded in survey plot B101

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation

Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	25-30	R	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation

Photo 18. B101. Flat sandy desert plain with ephemeroid-sagebrush vegetation

B103

40.556723° N, 64.648712° E, 263 m.s.l.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 19); 14 plant and 1 moss species were recorded (Table 14), one of them is nationally red-listed (*Tulipa lehmanniana,* photo 20); alien plants are absent. 1 generative and 8 pre-generative specimens of *Tulipa lehmanniana* have been count. A colony of gerbils (*Meriones sp.*) is situated on the area. The sandy soil is somewhat gravelly.

Table 14. Check-list of plants recorded in survey plot B103

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	25-30	R	+	vegetation

Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 19. B103. Flat sandy desert plain with ephemeroid-sagebrush vegetation

Photo 20. Plot B103. Non-flowering generative specimen of nationally red-listed *Tulipa lehmanniana*

B104

40.552364° N, 64.653046° E, 265 m.s.l.

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Salsola orientalis*) (photo 21); 13 plant species were recorded (Table 15), red-listed or alien plants are absent.

Table 15. Check-list of plants recorded in survey plot B104

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus campylorrhynchus	annual	10-12	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	25–30	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Oreosalsola arbusculiformis (*Salsola arbusculiformis*)	dwarf shrub	35-40	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 21. Plot B104. Flat sandy plain with saltwort-ephemeroid-sagebrush vegetation

B105

40.548117° N, 64.658976° E, 267 m.s.l. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Ferula foetida, Iris songarica, Caroxylon orientale*) (photo 22); 17 plant species and 1 moss species (*Tortula desertorum*) were recorded (Table 16), one of them is nationally red-listed (*Tulipa lehmanniana*) (photo 23); alien plants are absent. Number of specimens of *Tulipa lehmanniana* is 16: 4 generative, 12 pre-generative. 22 generative and 34 pre-generative specimens aslo have been count on 190–300 m from the plot. A colony of gerbils (*Meriones sp.*) is situated on the area.

Photo 22. Plot B105. Flat sandy plain with saltwort-ephemeroid-sagebrush vegetation with local abundance of giant umbelliferous *Ferula foetida*.

Photo 23. Non-flowering generative specimen of nationally red-listed species *Tulipa lehmanniana*.

Table 16. Check-list of plants recorded in survey plot B105

Species	Life form	Height, cm	Abundance	

			DAFOR	Braun-Blanquet	Phenol. Stage
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus campylorrhynchus	annual	10-12	R	+	vegetation
Astragalus rubromarginatus	perennial	12-15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	A	1	flowering
Iris songarica	Perennial	30–35	A	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	D	2	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	Vegetation
Xylosalsola arbuscula (*Salsola arbuscula*)	Shrub	50–60	R	+	vegetation

B106

40.545494° N, 64.66536° E, 269 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) on sabulous, somewhat gravelly desert soil (photo 24). The canopy cover is 20–25%. One moss and 9 plant species were recorded (Table 17), none of them are red-listed or alien.

Table 17. Check-list of plants recorded in survey plot B106

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Xylosalsola arbuscula (*Salsola arbuscula*)	Shrub	50–60	R	+	vegetation

Photo 24. B106. Flat sandy plain with ephemeroid-sagebrush vegetation

B108

40.550329° N, 64.62948° E, 266 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) on sabulous, somewhat gravelly desert soil. One moss and 9 plant species were recorded (Table 18), none of them are red-listed or alien.

Table 18. Check-list of plants recorded in survey plot B108

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	F	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering

B109

40.544428° N, 64.6308° E, 265 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 25). One moss and 11 plant species were recorded (Table 19), none of them are red-listed or alien.

Table 20. Check-list of plants recorded in survey plot B109

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 25. B109. Flat sandy plain with ephemeroid-sagebrush vegetation

B110

40.54095° N, 64.63479° E, 263 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Ferula foetida*). One moss and 18 plant species were recorded (Table 21), none of them are red-listed or alien.

Table 21. Check-list of plants recorded in survey plot B110

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	R	+	Flowering, fruiting
Artemisia diffusa	semishrub	25–30	D	2	vegetation

Astragalus campylorrhynchus	annual	10-12	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Climacoptera sp.	annual	7–10	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	A	1	flowering
Hypecoum pendulum	annual	12–15	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	D	2	vegetation
Suaeda sp.	annual	7–10	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	Shrub	50–60	R	+	vegetation

Photo 26. B110. Flat-wavy sandy plain with ephemeroid-sagebrush vegetation

4.1.2. Cliffs and eroded slopes of saline depression

B086, 087, 088, 089, and VP3

40.637241 – 40.649545° N, 64.626063 – 64.615312 ° E, 256–210 m.s.l. Slopes and bottom of saline depression. Native sparse ephemeroid-saltwort community was described on 4 survey plots on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%); the differences between these areas are negligible.

17 plant and 1 moss species were recorded (Table 22), includins solitary specimens of red-listed *Tulipa lehmanniana*. Alien plants are absent.

Table 22. Check-list of plants recorded in survey plots B086-B089 and VP3, April 2021.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	20–25	O	+	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Climacoptera sp.	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering

Photo 27. B089. Eroded sandstone slopes of saline depression with very sparse saltwort vegetation

Photo 28. B087. Eroded sandstone slopes of saline depression with very sparse saltwort vegetation

B090

40.630992° N, 64.62699° E, 210 m.s.l. Slopes of saline depression.

Native sparse saltwort community on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%). One moss and 13 plant species were

recorded (Table 23), none of them are alien. 7 generative and 18 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot.

Table 23. Check-list of plants recorded in survey plot B090, April 2021.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation

Photo 29, 30. B090. Flat sandy desert plain with sparse saltwort-ephemeroid-sagebrush vegetation intensively grazed by livestock on the top of cliff (above). Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (below).

B091

40.627159° N, 64.630565° E, 223 m.s.l. A border of flat sandy desert plain and steep slopes of saline depression.

Intensively grazed by livestock native saltwoth-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale*) with canopy cover of 10–15% on saline sabulous-loamy grey-brown desert soil on the top of cliff, and very sparse saltwort community on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%). One moss and 14 plant species were recorded (Table 24), none of them are alien. 4 generative and 21 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot.

Table 24. Check-list of plants recorded in survey plot B091.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	A	1 to 2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	+	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	A	+ to 1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation

Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	+ to 1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering

Photo 31, 32, 33. B091. Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (above and in the center). Flat sandy desert plain with sparse saltwort-ephemeroid-sagebrush vegetation intensively grazed by livestock on the top of cliff (below).

B100

80 m to the south-west of B100 turbine location. 40.58805° N, 64.65367° E, 251 m.s.l. A border of flat sandy desert plain and steep slopes of saline depression.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) with canopy cover of 30% on the top of cliff and very sparse saltwort community on steep eroded sandstone slopes (canopy cover is 0–10%). One moss and

13 plant species were recorded (Table 25), none of them are alien. 6 generative and 8 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot. A colony of gerbils (*Meriones sp.*) is situated on the area of turbine location.

Table 25. Check-list of plants recorded in survey plot B100.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation

Photo 34, 35. B100. Flat sandy desert plain with ephemeroid-sagebrush vegetation on the top of cliff (above). Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (below). Parallel paths trampled by livestock are visible in the foreground

B107

100 m to the north-west of B107 turbine location. 40.557216° N, 64.629407° E, 251 m.s.l. A border of sandy desert plain and steep eroded slopes of saline depression.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) on the top of cliff and very sparse saltwort community on steep sandstone slopes (canopy cover is less than 5%). One moss and 17 plant species were recorded (Table 26), none of them are alien. 4 generative and 11 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found.

Table 26. Check-list of plants recorded in survey plot B107.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Climacoptera sp.	annual	12–15	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Iris falcifolia	Perennial	12–15	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation

Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering

Photo 36. Plot B107. Steep sandstone slopes of saline depression with very sparse saltwort vegetation

4.1.3. Fixed and semi-fixed sands

Fixed and semi-fixed ridge-hilly sands prevail in the north-eastern part of “Bash” area. The vegetation of this habitat type is represented with native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Salsola arbuscula, Calligonum leucocladum, C. microcarpum*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes, Caroxylon orientale*). Psammophilous vegetation, particularly desert shrubs and saxaul woodlands, plays an important ecological role forming a unique landscape of sandy deserts of Central Asia and fixing sands.

The plant species diversity is higher than on flat and flat-wavy sandy desert plain (up to 30–31 species). The canopy cover is 40–50%. The vegetation is more or less uniform, only local abundance of saltworts and *Calligonum* varies on different areas. One moss species (*Tortula desertorum*) has been found in all plots; on some local areas it covers up to 5%. One nationally red-listed species, *Tulipa lehmanniana,* occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. The main type of land

use is pasture; an impact of grazing is medium; several shepherds houses are situated in this territory. Local impact is connected with several ground roads, railway and with electric lines. Within this habitat type, following geobotanical sample plots were described.

B005, B006

40.698465 – 40.694972° N, 64.63287 – 64.638676° E, 281–291 m.s.l.

Fixed hilly sands covered with native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes*), with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*) on the tops. The canopy cover is 30–40%. 25 plant and 1 moss species were recorded (Table 27), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. Endemic to Central Asian deserts *Cousinia sogdiana* previously also was included in the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009), but as a result of field surveys performed during the last 20 years, it has been revealed that this species is common in desert zone of Uzbekistan, and it has been removed from the 5th edition of the national Red Data Book. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 27. Check-list of plants recorded in survey plots B005–B006.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum leucocladum	shrub	50–70	R	+	vegetation
Calligonum microcarpum	shrub	50–70	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	30-35	R	+	Dried
Ceratocarpus arenarius	annual	15-20	O	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	1	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Sophora pachycarpa	Perennial	15–20	R	+	vegetation
Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation

Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation

Photo 37, 38. Plots B005 (above) and B006 (below). Fixed hilly sands with ephemeroid-sagebrush vegetation, and with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*) on the tops

B040, B041, B042, and VP4

40.68791 – 40.678088° N, 64.611974 – 64.638916° E, 270–282 m.s.l.

Native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Calligonum leucocladum, C.*

microcarpum) on fixed hilly sands; 30 plant and 1 moss species were recorded (Table 28), including nationally red-listed *Tulipa lehmanniana* (occurs sporadically within and between plots). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the territory.

Table 28. Check-list of plants recorded in survey plots B040–B042 and VP4.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alhagi pseudalhagi	Perennial	35–40	O	+	Dried
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A–D	1–2	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum leucocladum	shrub	50–100	A–O	1–2	vegetation
Calligonum microcarpum	shrub	50–100	A–O	1–2	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	30-35	R	+	Dried
Ceratocarpus arenarius	annual	15-20	O	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Heliotropium arguzioides	Perennial	25–30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation

Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A–O	1–+	vegetation

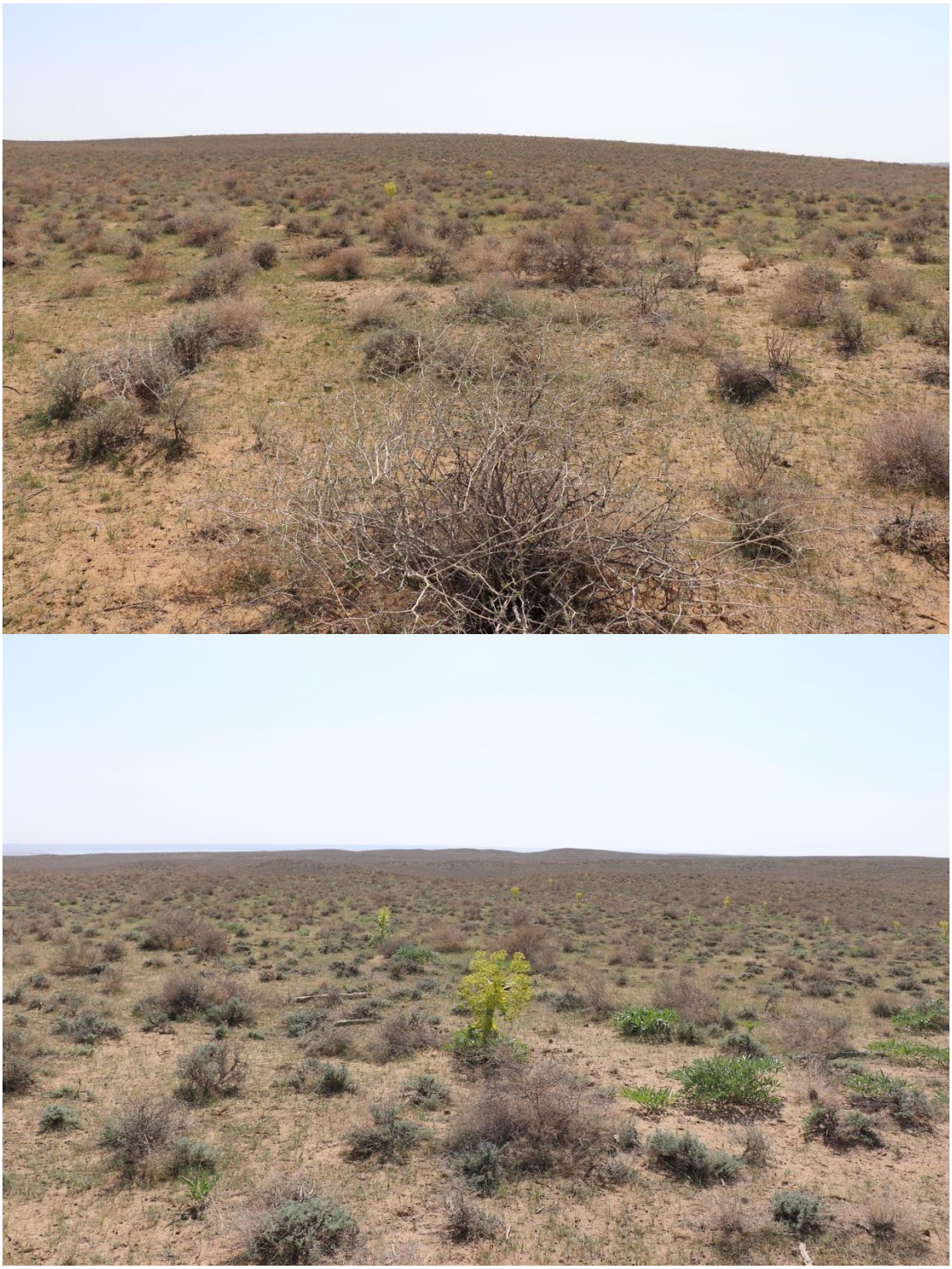

Photo 39, 40. Plots B040 (above) and B041 (below). Fixed sands with calligonum-saltwort-ephemeroid-sagebrush vegetation

Photo 41. Plot B040. Flowering and non-flowering generative specimens of *Tulipa lehmanniana,* nationally red-listed plant

B044, B045, and VP5

40.664263 – 40.661484° N, 64.669446 – 64.676604° E, 290–300 m.s.l.

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Caroxylon orientale*) on fixed hilly sands; 24 plant and 1 moss species were recorded (Table 29), including nationally red-listed *Tulipa lehmanniana* (solitary specimens occur sporadically within and between plots). The canopy cover is 30–40%. Alien plants are absent. A shepherd's house is situated on this territory, but the impact of grazing is medium.

Table 29. Check-list of plants recorded in survey plots B044–B045 and VP5.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alhagi pseudalhagi	Perennial	35–40	R	+	Dried
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum microcarpum	shrub	50–100	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	R	+	vegetation

Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O–A	1	flowering
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation

Photo 42, 43. Plot B044. Fixed sands with saltwort-ephemeroid-sagebrush vegetation, and a shepherd's house (below)

B067, B068

40.654247 – 40.659515° N, 64.637586 – 64.632302° E, 263 m.s.l.

Native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Calligonum leucocladum, C. microcarpum*) on fixed small-hilly sands; 31 plant and 1 moss species were recorded (Table 30), including nationally red-listed *Tulipa lehmanniana* (numerous mainly pre-generative specimens occurs sporadically within survey squares and between plots). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 30. Check-list of plants recorded in survey plots B067–B068.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus chiwensis	perennial	25–30	R	+	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus rubromarginatus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum leucocladum	shrub	50–100	A	1	vegetation
Calligonum microcarpum	shrub	50–100	A	1	vegetation

Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Heliotropium arguzioides	Perennial	25–30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Phlomoides desertotum	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

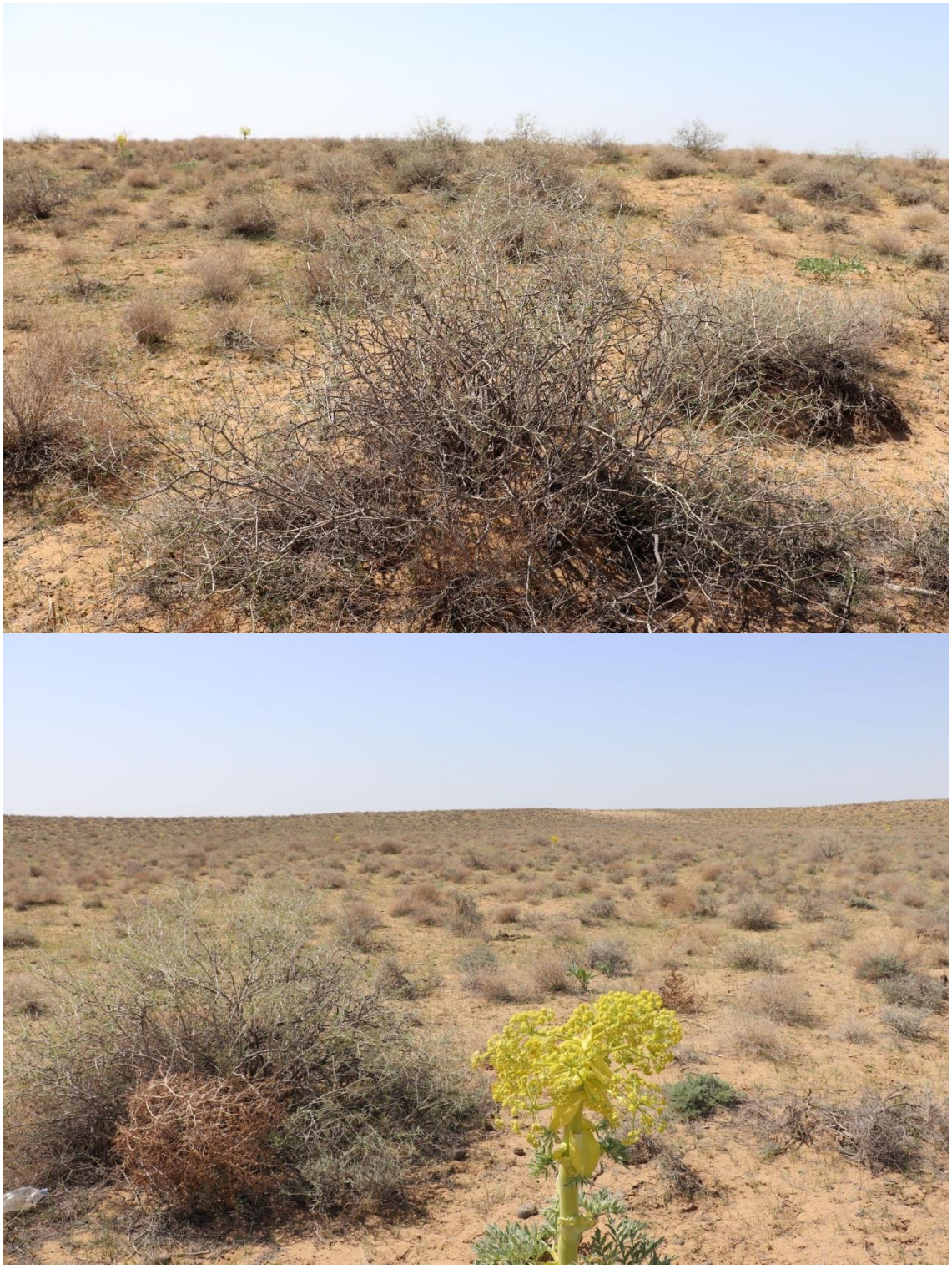

Photo 44, 45. Plots B068 (above) and B067 (below). Fixed sands with calligonum-saltwort-ephemeroid-sagebrush vegetation

Photo 46. *Calligonum microcarpum,* one of main dominant species of psammophilous shrubs of the Kyzylkum

B071–B083, and VP7

40.634589 – 40.582794° N, 64.674604 – 64.729295° E, 254–262 m.s.l.

The plantation of white saxaul (*Haloxylon persicum*), native dominant species of Central Asian sandy deserts, covers an area of 9x3 km of hilly sands between railway and electric line in the south-eastern part of project site. This plantation has been created in the past for fixation of sands. The saxaul stands are rather sparse, unclosed or partially closed on local areas; dominant plants of the herbaceous layer are sagebrush (*Artemisia diffusa*), desert sedge (*Carex physodes*), and *Ferula foetida*; 25 plant and 1 moss species were recorded in total within this area (Table 31), including nationally red-listed *Tulipa lehmanniana* (numerous generative and pre-generative specimens occur sporadically within and between survey squares). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 31. Check-list of plants recorded in survey plots B071–B083, and VP7.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum microcarpum	shrub	50–100	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering

Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	D–O	2–+	flowering
Haloxylon persicum	Small tree	180–200	A–D	1–3	
Heliotropium arguzioides	Perennial	25–30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A–O	1–+	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation

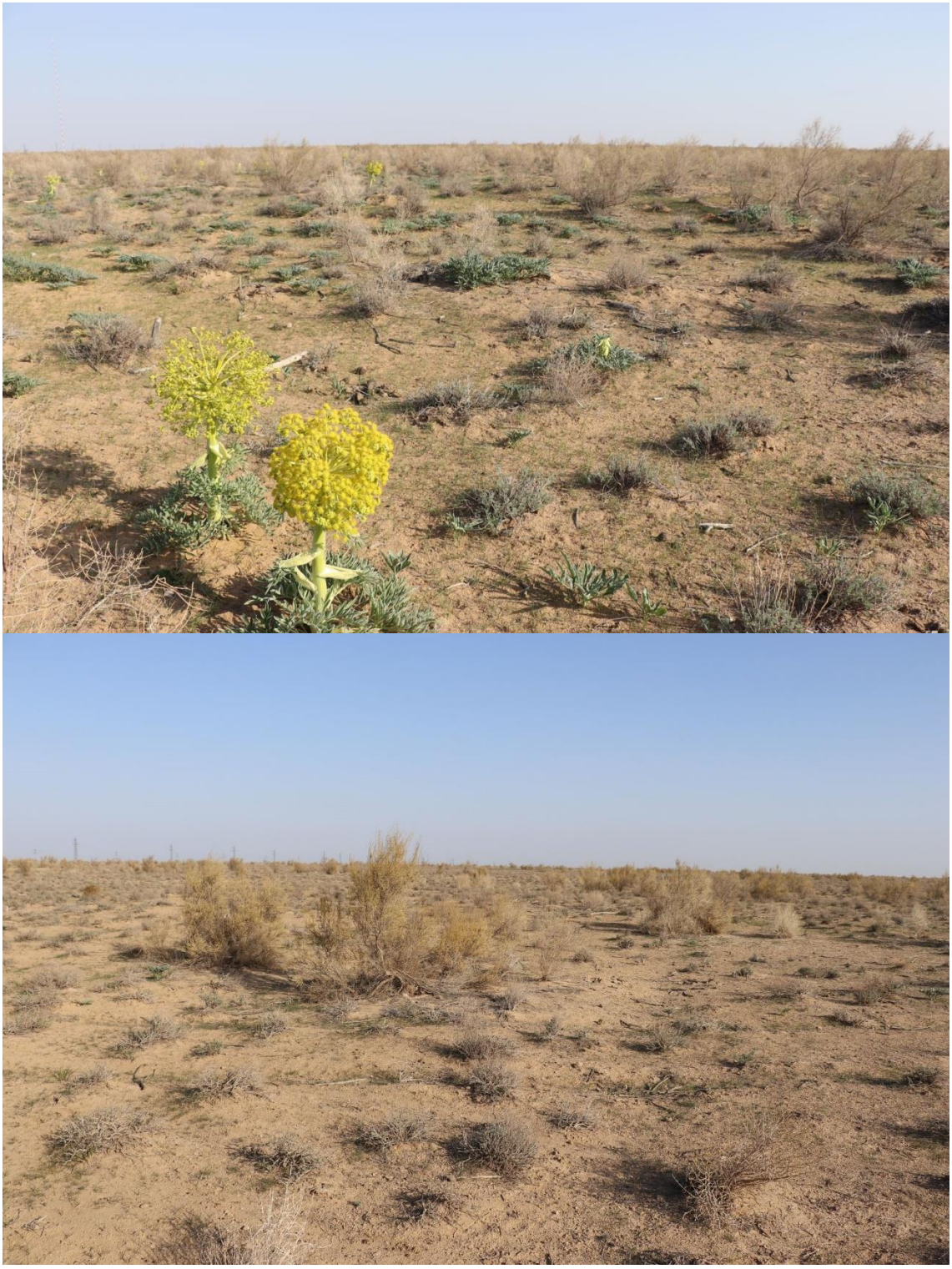

Photo 47, 48, 49. Plots B072 (above), B078 (middle) and B082 (below). Fixed sands with plantations of white saxaul and ephemeroid-sagebrush herbaceous layer

Photo 50. Plot B079. Flowering generative specimen of *Tulipa lehmanniana,* nationally red-listed plant

4.1.4. Relic uplands

Gently sloping stony relic hills with blown sandy cover are situated in the eastern part of the project site, and small insular uplands are found in the north-western part, at the border of saline depression Ayakagytma. The landscape of its sabulous slopes covered with ephemeroid-sagebrush and ephemeroid-sagebrush-saltwort vegetation is similar with neighboring sandy desert plain. On the small areas with outcrops of beds, the stony desert with ephemeroid-dwarf shrub-sagebrush-saltwort vegetation is represented. The canopy cover varies from 10–20% on stony areas to 30–40% on sabulous places. As in other types of landscapes of the project site, the main type of land use is rangeland; an impact of grazing is medium; several shepherds houses are situated here. Local impact is connected with several ground roads and electric lines. Within this habitat type, following geobotanical sample plots were described.

B032, B033, B034

40.655382 – 40.650094° N, 64.737142 – 64.750785° E, 304–317 m.s.l.

Gently sloping sandy-stony relics hills with eroded slopes, small outcrops of beds, and with native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*); species diversity is low; 12 plant and 1 moss species were recorded (Table 32). The canopy cover is 25–30%. The impact of grazing is medium to low.

Table 32. Check-list of plants recorded in survey plots B032–B034.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	15–20	D	2–3	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried

Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R–O	+	vegetation
Holosteum umbellatum	annual	6–8	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Meniocus linifolius	annual	6–7	O	+	Flowering, fruiting
Oreosalsola arbusculoformis (Salsola arbusculiformis)	dwarf shrub	35-40	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O–A	+–1	vegetation

Photo 51. Plot B034. Gently sloping sandy-stony relic hills with ephemeroid-sagebrush vegetation

B048, B049

40.653361 – 40.650308° N, 64.69859 – 64.704047° E, 293–300 m.s.l.

Gently sloping stony relic hill with sandy cover and with native ephemeroid-saltwort-sagebrush vegetation (*Oreosalsola arbusculiformis, Caroxylon orientale, Artemisia diffusa, Poa bulbosa, Carex subphysodes*). 16 plant and 1 moss species were recorded (Table 33), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. The canopy cover is 40%.

Table 33. Check-list of plants recorded in survey plots B048 and B049.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering

Artemisia diffusa	semishrub	15–20	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus divaricatus	semishrub	25–30	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	1	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 52. Plot 048. Gently sloping sandy-stony relic hill with ephemeroid-saltwort-sagebrush vegetation

B050, B051, B052, B053, B054, and VP8
40.646213 – 40.630183° N, 64.709880 – 64.731321° E, 274–300 m.s.l.

Gently sloping stony relic hill with blown sandy cover, sometimes with local outcrops of beds, and with native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*). 16 plant and 1 moss species were recorded (Table 34), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. The giant umbelliferous *Ferula foetida* is abundant on local areas on top of the hills. The canopy cover is 25–30%. The impact of grazing is medium to low. Colonies of gerbils (*Meriones sp.*) occur sporadically on the area, and nationally red-listed Central Asian turtles (*Testudo horsfieldii*) are very numerous on this part of project site.

Table 34. Check-list of plants recorded in survey plots B050–B054, and VP8.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	25–30	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	D	2–3	vegetation
Astragalus villosissimus	dwarf shrub	30-35	R	+	vegetation
Carex subphysodes	Perennial	12–15	O–A	+–1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R–A	+–1	vegetation
Holosteum umbellatum	annual	6–8	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–1	vegetation
Tortula desertorum	moss	0.3–0.5	O–A	+–1	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

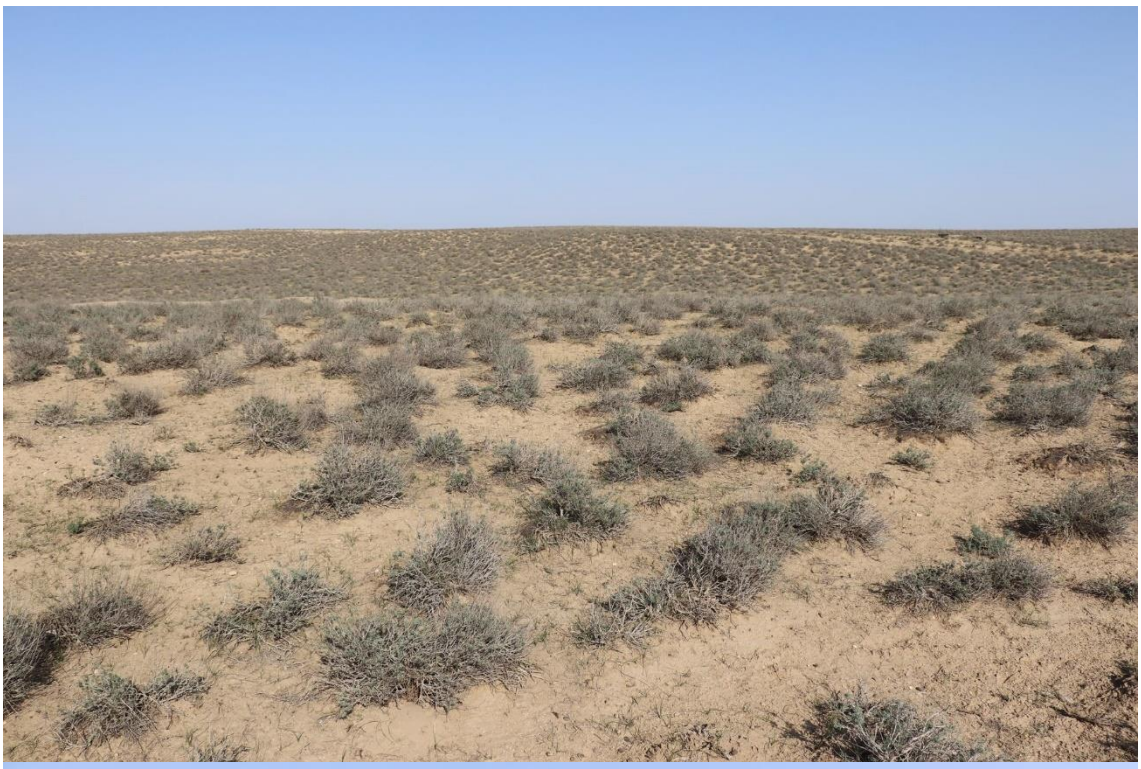

Photo 53, 54, 55. Plots B052 (above), B053(middle) and B054 (below). Gently sloping sandy-stony relic hills with uniform ephemeroid-sagebrush vegetation

B056, B057, B058, B059

40.686278 – 40.674739° N, 64.556687 – 64.571255° E, 272–292 m.s.l.

Rather small, gently sloping stony hill with blown sandy cover and native ephemeroid-dwarf shrub-sagebrush-saltwort vegetation (*Oreosalsola arbusculiformis, Caroxylon orientale, Artemisia diffusa, Astragalus villosissimus, Convolvulus hamadae, Poa bulbosa, Carex subphysodes*). This insular relic hill is situated on the boundary between sandy desert plain and saline depression. 19 plant and 1 moss species were recorded (Table 35). The canopy cover is 20–30%. Solitary generative and numerous pre-generative specimens of nationally red-listed *Tulipa lehmanniana* occurs sporadically within and between the survey squares.

Table 35. Check-list of plants recorded in survey plots B056–B059.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	A	1	vegetation
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	O	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation

Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Ixiolirion tataricum	Perennial	12–15	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Phlomoides desertotum	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation

Photo 56, 57. Plot 056 (above) and an area between plots B058 and B059 (below). Sandy-stony relic hill with ephemeroid- dwarf shrub-sagebrush-saltwort vegetation

4.1.5. Anthropogenic disturbed areas

At the present, technologically disturbed areas occupy only very small part of the project site, mainly in a narrow strip along the railway and underground gas pipeline (approximately 500–100 m wide). Small disturbed areas (construction sites or quarries about 250x150 and 350x250 m in size) with almost completely exterminated vegetation are located also in the south-eastern part of the project site, in surroundings of the survey plot B054. The plant species recorded here are the same that in surroundings of disturbed areas, but the canopy cover is extremely sparse, or the vegetation is almost completely exterminated (photo 58). Alien or red-listed plants are absent.

Such technogenically disturbed areas in the Kyzylkum desert, as well as overgrazed areas around farms, wells and villages, usually become centers of erosion which can lead to the formation of moving sands. Often this process can reach disaster scale. In the past, moving sands have frequently caused the death of cities and oases in desert zone of Central Asia.

Photo 58. Technologically disturbed area (construction site?) with almost completely exterminated vegetation, 1 km to the south of survey plot B054

Photo 59 *Peganum garmala*, an indicator of overgrazing and degradation of pastures

4.2. Dzhankeldy site

A total check-list of vascular plants recorded within the project site “Dzhankeldy” during the field survey in springtime and early summer includes … species (Appendix 2). Following habitat types (map units) were identified for the “Dzhankeldy” site:

4.2.1. Weakly inclined piedmont plain of relic low mountains

The field survey showed that this habitat type is present mainly in the southern part of "Dzhankeldy" area (on the southern proluvial piedmont trails of the mountains Kuldzhuktau), including the bird survey circles VP1, VP2, VP9 and VP10, as well as in the north-eastern part of the project site. The terrain is flat, wavy or gently hilly, sometimes with dry riverbeds and debris cones. The vegetation is represented with native ephemeroid-sagebrush, ephemeroid-saltwort-sagebrush, sagebrush-saltwort and saltwort plant communities on sabulous, loamy, slightly saline, gypsaceous or skeleton sabulous-loamy grey-brown desert soil. Dominant plants are *Artemisia turanica, Artemisia diffusa, Poa bulbosa, Carex pachystylis, Caroxylon orientale (Salsola orientalis)* and *Oreosalsola arbusculiformis (Salsola arbusculiformis))*. The dwarf shrub *Astragalus villosissimus,* giant umbellifer *Ferula foetida* and endemic desert-candle *Eremurus korolkowii* are subdominants on local areas. The canopy cover is sparse (10–30% or less), and plant species diversity is low (8 to 18 species). One moss species (*Tortula desertorum*) has been found in this habitat type; on some local areas it covers up to 1%. One nationally red-listed species, *Tulipa lehmanniana,* occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. The main type of land use is pasture; an impact of grazing is medium. Local impact is connected with asphalt road and several ground roads, and with geological exploration. Within this habitat type, following geobotanical sample plots were described.

VP1 and VP2

40.7843° N, 63.404295° E, 236 m.s.l.

Weakly inclined loamy-gravelly piedmont desert plain with native sagebrush-saltwort vegetation on gypsaceous, skeleton grey-brown desert soil (Photo 60–61). The canopy cover is 10–20%; 17 plant and 1 moss species were recorded (Table 36), none of them are alien. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum (Photo 62). This species has been included in second and third editions of the Red Data Book of Uzbekistan (1998, 2006), but later it has been removed from the national Red Data Book (2009, 2019). This plant is not evaluated in the IUCN Red List.

Table 36. Check-list of plants recorded in survey plots VP1 and VP2

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	20–25	A	1	vegetation
Artemisia turanica	semishrub	20–25	A	1	vegetation
Astragalus villosissimus	dwarf shrub	30–35	O	+	vegetation
Atraphaxis spinosa	shrub	30–35	R	+	vegetation
Carex pachystylis	Perennial	12–15	O	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30-35	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	O	+	Dried
Climacoptera sp.	annual	25–30	O	+	Dried
Eremurus korolkowii	Perennial	25–30	O	+	Vegetation, flowering

Ferula foetida	Perennial	50–60	R	+	Vegetation, flowering
Lycium ruthenicum	shrub	40–50	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30-35	A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 60. Survey circle VP1. Southern piedmont plain of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation

Photo 61. Western part of survey circle VP2. Southern piedmont plain of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation

Photo 62. Korolkow's desert-candle (*Eremurus korolkowii*) national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum

VP9 and VP10

40.87017–40.90958° N, 63.242–63.21672° E, 190–220 m.s.l. Weakly inclined loamy-gravelly piedmont desert plain and gently sloping foothills with native ephemeroid-saltwort-sagebrush and sagebrush-saltwort vegetation on gypsaceous, skeleton or gravelly grey-brown desert soil (Photo 63–64). The canopy cover is 5–20%; 23 plant and 1 moss species were recorded (Table 37), none of them are alien or red-listed. One

species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 37. Check-list of plants recorded in survey plots VP9 and VP10

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A	1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	12–15	A–D	+–1	flowering
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Climacoptera sp.	annual	25–30	R	+	Dried
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	40–70	R	+–1	vegetation
Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Lactuca orientalis	semishrub	35–40	R	+	vegetation
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Lycium ruthenicum	shrub	35–45	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30-35	O–A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 63. VP10. Southern piedmont plain of Kuldzhuktau mountains with ephemeroid-saltwort-sagebrush vegetation

Photo 64. VP9. Gravelly southern piedmont plain of Kuldzhuktau mountains with sparse saltwort-sagebrush vegetation

Photo 65. Desert sedge (*Carex pachystylis*), a dominant of ephemeroid-saltwort-sagebrush and ephemeroid-sagebrush communities

D050-D051

Gently inclined northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul (remains of plantations) on sandy-loamy grey-brown desert soil (Photo 66–67). The canopy cover is 30%. 25 plant and 1 moss species were recorded (Table 38), none of them are alien or listed in the Red Data Book of Uzbekistan (2019).

Table 38. Check-list of plants recorded in survey plots D050-D051

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	25–35	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O	+	vegetation
Artemisia turanica	semishrub	20–25	A-D	1-2	vegetation
Astragalus villosissimus	dwarf shrub	30–35	O	+	vegetation
Carex subphysodes	Perennial	10–12	A	1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R	+	vegetation
Ceratocarpus arenarius	annual	15–20	O–A	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	O–A	+-1	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation

Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–40	A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	1	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation

Photo 66. D050. Northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul

Photo 67. D051. Northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul

D114–D118, D125

40.86467 – 40.87791° N, 63.285775 – 63.252131° E, 219–230 m.s.l.

Weakly inclined southern piedmont plain of and foothills with gently sloping terrain, covered with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul on gypsaceous, loamy-gravelly grey-brown desert soil, sometimes with outcrops of variegated beds (Photo 68–72). The density of saxaul is up to 500–800 specimens per 1 hectare. The canopy cover is 5–30%. 23 plant and 1 moss species were recorded (Table 39), none of them are alien. One species, *Acanthophyllum cyrtostegium,* is listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); it is endemic to the south-western Kyzylkum and north-western spurs of Pamir-Alay, and national endemic. Solitary specimens of *Acanthophyllum cyrtostegium* occurs sporadically within and between survey plots D114–D118, the density of population is 40–45 individuals per 1 hectare. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 39. Check-list of plants recorded in survey plots D114–D118 and D125

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A	1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	12–15	O	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	A	1	vegetation
Ceratocarpus arenarius	annual	15–20	O	+	Dried
Climacoptera sp.	annual	25–30	O	+	Dried
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R	+	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–180	O–A	1–2	vegetation
Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Lycium ruthenicum	shrub	40–50	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation

Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 68. D114. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (April)

Photo 69. D114. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)

Photo 70. D117. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)

Photo 71. Between D114 and D125. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (April)

Photo 72. D125. Southern piedmont plain of Kuldzhuktau Mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)

4.2.2. Foothills of relic low mountains

This habitat type is characterized by more or less rugged hilly terrain, and the vegetation is represented with native saltwort-sagebrush vegetation on sandy-loamy, loamy, more or less skeleton grey-brown desert soils. The slopes of foothills are dissected with dry riverbeds.

D022–D029

Gently sloping foothills of the mountains Kuldzhuktau with native saltwort-sagebrush vegetation and solitary black saxaul on sabulous-loamy, skeleton grey-brown desert soil (Photo 73–76). The canopy cover is 20–30%. 31 plant and 1 moss species were recorded (Table 40), none of them are alien, and 3 species, *Acanthophyllum cyrtostegium, Ferula kyzylkumica* and *Tulipa lehmanniana,* are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (Photo 77–78). 3 generative and 11 pre-generative specimens of *Tulipa lehmanniana* and 6 specimens of *Acanthophyllum cyrtostegium* were count in survey plot D029; 6 generative and 31 pre-generative specimens of *Tulipa lehmanniana* and 4 specimens of *Acanthophyllum cyrtostegium* were count in survey plot D024; 8 specimens of *Ferula kyzylkumica* were found in survey plot D026.

Table 40. Check-list of plants recorded in survey plots D022–D029

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Allium protensum	perennial	15-20	R	+	fruiting
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O	+	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation

Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	10–12	O–A	1	fruiting
Carex subphysodes	Perennial	10–12	A	1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R	+	vegetation
Ceratocarpus arenarius	annual	15–20	A	+	Dried
Ceratocephala falcata	annual	3–4	R	+	fruiting
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	O	+	Vegetation
Ferula kyzylkumica	Perennial	10–15	R	+	Vegetation
Fritillaria karelinii	Perennial	10–12	R	+	fruiting
Gagea afghanica	Perennial	10–12	R	+	flowering
Gagea bergii	Perennial	5–7	R	+	flowering
Halimocnemis villosa	annual	10–12	O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	50–70	R	+	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Leontice inserta	perennial	10–12	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–40	A	1	vegetation
Peganum garmala	Perennial	20–25	O	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10-20	R	+	Vegetation, flowering
Tulipa sogdiana	Perennial	7–10	R	+	fruiting
Ziziphora tenuior	annual	7–10	R	+	flowering

Photo 73. D029. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (April)

Photo 74. D029. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (June)

Photo 75. D026. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (April)

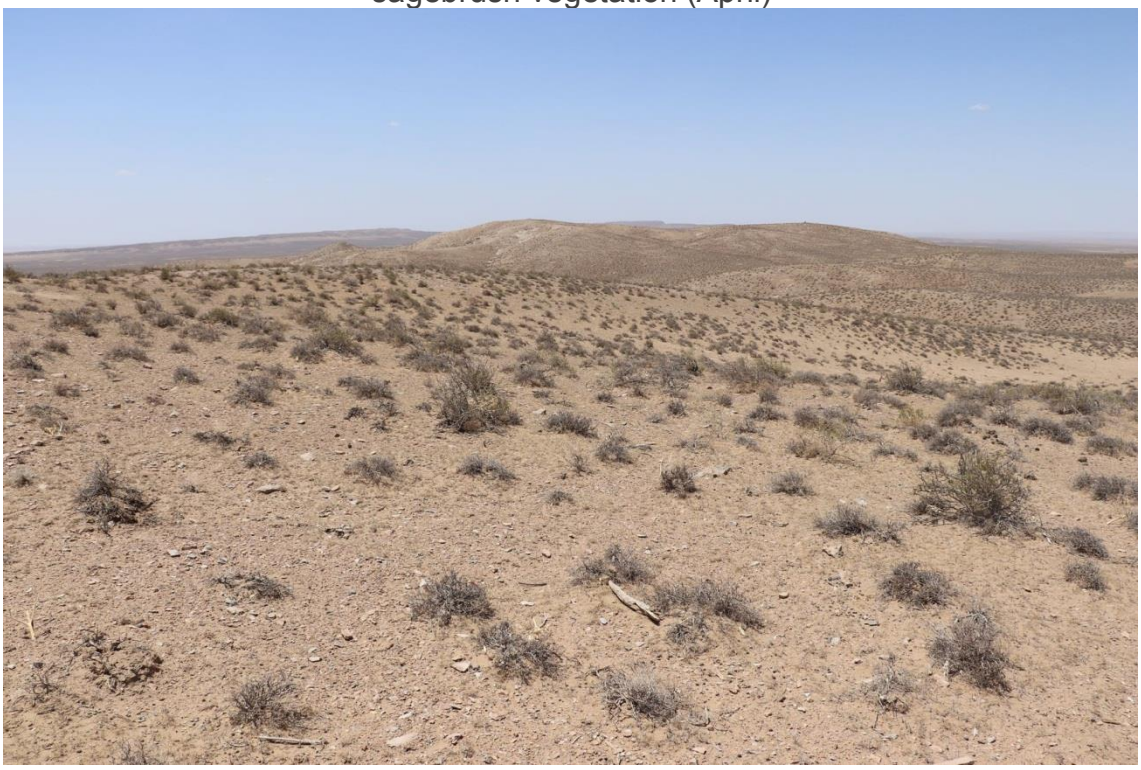

Photo 76. D026. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (June)

Photo 77. Plot D026. Pre- generative specimen of nationally red-listed *Ferula kyzylkumica*

Photo 78. Plot D024. One generative and 2 pre-generative specimens of nationally red-listed *Tulipa lehmanniana*

D030–D035

Foothills with rather gently sloping, hilly terrain, covered with native ephemeroid-saltwort-sagebrush and sagebrush-salthwort vegetation and sometimes with sparse plantations of black saxaul on loamy and skeleton-loamy grey-brown desert soil (Photo 79–81). The canopy cover is 10–30%. 24 plant and 1 moss species were recorded (Table 41), none of them are alien. Three species, *Acanthophyllum cyrtostegium, Ferula*

kyzylkumica and *Tulipa lehmanniana,* are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (photo 82–83); they occur sporadically within and between survey plots, solitary or in small groups.

Table 41. Check-list of plants recorded in survey plots D030–D035

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A-D	1	vegetation
Artemisia turanica	semishrub	20–25	O–D	+-1	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Atraphaxis spinosa	shrub	50-70	R	+-1	fruiting
Carex pachystylis	Perennial	12–15	O-A	+	flowering
Carex subphysodes	Perennial	10–12	O–A	+–1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Ceratocarpus arenarius	annual	15–20	O	+	Dried
Climacoptera sp.	annual	25–30	O	+	Dried
Convolvulus divaricatus	semishrub	25–30	R	+	flowering
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation, flowering
Gagea afghanica	Perennial	10–12	R	+	flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	10–15	R	+	Vegetation
Halimocnemis villosa	annual	10–12	R–O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	50–100	R	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Koelpinia linearis	annual	10–12	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–50	O–A	+–1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+-1	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R-O	+-1	vegetation
Tulipa lehmanniana	Perennial	10–20	R	+	Vegetation, flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 79. D032. Gently sloping foothills of Kuldzhuktau Mountains with ephemeroid-saltwort-sagebrush vegetation (April)

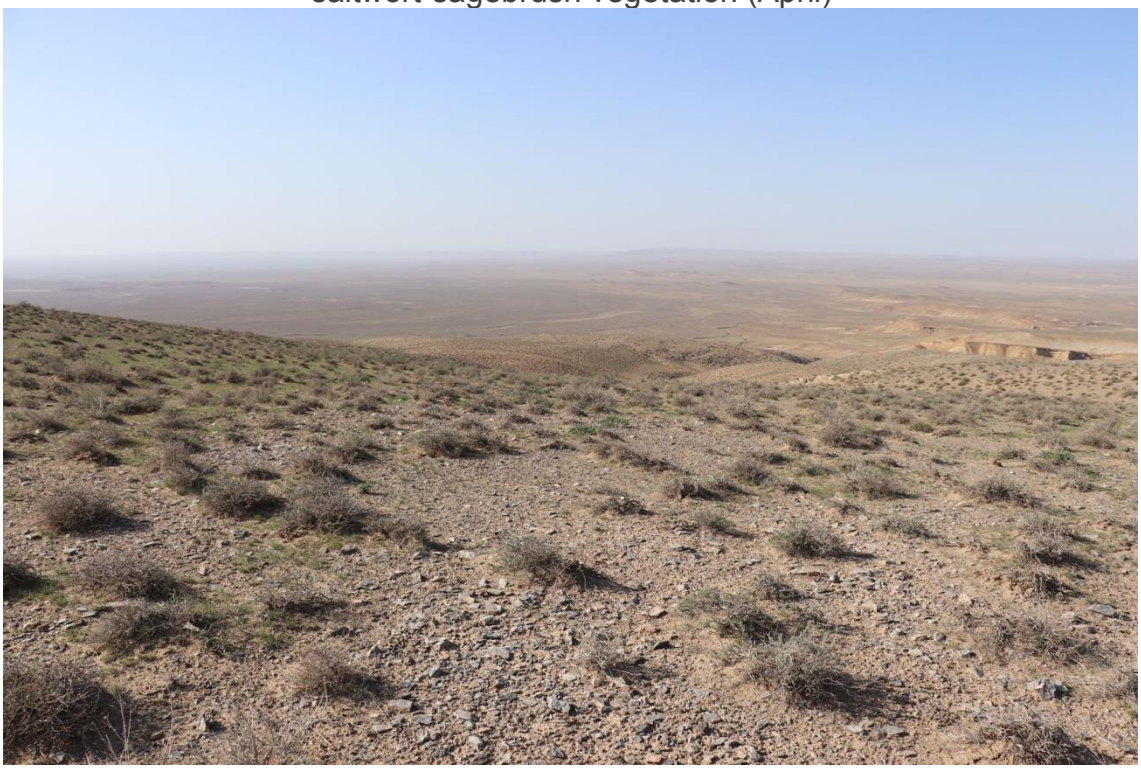

Photo 80. D035. Gently sloping foothills of Kuldzhuktau Mountains with ephemeroid-saltwort-sagebrush vegetation (April)

Photo 81. D034. Gently sloping foothills of Kuldzhuktau Mountains with sagebrush-salthwort vegetation (June)

Photo 82. D034. Dried generative specimen of nationally red-listed endemic *Ferula kyzylkumica* (June)

Photo 83. Plot D035. Flowering specimen of nationally red-listed *Tulipa lehmanniana*

D059–D072

Foothills with rather gentle hilly terrain, covered with native ephemeroid-saltwort-sagebrush vegetation and sparse plantations of black saxaul on sandy-loamy, loamy and skeleton-loamy grey-brown desert soil. The differences between these survey plots are negligible; landscapes and the vegetation cover are uniform (Photo 84–87). The canopy cover is 20–30%. 43 plant and 1 moss species were recorded (Table 42), none of them are alien, 3 species, *Acanthophyllum cyrtostegium, Calligonum zakirovii* and *Tulipa lehmanniana* are listed in the Red Data Book of Uzbekistan (2019). Solitary specimens and small groups of *Acanthophyllum cyrtostegium* and *Tulipa lehmanniana* occur sporadically within and between survey plots, the density of population is up to 40–50 individuals per 1 hectare. 23 individuals of *Calligonum zakirovii* (category 1 – endangered, disappearing species; national endemic, endemic to south-western Kyzylkum) were count on an area of 0.5 hectare between D066 and D067 (40.86532° N, 63.43467° E, 335 m.s.l.) (Photo 88).

Table 42. Check-list of plants recorded in survey plots D059–D072

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Allium griffithianum	Perennial	7–10	R	+	fruiting
Allium sabulosum	Perennial	15–20	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A–D	1	vegetation
Artemisia juncea	semishrub	30–35	O	+–1	vegetation
Artemisia scoparia	biennial	25–30	O	+	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation

Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Atraphaxis spinosa	shrub	50–70	R	+–1	fruiting
Calligonum leucocladum	shrub	50–70	R	+–1	fruiting
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Carex pachystylis	Perennial	7–10	O–A	+–1	flowering
Carex physodes	perennial	12–15	O	+	flowering
Carex subphysodes	Perennial	10–12	O–A	+–1	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O	+	vegetation
Ceratocarpus arenarius	annual	15–20	O	+	Dried
Climacoptera sp.	Annual	25–30	O	+	Dried
Convolvulus hamadae	semishrub	25–30	O–A	+–1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ephedra strobilacea	shrub	40–50	R	+	vegetation
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Gagea afghanica	Perennial	10–12	R	+	flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–O	1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Holosteum umbellatum	annual	6–8	R	+	fruiting
Hypecoum pendulum	annual	12–15	R	+	fruiting
Iris songarica	Perennial	20–25	R	+	vegetation
Koelpinia linearis	annual	10–12	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	O–A	+–1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Smirnowia turkestana	Perennial	30–35	R	+	vegetation
Stipa hohenackeriana	Perennial	25–30	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa lehmanniana	Perennial	10–20	R	+	Vegetation, flowering
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation
Ziziphora tenuior	annual	5–7	R	+	flowering

Photo 84. D061. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)

Photo 85. D066. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)

Photo 86. D067. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)

Photo 87. D071. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)

Photo 88. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum, between D066 and D067, 40.86532° N, 63.43467° E.

4.2.3. Outcrops of variegated beds

Variegated hills composed with outcrops of gypsaceous red, yellow or white clays, sandstones and limestones are very widely distributed in the southern and northern piedmonts of Kuldzhuktau Mountains.

VP2

40.796053–40.81528° N, 63.385813–64.34925 ° E, 200–230 m.s.l. Variegated southern foothills of Kuldzhuktau mountains within survey circle VP2 and between VP1 and VP2. Very sparse native community of saltworts and gypsophytes with *Artemisia turanica* (canopy cover is 1–10%) (photo 89–91); 22 plant species were recorded (Table 43); red-listed and alien plants are absent. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 43. Check-list of plants recorded for outcrops of variegated beds in survey plot VP2

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia turanica	semishrub	20–25	O–A	+–1	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35–40	O	+	vegetation
Ceratocarpus arenarius	annual	15–20	R	+	Dried
Climacoptera sp.	Annual	15–20	R	+	Dried

Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	30–60	R	+	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	40–70	R	1	vegetation
Iris longiscapa	Perennial	15–17	R	+	flowering
Lycium ruthenicum	shrub	40–50	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35–40	R–O	+–1	vegetation
Peganum garmala	Perennial	15–20	R–O	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–15	R	+	flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 89. VP2. Outcrops of variegated beds with very sparse community of saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.

Photo 90. VP2. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.

Photo 91. VP2. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.

VP3

40.82622° N, 63.4114° E, 269 m.s.l. Variegated southern foothills of Kuldzhuktau mountains in the southern part of ornithological survey circle VP3. Very sparse native community of saltworts and gypsophytes with *Artemisia turanica* (canopy cover is 1–5%) (photo 92–93); 28 plant species were recorded (Table 44), including one species red-listed at the national level. It is *Calligonum zakirovii* (category 1 – endangered,

disappearing species; national endemic, endemic to south-western Kyzylkum) (photo 94). 17 individuals were count per 1 hectare. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum. Alien plants are absent.

Table 44. Check-list of plants recorded on outcrops of variegated beds in survey circle VP3

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia turanica	semishrub	20–25	O	+	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	dried
Astragalus villosissimus	dwarf shrub	35-40	R	+	fruiting
Atraphaxis spinosa	shrub	20–25	R	+	fruiting
Bromus tectorum	annual	12–15	R	+	dried
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35–40	O	+	vegetation
Ceratocarpus arenarius	annual	10–15	R	+	fruiting
Climacoptera sp.	Annual	10–15	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	flowering
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R–O	+	dried
Ferula foetida	Perennial	30–60	R	+	dried
Halimocnemis gamocarpa	annual	12–15	R	+	Vegetation
Halimocnemis latifolia	annual	12–15	R	+	Vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	40–70	R	1	vegetation
Lycium ruthenicum	shrub	40–50	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35–40	R–O	+–1	vegetation
Peganum garmala	Perennial	15–20	R–O	+	fruiting
Poa bulbosa	Perennial	15–17	O	+	dried
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	dried
Zygophyllum macrophyllum	Perennial	10–15	R	+	dried

Photo 92. VP3. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains

Photo 93. VP3. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains

Photo 94. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species), 40.82622° N, 63.4114° E.

4.2.4. Stony slopes of relic low mountains

This habitat type is characterized by stongly rugged terrain, and the vegetation is represented with native sagebrush-saltwort and ephemeroid-saltwort-sagebrush vegetation on loamy and skeleton grey-brown desert soils with outcrops of bedrocks. The slopes are eroded and dissected with numerous dry riverbeds.

D001–D021, D036–D046

Stony and rocky slopes with rugged terrain, and wide watershed ridges with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on sandy-loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 95–99). The canopy cover is 5–30%. 43 plant and 1 moss species were recorded (Table 45), none of them are alien. Two species, *Ferula kyzylkumica* and *Tulipa lehmanniana* (photo 100), are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); both species occur sporadically, solitary or in groups, within and between survey plots. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots.

Table 45. Check-list of plants recorded in survey plots D001–D021 and D36–D046

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	R–O	+	fruiting
Alyssum linifolium (Meniocus linifolius)	annual	5–7	R–O	+	fruiting
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O–A	+–1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1–2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation

Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	10–12	O–A	+–1	Flowering, fruiting
Carex physodes	Perennial	12–15	O	+	fruiting
Carex subphysodes	Perennial	10–12	O–A	+–1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Climacoptera sp.	Annual	25–30	R–O	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	15–20	R–O	+	Vegetation
Fritillaria karelinii	Perennial	10–12	R	+	fruiting
Gagea afghanica	Perennial	10–12	R	+	flowering
Gagea bergii	Perennial	5–7	R	+	flowering
Halimocnemis villosa	annual	10–12	R–O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–180	R–O	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Koelpinia linearis	annual	10–12	R	+	fruiting
Lactuca orientalis	semishrub	35–40	R	+	vegetation
Leontice inserta	perennial	10–12	R	+	vegetation
Leptaleum filifolium	annual	4–5	R	+	fruiting
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	O–A	1–2	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–1	vegetation
Rheum turkestanicum	Perennial	20–40	R	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa lehmanniana	Perennial	10–20	R–O	+	Vegetation, fruiting
Tulipa sogdiana	Perennial	7–10	R	+	fruiting
Ziziphora tenuior	annual	7–10	R	+	flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering

Photo 95. D001. Watershed of Kuldzhuktau range with gentle terrain and sparse saltwort-sagebrush vegetation (April)

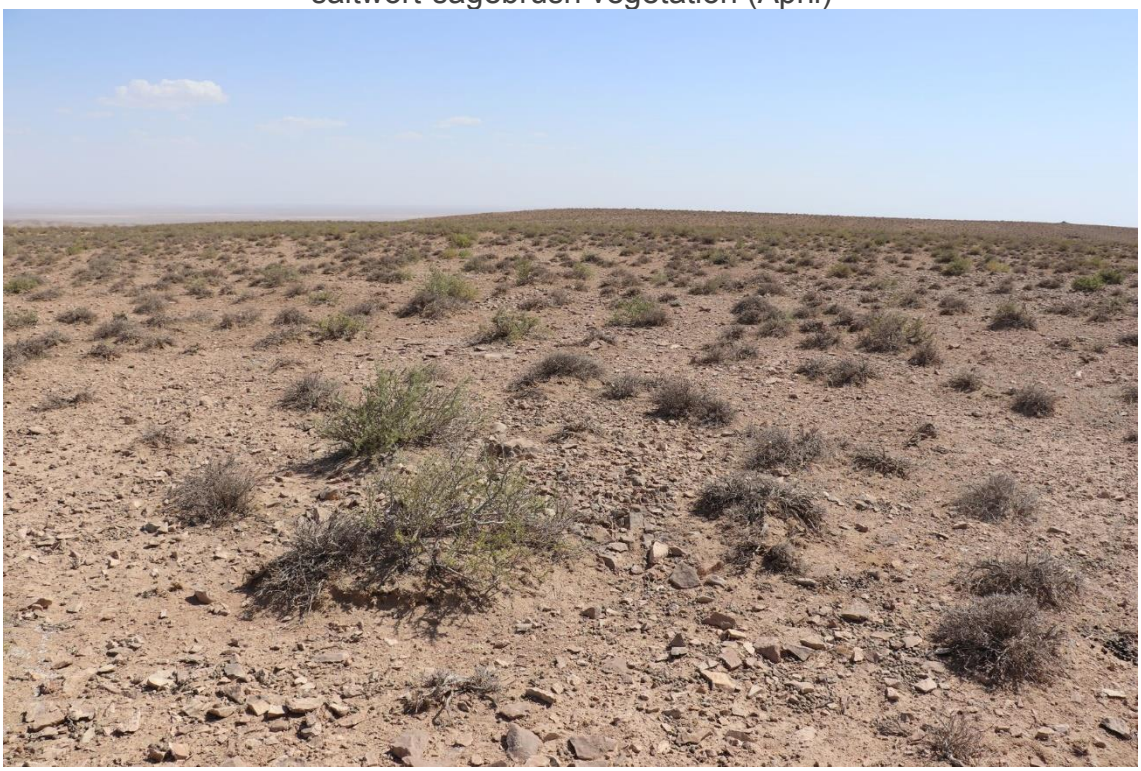

Photo 96. D001. Watershed of Kuldzhuktau range with gentle terrain and saltwort-sagebrush vegetation (June)

Photo 97. Surroundings of D001. Steep rocky northern slopes of Kuldzhuktau range with very sparse vegetation (April)

Photo 98. Surroundings of D001. Steep rocky northern slopes of Kuldzhuktau range with very sparse vegetation (June)

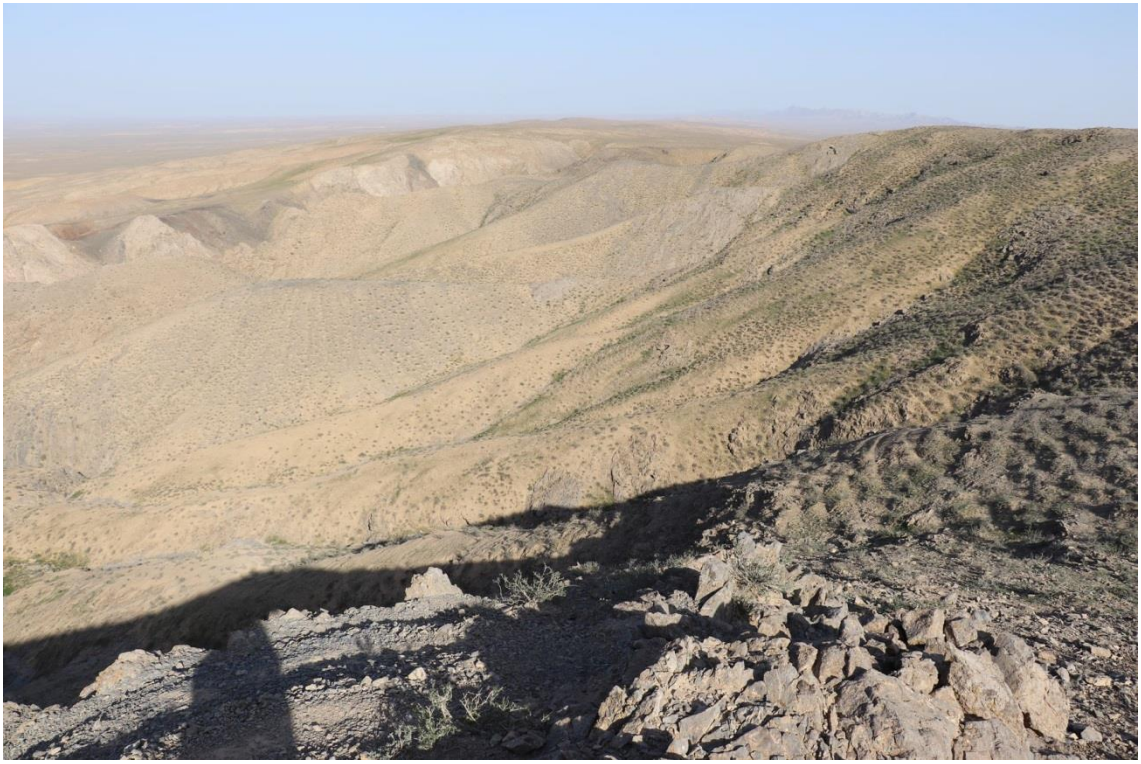

Photo 99. Surroundings of D003. Steep stony slopes of Kuldzhuktau range with sagebrush-saltwort vegetation, intensively grazed by livestock (April)

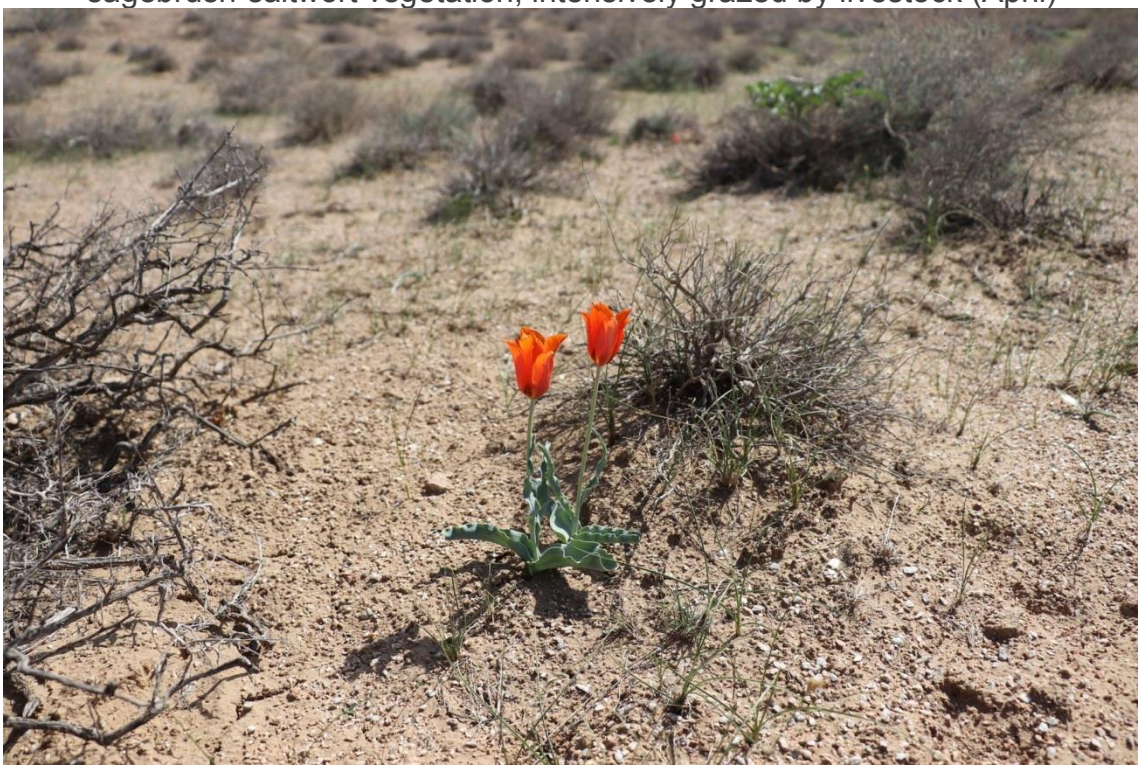

Photo 100. Plot D042. Flowering specimens of nationally red-listed *Tulipa lehmanniana*

D073–D091

Stony and rocky slopes with rugged terrain, and wide watersheds with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 101–105). The canopy cover is 5–30%. 56 plant and 1 moss species were recorded (Table 46), none of them are alien. Two species, *Ferula kyzylkumica* and *Tulipa lehmanniana,* are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (Photo 106–107). Solitary

specimens and populations of 50–100 individuals occur sporadically within and between survey plots. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots D073–D091.

Table 46. Check-list of plants recorded in survey plots D073–D091

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Allium griffithianum	Perennial	7–10	R	+	fruiting
Allium karakense	Perennial	15–17	R	+	vegetation
Allium sabulosum	Perennial	15–20	R	+	vegetation
Alyssum desertorum	annual	5–6	R–O	+	fruiting
Alyssum linifolium (Meniocus linifolius)	annual	5–7	R–O	+	fruiting
Ammodendron conollyi	Small tree	100–150	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Anabasis turkestanica	semishrub	20–25	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O	+–1	vegetation
Artemisia juncea	semishrub	30–35	O	+–1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1–2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–A	+–1	vegetation
Atraphaxis spinosa	shrub	50–70	O	1	fruiting
Bassia prostrata (*Kochia prostrata)*	semishrub	20–25	R	+	vegetation
Bromus tectorum	annual	12–15	O	+	fruiting
Carex pachystylis	Perennial	10–12	O–A	+	flowering
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Convolvulus hamadae	semishrub	25–30	O–A	+–1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Eminium lehmannii	Perennial	15–20	R	+	fruiting
Ephedra intermedia	shrub	15–30	R	+	vegetation
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	15–20	R–O	+	Vegetation
Ferula varia	Perennial	25–30	R	+	Vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	fruiting
Hypecoum pendulum	annual	12–15	R	+	Flowering, fruiting
Isatis minima	annual	15–17	R	+	fruiting

Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Krascheninnikovia ceratoides	semishrub	40–50	R	+	vegetation
Lactuca orientalis	semishrub	35–40	R–O	+–1	vegetation
Lallemantia royleana	annual	7–8	R	+	flowering
Leptaleum filifolium	annual	4–5	R	+	fruiting
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	A–D	1–2	vegetation
Peganum garmala	Perennial	20–25	R–O	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–+1	vegetation
Rheum turkestanicum	Perennial	20–40	R	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R–O	+	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Stipa hohenackeriana	Perennial	25–30	R–O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	Vegetation, fruiting
Tulipa lehmanniana	Perennial	10–20	R	+	Vegetation, flowering
Ziziphora tenuior	annual	7–8	R	+	flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 101. D076. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (June)

Photo 102. D077. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)

Photo 103. D079. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)

Photo 104. Between D081 and D082. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)

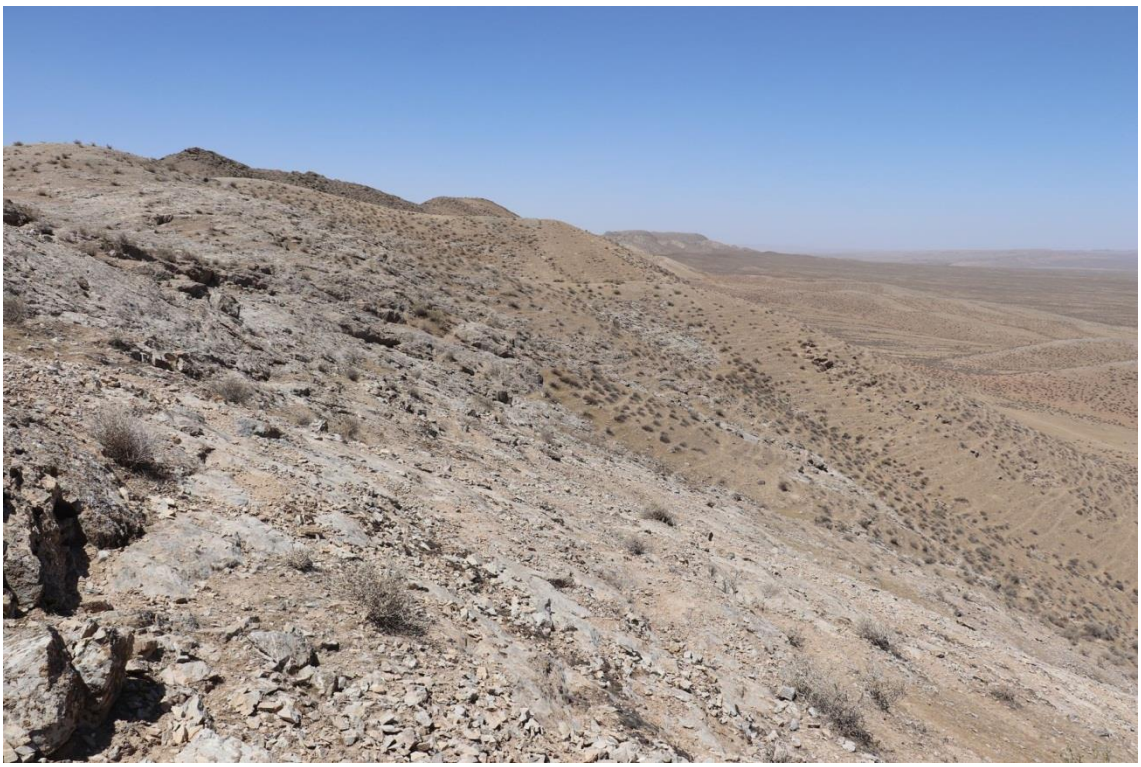

Photo 105. D087. Stony northern slopes of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation (June)

Photo 106. D078. On the foreground – Korolkow's desert-candle (*Eremurus korolkowii*), national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum, and on the background – black saltwort (*Oreosalsola arbusculiformis*), main dominant of sagebrush-saltwort communities of vegetation of relic mountains

Photo 107. D087. Dried generative specimen of nationally red-listed endemic *Ferula kyzylkumica* (June)

D092–D113 and D119–D124

Stony and rocky slopes with rugged terrain, and wide watershed ridges with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 108–115). The canopy cover is 5–30%. 44 plant and 1 moss species were recorded (Table 47), none of them are alien. One species, *Ferula kyzylkumica,* is listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); it is endemic to the relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains, and national endemic. Solitary specimens and populations of 50–100 individuals occur sporadically within and between survey plots D092–D113 and D119–D124. For example, 94 specimens *Ferula kyzylkumica* were count on a plot 50x10 m of near the D102 (40.9178° N, 63.2387° E, 259 m.s.l.) (photo 116). One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots D092–D113 and D119–D124.

Table 47. Check-list of plants recorded in survey plots D092–D113 and D119–D124

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	R–O	+	fruiting
Alyssum linifolium (Meniocus linifolius)	annual	5–7	R–O	+	fruiting
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Anabasis turkestanica	semishrub	20–25	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O–A	+–1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1–2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation

Atraphaxis spinosa	shrub	50-70	R	+-1	fruiting
Carex pachystylis	Perennial	10–12	O–A	+	flowering
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Ephedra intermedia	shrub	15–30	R	+	vegetation
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	15–20	R–O	+	Vegetation
Halimocnemis latifolia	annual	12–15	R	+	Vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–180	R–O	+–1	vegetation
Hypecoum pendulum	annual	12–15	R	+	Flowering, fruiting
Isatis minima	annual	15–17	R	+	fruiting
Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Krascheninnikovia ceratoides	semishrub	40–50	R–O	+	vegetation
Lactuca orientalis	semishrub	35–40	R–O	+–1	vegetation
Lallemantia royleana	annual	7–8	R	+	flowering
Leptaleum filifolium	annual	4–5	R	+	fruiting
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Lycium ruthenicum	shrub	40–50	R–O	+–1	vegetation
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	O–A	1–2	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–+1	vegetation
Rheum turkestanicum	Perennial	20–40	R–O	+–1	vegetation
Scrophularia leucoclada	semishrub	40–50	R–O	+	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	Vegetation, fruiting
Ziziphora tenuior	annual	7–8	R	+	flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering

Photo 108. D106. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)

Photo 109. D100. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)

Photo 110. D099. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)

Photo 111. D099. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)

Photo 112. D098. Stony slopes of Kuldzhuktau mountains with very sparse vegetation (April)

Photo 113. D092. Stony slopes of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation (June)

Photo 114. D123. Slopes of western part of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)

Photo 115. D121. Southern slopes of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation (June)

Photo 116. *Ferula kyzylkumica*, nationally red-listed endemic species, surroundings of D102, 40.9178° N, 63.2387° E

4.2.5. Anthropogenic habitats

Several small villages (the largest are Dzhankeldy and Kalata) and farmsteads are situated within the project site, on the piedmont plain and foothills of the relic ridge Kuldzhuktau (Photo 117–118). In addition, the impact of mining operations is more expressed in “Dzhankeldy” site than in “Bash”; there are numerous active and abandoned mines and quarries, geological exploration is underway at the present (Photo 119). Dense thickets of *Peganum garmala* typical for degraded rangelands of arid zone of Uzbekistan occur around settlements, farmsteads and wells. Halophytic shrubs (*Lycium ruthenicum, Halimodendron halodendron, Tamarix hispida* and *Tamarix laxa*) grows near the springs and wells. In surroundings of quarries and mines, the canopy cover is extremely sparse, or the vegetation is almost completely exterminated. Alien or red-listed plants were not found.

Photo 117. Surroundings of the village Kalata (April)

Photo 118. *Peganum harmala* in surroundings of the village Dzhankeldy (June)

Photo 119. Ruins of an abandoned mining village

4.3. "Bash-Dzhankeldy" power line

Following types of habitats (mapping units) were identified along the "Bash-Dzhankeldy" line:

4.3.1. Sandy and sandy-loamy desert plain

This habitat type occupies the southernmost part of planned power line, at the northern edge of the "Bash" project site, as well as along the railway, between the "Bash" project site and the rail crossing.

Sandy and sandy-loamy desert plain with flat or flat-wavy terrain is covered with native ephemeroid-sagebrush (*Artemisia diffusa, Poa bulbosa, Carex physodes, Carex subphysodes*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes, Carex subphysodes, Caroxylon orientale (Salsola orientalis), Xylosalsola arbuscula, (Salsola arbuscula*), sometimes with small plots of fixed sands with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*), or with saxaul plantations (*Haloxylon ammodendron*) or solitary saxaul trees on sabulous grey-brown desert soil and sandy desert soil (photo 120–121). The elevation is 263–180 m a.s.l. The canopy cover is 20 to 40%, and the density saxaul stands is up to 0.1–0.2. Plant communities are characterized with low species diversity and low to medium level of anthropogenic disturbance. A check-list of 16 plant species and 1 moss recorded for this habitat is presented below (table 48).

Table 48. Check-list of plants recorded for sandy and sandy-loamy desert plain with ephemeroid-sagebrush and saltwort-ephemeroid-sagebrush vegetation, and with saxaul plantations

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	flowering

Alyssum desertorum	annual	5–6	R–O	+	dried
Artemisia diffusa	semishrub	25–35	A–D	1–2	vegetation
Astragalus villosissimus	dwarf shrub	30–35	O	+	vegetation
Bromus tectorum	annual	12–15	R–O	+	fruiting
Calligonum leucocladum	shrub	50–100	R–O	+	fruiting
Calligonum microcarpum	shrub	50–70	R–O	+	fruiting
Carex physodes	Perennial	12–15	O–A	+–1	dried
Carex subphysodes	Perennial	10–12	A–D	1	dried
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	R–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Convolvulus hamadae	semishrub	25–30	R–O	+	flowering
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R–A	+	Fruiting, dried
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–170	R–A	1–2	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Iris songarica	Perennial	30–35	R–O	+	vegetation
Peganum garmala	Perennial	30–35	R	+	flowering
Poa bulbosa	Perennial	15–17	O–A	+–1	dried
Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R–A	+–1	vegetation

Photo 121. Sandy-loamy desert plain with native ephemeroid-sagebrush plant community and sparse black saxaul (remains of plantations), 40.708281° N, 64.573836° E

Photo 122. Sandy plain with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul, 40.76059° N, 64.52554° E

4.3.2. Fixed and semi-fixed sands

Fixed and semi-fixed sands with hilly, ridge-hilly, ridge and wavy terrain are covered with psammophilous shrublands (photo 123). Dominants and subdominants are *Calligonum leucocladum, Calligonum microcarpum, Haloxylon persicum, H. ammodendron,*

Astragalus villosissimus, Artemisia diffusa, Carex physodes, and on local plots – sand acacia (*Ammodendron conollyi)*. The grass cover of the sandy desert is formed by desert sedge (*Carex physodes*) which plays a key role in sands fixation through its densely branched root system. The giant Umbelliferae *Ferula foetida* often is a subdominant. 36 plant species and one moss were recorded for this habitat type (table 49), including one nationally red-listed species, *Tulipa lehmanniana* (solitary fruiting and dried specimens were found on the route between 40.80932° N, 64.48027° E and 40.85202° N, 64.4183° E). This habitat is located in the southern part of the previous variant of the power line (red line), and also along the railway, between the rail crossing and village Chengeldy.

Table 49. Check-list of plants recorded for fixed and semi-fixed sands with psammophilous shrubs and ephemeroid-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R–O	+	flowering
Alhagi pseudalhagi	Perennial	30–35	R–O	+	vegetation
Alyssum desertorum	annual	5–6	R	+	dried
Ammodendron conollyi	Small tree	100–150	R–A	+–1	fruiting
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	35–40	A–D	1–2	vegetation
Astragalus flexus	perennial	15-17	R	+	dried
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O–A	+	dried
Calligonum leucocladum	shrub	50–100	D–O	1–2	fruiting
Calligonum microcarpum	shrub	50–100	A–O	1	fruiting
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–O	+	vegetation
Ceratocarpus arenarius	annual	15-20	O	+	vegetation
Convolvulus divaricatus	semishrub	30–45	O	+	flowering
Convolvulus hamadae	semishrub	30–40	O	+	flowering
Cousinia hamadae	Perennial	30–35	R–O	+	vegetation
Eremopyrum bonaepartis	annual	10–12	O	+	fruiting
Eremopyrum distans	annual	10–12	O	+	fruiting

Euphorbia turczaninowii	annual	10–12	R	+	Flowering, fruiting
Ferula foetida	Perennial	50–60	O–A	1	Fruiting, dried
Haplophyllum ramosissimum	Perennial	25–30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–170	R–O	+–1	vegetation
Haloxylon persicum	Small tree	150–170	O–A	1	vegetation
Heliotropium arguzioides	Perennial	25–30	R–O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O–A	1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O	+–1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Poa bulbosa	Perennial	15–17	O	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Sophora pachycarpa	Perennial	20–25	R	+	flowering
Smirnowia turkestana	Perennial	30–35	R–O	+	flowering
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	fruiting
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R–O	+	vegetation

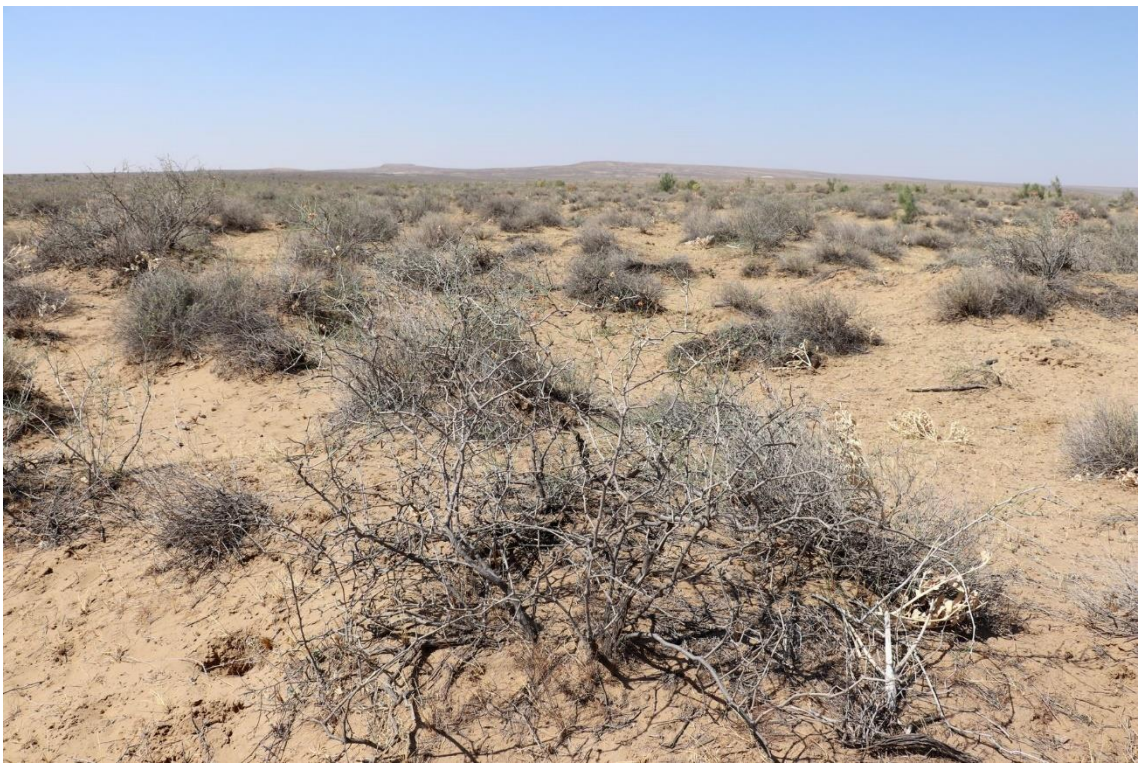

Photo 123. Fixed hilly sands with Calligonum-sagebrush vegetation with participation of black saxaul, 40.81108° N, 64.47365° E

4.3.3. Complex of fixed and semi-fixed sands, saline depressions and takyrs

This habitat is located in surroundings of the village Shengeldy (2–6 km to the south), on the edge of the saline depression Karakata. Sandy areas are covered with psammophytic shrubs and ephemeroid-sagebrush vegetation (photo 124). Dominants are sand acacia (*Ammodendron conollyi), Calligonum leucocladum, Artemisia diffusa, Carex physodes,* subdominants – *Haloxylon ammodendron, Calligonum microcarpum, Astragalus villosissimus, Oreosalsola arbusculiformis (Salsola arbusculiformis), Ferula foetida*. Small saline depressions and takyrs have very sparse vegetation (canopy cover less than 10%) represented with the same species that on the sands, with participation of *Tamarix sp.* and *Lycium ruthenicum.* 35 plant species and one moss were recorded for this habitat type in total (table 50).

Table 50. Check-list of plants recorded for complex of fixed and semi-fixed hilly and wavy sands, small saline depressions and takyrs

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	flowering
Alhagi pseudalhagi	Perennial	30–35	R–O	+	vegetation
Alyssum desertorum	annual	5–6	R	+	dried
Ammodendron conollyi	Small tree	100–150	O–D	+–12	fruiting
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	35–40	O–A	+–1	vegetation

Astragalus villosissimus	dwarf shrub	35-40	O–A	+–1	vegetation
Bassia eriophora	annual	12–15	O	+	fruiting
Bromus tectorum	annual	12–15	O–A	+	dried
Calligonum leucocladum	shrub	50–100	A–O	1	fruiting
Calligonum microcarpum	shrub	50–100	A–O	1	fruiting
Carex physodes	Perennial	12–15	O–A	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–O	+	vegetation
Ceratocarpus arenarius	annual	15-20	O–A	+	vegetation
Convolvulus divaricatus	semishrub	30–45	O–R	+	flowering
Convolvulus hamadae	semishrub	30–40	O–R	+	flowering
Cousinia hamadae	Perennial	30–35	R	+	vegetation
Eremopyrum bonaepartis	annual	10–12	O–R	+	fruiting
Eremopyrum distans	annual	10–12	O–R	+	fruiting
Euphorbia turczaninowii	annual	10–12	R	+	Flowering, fruiting
Ferula foetida	Perennial	50–60	O–R	+–1	Fruiting, dried
Haplophyllum ramosissimum	Perennial	25–30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–170	R–O	+–1	vegetation
Heliotropium arguzioides	Perennial	25–30	R–O	+	flowering
Lycium ruthenicum	Shrub	50–70	R–O	+–1	flowering
Mausolea eriocarpa	semishrub	45–50	R–O	+–1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O–A	+–1	vegetation
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Poa bulbosa	Perennial	15–17	R–O	+	dried
Salsola paulsenii	annual	30–35	R–O	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–O	+	flowering
Smirnowia turkestana	Perennial	30–35	R–O	+	flowering

Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tamarix sp.	Shrub	100–150	R	+–1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation

Photo 124. Fixed sands with native psammophilous vegetation with domination of sand acacia, 40.94366° N, 64.35031° E

4.3.4. Weakly inclined piedmont plain of relic low mountains

Weakly inclined piedmonts of relic low mountains Kuldzhuktau with flat, wavy or gently sloping terrain are covered with native ephemeroid-sagebrush and saltwort-sagebrush vegetation, sometimes with *Calligonum* and plantations of black saxaul on sabulous grey-brown desert soil (photos 125–127). This habitat type is located along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site. Canopy cover is 20–40%. 31 plant species and one moss were recorded for this habitat type (table 51), including 3 species listed in the Red Data Book of Uzbekistan (2019). They are *Acanthophyllum cyrtostegium* (category 3 – reducing; national endemic) (photo 128), *Calligonum zakirovii* (category 1 – endangered, disappearing species; national endemic) (photo 129), and *Tulipa lehmanniana* (category 3 – reducing). A small population of *Acanthophyllum cyrtostegium* (8 plants) was found near the route P-61 (40.95635° N, 64.3285° E); 11 plants were found near the village Shengeldy (40.9735° N, 64.3617° E). Solitary individuals of *Calligonum zakirovii* (30–40 per 1 hectare) were recorded among *Calligonum leucocladum* and *C. microcarpum* along the route P-61, on the border of saline depression (40.9846° N, 63.9094° E). During the April expedition, it has been noted that *Tulipa lehmanniana* (several dozens of individuals in each population, mostly pre-generative) occur sporadically along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site (photo 130).

Table 51. Check-list of plants recorded for piedmont plains with ephemeroid-sagebrush and saltwort-sagebrush vegetation, with plantations of black saxaul

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	25–30	R	+	flowering
Acanthophyllum elatius	Perennial	40–45	R	+	flowering
Alyssum desertorum	annual	5–6	R	+	dried
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	30–35	A–D	1–2	vegetation
Artemisia turanica	semishrub	30–35	O–A	+–1	vegetation
Astragalus villosissimus	dwarf shrub	40–60	O–A	+–1	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Bromus tectorum	annual	12–15	R–O	+	fruiting
Calligonum leucocladum	shrub	50–100	R–O	+	fruiting
Calligonum microcarpum	shrub	50–70	R–O	+	fruiting
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Carex physodes	Perennial	12–15	O–A	+	dried
Carex subphysodes	Perennial	10–12	O–A	+	dried
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O–A	+–1	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	15–20	R	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O–A	+–1	flowering
Cousinia hamadae	Perennial	25–30	R	+	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Ferula foetida	Perennial	100–150	O–A	+–1	Fruiting, dried

Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–O	+–1	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O	+–1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Poa bulbosa	Perennial	15–17	O–A	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Smirnowia turkestana	Perennial	30–35	R	+	flowering
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–20	R–O	+	Vegetation, flowering
Ziziphora tenuior	annual	6–7	R–O	+	dried

Photo 125. Weakly inclined piedmont plain of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation, 40.9156° N, 63.51822° E

Photo 126. Piedmont plain of the relic ridge Kuldzhuktau with ephemeroid-sagebrush vegetation and sparse black saxaul (remains of plantation), 40.94507° N, 64.28577° E

Photo 127. Piedmont plain of the relic ridge Kuldzhuktau with ephemeroid-sagebrush vegetation and plantation of black saxaul, surroundings of the village Chontabay, 40.99858° N, 63.68805° E

Photo 128. *Acanthophyllum cyrtostegium,* nationally red-listed endemic species (category 3 – reducing species).

Photo 129. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species).

Photo 130. *Tulipa lehmanniana,* nationally red-listed species. Roadside of the road P-61, between the villages Shengeldy and Chontabay, April 2021

4.3.5. Foothills of relic low mountains

This habitat type is found on some plots along the previous variant of the power line (red line) running across the foothills of the relic ridge Kuldzhuktau. The terrain is more or less rugged, and the vegetation is represented with native saltwort-sagebrush communities on gypsiferous grey-brown desert soil and outcrops of variegated beds (photo 131), sometimes with tamarisk along dry riverbeds. Canopy cover is 10–30%. 27 plant species and one moss were recorded for this habitat type (table 52).

Table 52. Check-list of plants recorded for eroded foothills with outcrops of variegated beds and saltwort-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Anabasis turkestanica	semishrub	15–20	R	+	vegetation
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	30–35	A	1–2	vegetation
Artemisia turanica	semishrub	30–35	O–A	+–1	vegetation
Astragalus villosissimus	dwarf shrub	40–60	O	+	vegetation
Bassia prostrata (Kochia prostrata)	semishrub	15–20	R	+	vegetation
Bromus tectorum	annual	12–15	R	+	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation

Caroxylon scleranthum (Salsola sclerantha)	annual	15–20	R–O	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–O	+	vegetation
Climacoptera sp.	annual	10–15	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O–A	+–1	flowering
Cousinia hamadae	Perennial	25–30	R–O	+	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Ferula foetida	Perennial	100–120	R	+	Fruiting, dried
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+	vegetation
Haplophyllum bungei	perennial	20–25	R	+	flowering
Haplophyllum robustum	perennial	25–30	R	+	flowering
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O–A	+–1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Poa bulbosa	Perennial	15–17	O	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Tamarix sp.	shrub	100–120	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Ziziphora tenuior	annual	6–7	R	+	dried

Photo 131. Eroded foothills of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation, 40.87604° N, 64.25413° E

4.3.6. Outcrops of variegated beds

This habitat type is found on rather small plots along the previous variant of the power line (red line) running across the northern foothills of the relic ridge Kuldzhuktau. The terrain is more or less rugged; the vegetation is very sparse (canopy cover is 1–10%) and composed by saltworts and gypsophytes. The species composition is the same that is described in 4.2.3.

4.3.7. Saline lands

Several rather small saline depressions with very sparse saltworts or with takyrs and without any vegetation are situated along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site, among the weakly inclined northern piedmonts of the relic mountains Kuldzhuktau (photos 132–133). Canopy cover is 0–5%. 22 plant species were recorded for this habitat type (table 53), including one red-listed species, *Tulipa lehmanniana* (4 dried pre-generative specimens, 40.46116° N, 64.21558° E).

Note: “takyr” is a peculiar type of landscape occurring in the deserts of Central Asia, which is formed on periodically inundated depressions with loamy soil, forming a cracked crust at the dry season.

Table 53. Check-list of plants recorded for saline depressions and takyrs

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alhagi pseudalhagi	Perennial	30–35	R–O	+	vegetation
Anabasis turkestanica	semishrub	15–20	R	+	vegetation
Artemisia turanica	semishrub	30–35	R–O	+	vegetation

Bassia eriophora	annual	12–15	O	+	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	15–20	R–O	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–O	+	vegetation
Climacoptera sp.	annual	10–15	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	R–O	+	flowering
Cousinia hamadae	Perennial	25–30	R–O	+	vegetation
Eremopyrum bonaepartis	annual	10–12	R	+	fruiting
Eremopyrum distans	annual	10–12	R	+	fruiting
Ferula foetida	Perennial	70–100	R	+	Fruiting, dried
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Halimodendron halodendron	Shrub	50–70	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+	vegetation
Lycium ruthenicum	Shrub	50–70	R–O	+–1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	R–O	+1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Tamarix sp.	shrub	100–120	R	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	dried
Ziziphora tenuior	annual	6–7	R	+	dried

Photo 132. Saline depression with sparse saltworts, 40.96116° N, 64.21218° E.

Photo 133. Depression with takyr, vegetation is absent, 40.96262° N, 64.08994° E

It has been found that the vegetation along the planned power line “Bash-Dzhankeldy” is represented with native plant communities typical for South-western Kyzylkum, somewhere with saxaul plantations created in the past to prevent erosion of soils. The vegetation of studied area is characterized with sparse canopy cover, low species diversity and low to medium level of anthropogenic disturbance. At the present, the human impact is connected mainly with use of rangelands and a network of ground roads, as well as with littering by household waste near farms and villages and along roads.

A total check-list of vascular plants recorded along the planned power line "Bash-Dzhankeldy" during the field survey in May includes 52 species (Appendix 1); 3 species are nationally red-listed. *Calligonum zakirovii,* an endemic to south-western Kyzylkum and national endemic, is included in the Red Data Book of Uzbekistan (2019) with the status 1 (endangered, disappearing species). *Acanthophyllum cyrtostegium* and *Tulipa lehmanniana* are included in the Red Data Book of Uzbekistan (2019) with the status 3 (reducing).

4.4. "Bash-Karakul" power line

Following types of habitats (mapping units) were identified along the "Bash-Karakul" line:

4.4.1. Sandy and sandy-loamy desert plain

Sandy and sandy-loamy desert plain with flat, flat-wavy or wavy terrain is covered with native ephemeroid-sagebrush (*Artemisia diffusa, Poa bulbosa, Carex physodes, Carex subphysodes*) and ephemeroid-saltwort-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes, Caroxylon orientale (Salsola orientalis), Xylosalsola arbuscula, (Salsola arbuscula*)), sometimes with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*) and with saxaul plantations (*Haloxylon ammodendron*) on sandy desert soil (photo 134–135). On some areas, subdominants are *Alhagi pseudalhagi, Ferula foetida* and *Iris songarica* (photo 136–137). Local thickets of *Peganum garmala* have been found on overgrazed areas around farms and wells (photo 138). The elevation is 265–223 m a.s.l. The canopy cover is 10 to 40%, and the density of saxaul stands is up to 10–20%. A check-list of 29 plant species and 1 moss recorded for this habitat is presented below (table 54). This habitat is situated in the northern part of the power line, between the "Bash" project site and the discharge channel Agytma.

Table 54. Check-list of plants recorded for sandy desert plain with ephemeroid-sagebrush ephemeroid-saltwort-sagebrush vegetation, with psammophilous shrubs and saxaul plantations

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	flowering
Alhagi pseudalhagi	Perennial	30–35	R–A	+–1	vegetation
Alyssum desertorum	annual	5–6	R	+	dried
Artemisia diffusa	semishrub	20–35	A–D	1–2	vegetation
Astragalus villosissimus	dwarf shrub	35-45	O–A	+	vegetation
Bromus tectorum	annual	12–15	R–O	+	fruiting
Calligonum leucocladum	shrub	50–100	R–O	+	fruiting
Calligonum microcarpum	shrub	50–70	R–O	+	fruiting
Carex physodes	Perennial	12–15	A–D	1	dried
Carex subphysodes	Perennial	10–12	O–D	1	dried
Calligonum leucocladum	shrub	50–100	R–O	+–1	fruiting
Calligonum microcarpum	shrub	50–100	R–O	+–1	fruiting

Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–A	+–1	vegetation
Ceratocarpus arenarius	annual	10-12	R–A	+–1	vegetation
Convolvulus divaricatus	semishrub	25–35	R–O	+	flowering
Convolvulus hamadae	semishrub	25–30	R–A	+–1	flowering
Cousinia hamadae	Perennial	25–30	R–O	+	vegetation
Ferula foetida	Perennial	50–80	R–A	+–1	Fruiting, dried
Halothamnus subaphyllus	semishrub	50–60	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–A	+–2	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Iris songarica	Perennial	30–35	R–A	+–1	vegetation
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Poa bulbosa	Perennial	15–17	A	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–O	+	flowering
Smirnowia turkestana	Perennial	30–35	R	+	flowering
Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O–A	+–1	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O–A	+–1	vegetation

Photo 134. Sandy plain with native ephemeroid-sagebrush vegetation and remains of plantations of black saxaul, 40.538601° N, 64.69604° E

Photo 135. Sandy plain with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul, 40.42977° N, 64.57947° E

Photo 136. Sandy plain with native ephemeroid-sagebrush vegetation, with abundance of *Ferula foetida* and *Iris songarica*, 40.42856° N, 64.555° E

Photo 137. Wavy sandy plain with native ephemeroid-sagebrush vegetation, with abundance of *Ferula foetida*, 40.46222° N, 64.58032° E

Photo 138. Overgrazed rangelands with abundance of *Peganum garmala* on sandy plain near the sheep farm, 40.48734° N, 64.64465° E

4.4.2. Fixed and semi-fixed sands

Fixed and semi-fixed sands with hilly, ridge-hilly, ridge and wavy terrain are covered with native stands of saxaul, communities of psammophytic shrubs, dwarf shrubs, ephemers and ephemeroids (photo 139–141), and with plots of saxaul plantations. This habitat prevails in the central and southern part of the power line, between the discharge channel Agytma and Karakul. Dominants and subdominants are *Haloxylon persicum, H. ammodendron, Ammodendron conollyi,* species of *Calligonum* and *Xylosalsola, Artemisia diffusa, Astragalus villosissimus, Carex physodes, Ferula foetida, Convolvulus divaricatus*. The density of saxaul stands is up to 0.3–0.4. Local plots of unfixed moving sands and communities of pastoral weeds *Peganum garmala* and *Sophora pachycarpa* have been found on overgrazed and other disturbed areas around farms and wells, and along roads (photo 142). 48 plant species and one moss were recorded for this habitat type (table 55), including one nationally red-listed species, *Calligonum zakirovii* (fruiting specimens were found near the southern edge of saline wetland situated along the discharge channel Agytma, 40.80932° N, 64.48027° E) (photo 143).

Table 55. Check-list of plants recorded for fixed and semi-fixed sands with psammophytic shrubs and ephemeroid-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R–O	+	flowering
Agriophyllum lateriflorum	annual	20–30	R–O	+	vegetation
Alhagi pseudalhagi	Perennial	30–40	R–A	+–1	vegetation

Alyssum desertorum	annual	5–6	R	+	dried
Ammodendron conollyi	Small tree	100–150	R–A	+–1	fruiting
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	35–40	O–D	+–2	vegetation
Astragalus unifoliolatus	dwarf shrub	35-40	R–O	+	fruiting
Astragalus villosissimus	dwarf shrub	35-40	O–A	+–1	fruiting
Atriplex dimorphostegia	annual	10–15	R	+	fruiting
Bassia eriophora	annual	10–15	R	+	fruiting
Bromus tectorum	annual	12–15	O–A	+	dried
Calligonum caput-medusae	shrub	100–150	R–O	+–1	fruiting
Calligonum eriopodum	shrub	150–170	R–O	+	fruiting
Calligonum leucocladum	shrub	100–150	O–D	1–2	fruiting
Calligonum microcarpum	shrub	50–100	O–A	1	fruiting
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Carex physodes	Perennial	12–15	A–D	+–1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35–40	R–O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	20–25	R–O	+	vegetation
Ceratocarpus arenarius	annual	15–20	O–A	+	vegetation
Climacoptera sp.	annual	15–20	R–O	+	vegetation
Convolvulus divaricatus	semishrub	30–45	R–A	+–1	flowering
Convolvulus hamadae	semishrub	30–40	R–A	+–1	flowering
Cousinia hamadae	Perennial	30–35	R–O	+	vegetation
Ephedra strobilacea	shrub	50–150	R–O	+	fruiting
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Euphorbia cheirolepis	annual	25–30	R	+	Flowering, fruiting

Euphorbia turczaninowii	annual	10–12	R	+	Flowering, fruiting
Ferula foetida	Perennial	50–60	R–A	+–1	Fruiting, dried
Haplophyllum ramosissimum	Perennial	25–30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–200	R–A	+–1	vegetation
Haloxylon persicum	Small tree	150–200	O–D	1–3	vegetation
Heliotropium arguzioides	Perennial	25–30	R–O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O–A	1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O	+–1	vegetation
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Poa bulbosa	Perennial	15–17	O	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–A	+–1	flowering
Smirnowia turkestana	Perennial	30–35	R–O	+	flowering
Stipagrostis karelinii	Perennial	35–45	O	+	vegetation
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R–O	+–1	vegetation
Xylosalsola richteri (Salsola richteri)	shrub	100–150	R–O	+–1	vegetation

Photo 139. Semi-fixed hilly sands with native stands of saxaul and psammophytic shrubs, 40.31608° N, 64.3448° E

Photo 140. Fixed hilly sands with native stands of saxaul, 40.01175° N, 64.01932° E

Photo 141. Fixed sands with native community of *Calligonum* in surroundings of Karakul, 39.5784° N, 63.87543° E

Photo 142. An overgrazed area with unfixed sands and community of pastoral weeds *Peganum garmala* and *Sophora pachycarpa,* 40.24304° N, 64.28011° E

Photo 143. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species), 40.48764° N, 64.60557° E.

4.4.3. Saline lands and wetlands

Saline lands and wetlands are situated in the ancient delta of the Zeravshan River, in depressions and along several irrigation and discharge channels and collectors of the irrigation system of Bukhara oasis (Agytma and Echkiliksay discharge channels, Northern and Central Bukhara collectors, Gazli channel, Karakuldarya, etc.). The vegetation is represented by tugay and salt marsh communities with halophilic shrubs (*Tamarix sp., Halimodendron halodendron, Halostachys belangeriana, Lycium ruthenicum*), reeds (*Phragmites australis, Typha latifolia, T. minima*), camel thorn (*Alhagi pseudalhagi*), saltworts (*Halocnemum strobilaceum*, *Ceratocarpus arenarius, Climacoptera sp., Salicornia europaea, Salsola paulsenii, Suaeda sp.*), other halophytes, halomesophytes and halohydrophytes, as *Limonium otolepis, Karelinia caspia*, and pastoral weeds (*Peganum garmala, Sophora pachycarpa*). Canopy cover and species composition are variable in different locations (photos 144–149). In total, 43 plant species were recorded for this habitat type (table 56), red-listed plants are absent.

Note: “tugay” (or “tugai”) is a local name of riparian ecosystems occurring in the river valleys of the desert zone of Central Asia.

Table 56. Check-list of plants recorded for saline lands and wetlands

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Aeluropus litoralis	Perennial	10–20	O–A	+–1	Vegetation, flowering
Alhagi persarum	Perennial	35–45	O	+	vegetation
Alhagi pseudalhagi	Perennial	35–45	O–D	+–3	vegetation
Artemisia scoparia	Annual, biennial	35–40	R–A	+–1	vegetation

Bassia eriophora	annual	12–15	R–O	+	fruiting
Bromus tectorum	annual	12–15	O–A	+	dried
Caroxylon scleranthum (Salsola sclerantha)	annual	20–25	R–O	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–A	+–1	vegetation
Climacoptera sp.	Annual	10–15	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	R–O	+	flowering
Cousinia resinosa	Perennial	25–30	R–O	+	vegetation
Elaeagnus angustifolia	tree	250–350	R	1	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Erianthus ravennae	perennial	150–250	R	+	vegetation
Euphorbia granulata	annual	5–10	R–O	+	Flowering, fruiting
Ferula foetida	Perennial	70–100	R–O	+	Fruiting, dried
Glycyrrhiza glabra	Perennial	50–100	R–O	+	Vegetation
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Halimodendron halodendron	Shrub	70–150	R–O	1–2	vegetation
Halocnemum strobilaceum	semishrub	40–100	R–A	+–1	vegetation
Halostachys belangeriana	Shrub	50–100	R–O	+–1	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–O	1–2	vegetation
Heliotropium ellipticum	annual	15–20	R–O	+	flowering
Karelinia caspia	Perennial	40–100	R–A	+–1	vegetation
Limonium otolepis	Perennial	35–50	R–A	+–1	flowering
Limonium suffruticosum	semishrub	25–35	R–O	+	vegetation
Lycium ruthenicum	Shrub	50–70	R–A	+–2	flowering
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Phragmites australis	Perennial	200–400	O–D	1–4	vegetation
Poa bulbosa	Perennial	15–17	O–A	+	dried
Salicornia europaea	annual	10–20	O	+	vegetation

Salsola paulsenii	annual	30–35	R–O	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–A	+–1	flowering
Sphaerophysa salsula	Perennial	30–35	R–O	+	vegetation
Suaeda altissima	annual	25–35	R–O	+	vegetation
Suaeda sp.	Annual	10–20	R–O	+	vegetation
Tamarix hispida	shrub	70–150	R–A	1–2	vegetation
Tamarix laxa	shrub	70–150	R–A	1–2	vegetation
Tamarix ramosissima	shrub	150–200	R–D	+–4	vegetation
Typha latifolia	Perennial	150–200	R–O	+–1	vegetation
Typha minima	Perennial	100–150	R	+	vegetation
Zygophyllum oxianum	Perennial	20–30	R	+	fruiting

Photo 144. Saline wetland and a seasonal lake with tamarisk, reeds and halophytes in a small depression between the “Bash” site and Agytma discharge channel, 40.4746° N, 64.63179° E.

Photo 145. Reeds along the Echkiliksay discharge channel, 40.412075° N, 64.50982° E.

Photo 146. Saline wetland and a seasonal lake with tamarisk, reeds and halophytes in a small depression between the “Bash” site and Agytma discharge channel, 40.4746° N, 64.63179° E.

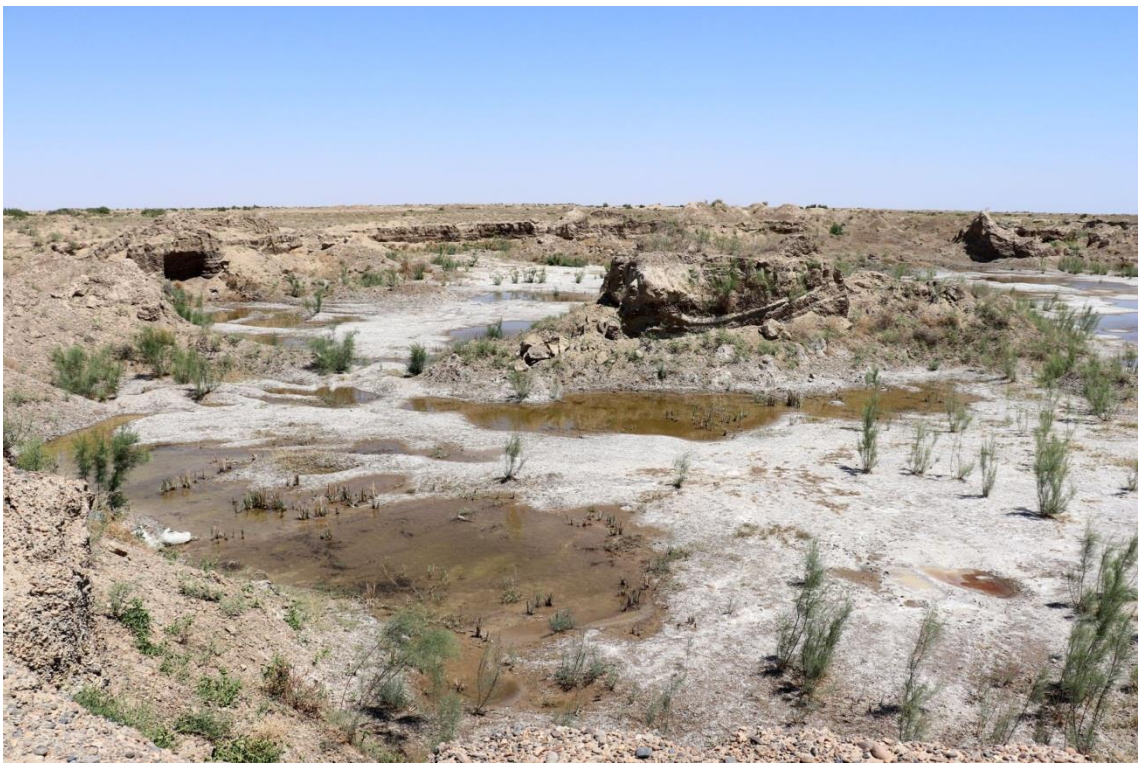

Photo 147. Sparse tamarisk in saline depression near the collector Karakyr, 40.12676° N, 64.105211° E.

Photo 148. Saline land with community of *Lycium ruthenicum* and camel thorn near the Echkiliksay discharge channel, 40.42561° N, 64.52462° E.

Photo 149. Camel thorn community on saline sands near the Agytma discharge channel (at the border between saline lands and sandy desert, 40.47556° N, 64.59086° E.

4.4.5. Agricultural lands

This is the anthropogenic agricultural landscape of the ancient Bukhara Oasis situated in the lower course and the ancient delta of Zeravshan River. There are irrigated croplands, saline fallow lands, wastelands, villages, farmsteads, branched irrigation system of numerous channels and collectors, roads, power lines, and other disturbed areas; vegetation is represented by cultural crops (wheat, rice, cotton, vegetables, etc.), weeds (*Cynodon dactylon, Descurainia sophia, Peganum garmala, Sophora pachycarpa, Tribulus terrestris*) and small plots of above-mentioned vegetation of saline lands and wetlands (photo 150–151). Canopy cover and species composition are variable in different locations. The check-list of wild growing plant species is almost the same than the previos habitat type (table 57); 42 species were recorded; red-listed plants are absent, and 2 species are alien (*Cynodon dactylon, Tribulus terrestris*).

Table 57. Check-list of plants recorded for agricultural lands

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Aeluropus litoralis	Perennial	10–20	O–A	+–1	Vegetation, flowering
Alhagi kirghisorum	Perennial	35–45	O–A	+–2	vegetation
Alhagi persarum	Perennial	35–45	O	+	vegetation
Alhagi pseudalhagi	Perennial	35–45	O–D	+–3	vegetation
Artemisia scoparia	Annual, biennial	35–40	R–A	+–1	vegetation
Bromus tectorum	annual	12–15	O–A	+	dried

Ceratocarpus arenarius	annual	10-12	R–A	+–1	vegetation
Climacoptera sp.	Annual	10–15	R–O	+	vegetation
Cousinia resinosa	Perennial	25–30	R–O	+	vegetation
Cynodon dactylon	Perennial	10–15	R–O	+	Vegetation, flowering
Descurainia sophia	annual	20–25	O	+	fruiting
Elaeagnus angustifolia	tree	250–350	R	1	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Erianthus ravennae	perennial	150–250	R	+	vegetation
Euphorbia granulata	annual	5–10	R–O	+	Flowering, fruiting
Glycyrrhiza glabra	Perennial	50–100	R–O	+	Vegetation
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Halimodendron halodendron	Shrub	70–150	R–O	1–2	vegetation
Halocnemum strobilaceum	semishrub	40–100	R–A	+–1	vegetation
Halostachys belangeriana	Shrub	50–100	R–O	+–1	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	50–150	R	+–1	vegetation
Heliotropium ellipticum	annual	15–20	R–O	+	flowering
Karelinia caspia	Perennial	40–100	R–A	+–1	vegetation
Limonium otolepis	Perennial	35–50	R–A	+–1	flowering
Lycium ruthenicum	Shrub	50–70	R–A	+–2	flowering
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Phragmites australis	Perennial	200–400	O–D	1–4	vegetation
Poa bulbosa	Perennial	15–17	O–A	+	dried
Populus pruinosa	tree	400–600	R–O	1–2	Vegetation, fruiting
Salicornia europaea	annual	10–20	O	+	vegetation
Salsola paulsenii	annual	30–35	R–O	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–A	+–1	flowering
Suaeda altissima	annual	25–35	R–O	+	vegetation
Suaeda sp.	Annual	10–20	R–O	+	vegetation
Tamarix hispida	shrub	70–150	R–A	1–2	vegetation

Tamarix laxa	shrub	70–150	R–A	1–2	vegetation
Tamarix ramosissima	shrub	150–200	R–D	+–4	vegetation
Tribulus terrestris	annual	10–20	R–O	+	Vegetation, flowering
Typha latifolia	Perennial	150–200	R–O	+–1	vegetation
Typha minima	Perennial	100–150	R–O	+	vegetation
Zygophyllum oxianum	Perennial	20–30	R–O	+	fruiting

Photo 150. Rice fields, 40.04997° N, 64.63179° E.

Photo 151. Saline fallow lands, 40.4215° N, 64.50701° E.

5. Conclusion

Results of the field surveys conducted in both project sites in springtime (April) and early summer (middle May and middle June) showed that the species composition has been identified almost completely during the first survey. The main difference between data of springtime and summer surveys is that all ephemers and ephemeroids completed their vegetation and dried, so their abundance and coverage decreased. Some representatives of Amarantaceae family (Climacoptera, Suaeda) were identified only at generic level, because the correct identification of these plants is possible at the flowering or fruiting stage (second half of August to October).

It has been found that the vegetation of the project zone, including “Bash” and “Dzhankeldy” sites, and an area between these sites along the planned power line, is represented with native ephemeroid-sagebrush, saltwort-sagebrush, saltwort-ephemeroid-sagebrush and saltwort plant communities on sandy, sandy-loamy and skeleton grey-brown desert soils, with sparse halophilous and gypsophilous vegetation on saline depressions and outcrops of variegated beds, with psammophilous shrubs on fixed and semi-fixed sands, and sometimes with saxaul plantations created in the past for fixation of sands and combat soil deflation. The vegetation of the project zone is typical for South-western Kyzylkum (and for the desert zone of Central Asia). The field survey showed that the draft maps of habitats created on the basis of proxy data are generally correct, and only some adjustmens are necessary.

Plant communities of the project zone are characterized with sparse canopy cover, low species diversity and low to medium level of anthropogenic disturbance. The canopy cover is 20–40% on most areas, less than 10% (sometimes almost 0%) on saline depressions, takyrs and outcrops of variegated beds, and up to 40–50% for communities of psammophilous shrubs or saxaul stands.

A total check-list of vascular plants were recorded within the project site “Bash” during the field surveys includes 49 species (Annex 1); 85 species were recorded within the “Dzhankeldy” site (Annex 2), 52 species – along the planned power line “Bash-Dzhankeldy” (Annex 3), and 76 species – along the “Bash-Karakul” line (Annex 4). Among them, 4 species are nationally red-listed. *Calligonum zakirovii,* an endemic to south-western Kyzylkum and national endemic, is included in the Red Data Book of Uzbekistan (2019) with the status 1 (endangered, disappearing species). *Acanthophyllum cyrtostegium, Ferula kyzylkumica* and *Tulipa lehmanniana* are included in the Red Data Book of Uzbekistan (2019) with the status 3 (reducing). Among them, 3 species are endemics with restricted range (*Acanthophyllum cyrtostegium, Calligonum zakirovii, Ferula kyzylkumica)*.

Nationally red-listed *Tulipa lehmanniana* occurs sporadically within two project sites and along the planned power line “Bash-Dzhankeldy”; its relative abundance according the DAFOR scale is R (rare) to O (occasional), population density varies from solitary specimens to 900–1000 per 1 hectare. Due to the dry weather conditions of last winter and this spring, mainly pre-generative and non-flowering generative specimens of this tulip were observed; the number of flowering specimens is very low. *Tulipa lehmanniana* included in the Red Data Book of Uzbekistan (2019) with the status 3 (vulnerable, reducing), it is nationally red-listed also in Kazakhstan, Tajikistan and Turkmenistan, and not evaluated in the IUCN Red List. The main threats are overgrazing, habitat loss, collection of flowers and bulbs. This species is quite widely spread in the desert zone of Irano-Turanian region of Tethyan (Ancient Mediterranean) floristic subkingdom of Holarctic (Takhtajan, 1986), and it grows in Uzbekistan, Kazakhstan, Tajikistan, Turkmenistan, Afghanistan, Pakistan, and Iran. Recent field studies (Abduraimov, 2017; Shomurodov & al., 2018) showed that large populations with thousands of specimens grow in the Uzbek part of the Kyzylkum desert. Tojibaev &

Beshko (2015) noted that this species can be assessed as Least Concern (LC) by the IUCN Red List Categories and Criteria (IUCN, 2012).

Another plant listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing), *Ferula kyzylkumica,* is endemic to the relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains, and national endemic. This species also is widely spread in the Kuldzhuktau Mountains; solitary specimens and populations of 50–100 individuals occur sporadically on stony slopes and foothills within and between survey plots in "Dzhankeldy" project site.

Nationally red-listed endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains, *Acanthophyllum cyrtostegium,* occurs sporadically in the piedmont plains and foothills of Kuldzhuktau, solitary or in small groups, the population density is up to 40–50 individuals per 1 hectare.

As for *Calligonum zakirovii,* only several small populations were found in "Dzhankeldy" project site and along the "Bash-Dzhankeldy" power line during the field studies.

Three species (*Cousinia sogdiana, Eremurus korolkowii* and *Tulipa sogdiana*) are endemic to Central Asian deserts, which previously were included in the Red Data Book of Uzbekistan, but on the basis of field surveys performed during the last 20 years they have been removed from the national Red Data Book. Among them, endemic to relic mountains of Kyzylkum *Eremurus korolkowii* has most restricted range and habitat.

None of these nationally red-listed or endemic plants were evaluated in the IUCN Red List.

Other threatened or endemic species known for the study area from literature (see Chapter 2.2 above) were not recorded during our field surveys in 2021, but can potentially be found with more detailed studies in the future. Taking into account the published and field data, the insular mountains Kuldzhuktau (and "Dzhankeldy" project site in particular) meets the critical habitat criteria 1 and 2 as a habitat of several nationally red-listed and restricted range endemic plant species (Annex 5).

Within the whole project area, anthropogenically transformed ecosystems are mainly concentrated along the "Bash-Karakul" power line; there are irrigated croplands, fallow lands, wastelands, villages, farmsteads, irrigation systems, roads, power lines, and other infrastructure; vegetation is represented by cultural crops, weeds and small plots of vegetation of saline lands and wetlands.

At the present, the human impact within the "Bash" and "Dzhankeldy" sites and along the "Bash-Dzhankeldy" power line is connected mainly with economical activities of local people inhabiting several small villages and farmsteads (use of rangelands and ground roads). *Peganum garmala*, a plant species which is an indicator of overgrazing and degradation of pastures, has been found in all natural habitats and majority of survey plots, but its abundance is low. Within the "Navoi-Bah" site, we did not observe dense thickets of *Peganum garmala* typical for degraded rangelands of arid zone of Uzbekistan, but in "Dzhankeldy" site and along the power lines these thickets occur around settlements, farmsteads and wells. As for invasive alien plants, these were not recorded during our field surveys in "Bash" and "Dzhankeldy" sites and along "Bash-Dzhankeldy" power line, and 2 alien weeds (*Cynodon dactylon* and *Tribulus terrestris*) were found along the "Bash-Karakul" power line, in anthropogenic landscapes.

Technologically disturbed areas occupy very small part of the "Bash" project site in a narrow strip along the railway and underground gas pipeline. Small disturbed areas (construction sites or quarries about 250x150 and 350x250 m in size) with almost completely exterminated vegetation are located also in the south-eastern part of this project site. In "Dzhankeldy" site, the impact of mining operations is more expressed (there are numerous active and abandoned mines and quarries, geological exploration is underway at the present). Such technogenically disturbed areas in the Kyzylkum desert,

as well as overgrazed territories around farms, wells and villages, usually become centers of erosion which can lead to the formation of moving sands.

Table 58. Summary table

SPECIES	ABUNDANCE ON SITE (RARE/OCCASIONAL/FREQUENT/DOMINANT)	RANGE (ENDEMIC / REGIONAL / TRANSCONTINENTAL)	IUCN /RDB STATUS
"Bash WF" site			
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
"Dzhankeldy WF" site			
Acanthophyllum cyrtostegium Vved.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)
Eremurus korolkowii Regel (see note below)	Occasional to Rare	Endemic	Not Evaluated (NE) / UzbRDB 2 (rare species) in former editions, currently excluded
Ferula kyzylkumica Korovin	Occasional to Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
OHTL segment 1 ("Bash WF – Dzhankeldy WF")			
Acanthophyllum cyrtostegium Vved.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
OHTL segment 2 ("Bash WF – Karakul sub-stantion")			
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)

Note: In the international taxonomic databases, Eremurus korolkowii currently treated as a synonym of Eremurus anisopterus (assessed as LC by IUCN). But experts in Central Asian flora do not support this point of view and consider these plants as two separated species, which morphologically and ecologically well differ from each other. Additional molecular-genetic studies are needed.

	NAME OF SPECIES		IUCN /RDB STATUS	ABUNDANCE/ DENSITY
	LATIN	ENGLISH		
1	Acanthophyllum cyrtostegium Vved.	-	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Rare / up to 40–50 individuals per 1 hectare
2	Calligonum zakirovii (Khalk.) Czerep.	Zakirov's calligonum	Not Evaluated (NE) / UzbRDB 1 (endangered species)	Rare / density varies from solitary plants to 30–40 per 1 hectare
3	Eremurus korolkowii Regel	Korolkow's desert-candle	Not Evaluated (NE) / UzbRDB 2 (rare species) in former editions, currently excluded	Occasional to Rare / density varies from solitary plants to 100–150 per 1 hectare
4	Ferula kyzylkumica Korovin	Kyzylkum's ferula	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Occasional to Rare / density varies from solitary plants to 50–100 per 1 hectare
5	Tulipa lehmanniana Merckl.	Lehmann's tulip	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Occasional to Rare / density varies from solitary plants to 900–1000 per 1 hectare

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Annex 1. A check-list of plants recorded in "Bash" site

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum elatius	Perennial	Caryophyllaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
2. Alhagi pseudalhagi	Perennial	Fabaceae	O–R	Fixed and semi-fixed sands
3. Alyssum desertorum	annual	Brassicaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
4. Artemisia diffusa	semishrub	Asteraceae	D–A	All natural habitats and all survey plots
5. Atraphaxis spinosa	shrub	Polygonaceae	R	Cliffs and eroded slopes of saline depression
6. Astragalus ammotrophus	perennial	Fabaceae	R	Cliffs and eroded slopes of saline depression
7. Astragalus chiwensis	perennial	Fabaceae	R	Fixed and semi-fixed sands (B067, B068)
8. Astragalus flexus	perennial	Fabaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
9. Astragalus rubromarginatus	perennial	Fabaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
10. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	All natural habitats and majority of survey plots
11. Bassia prostrata (*Kochia prostrata)*	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression
12. *Bromus tectorum*	annual	Poaceae	O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
13. Calligonum leucocladum	shrub	Polygonaceae	A–R	Fixed and semi-fixed sands
14. Calligonum microcarpum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
15. Carex physodes	Perennial	Cyperaceae	D–A	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
16. Carex subphysodes	Perennial	Cyperaceae	A–O	Sandy and sandy-loamy desert plain, cliffs and eroded

				slopes of saline depression, relic hills
17. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	D–R	All natural habitats and all survey plots
18. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
19. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All natural habitats and majority of survey plots
20. Ceratocephala falcata	annual	Ranunculaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
21. Climacoptera sp.	Annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression
22. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands, relic hills
23. Convolvulus hamadae	semishrub	Convolvulaceae	A-R	All natural habitats and majority of survey plots
24. Cousinia hamadae	perennial	Asteraceae	R	All natural habitats and majority of survey plots
25. Cousinia sogdiana	biennial	Asteraceae	R	fixed and semi-fixed sands
26. Cousinia resinosa	perennial	Asteraceae	R	Sandy and sandy-loamy desert plain (B036, B037)
27. Ferula foetida	Perennial, ephemeroid	Apiaceae	D-R	All natural habitats and majority of survey plots
28. Halothamnus subaphyllus	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, relic hills
29. Haloxylon persicum	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
30. Heliotropium arguzioides	Perennial	Boraginaceae	R	fixed and semi-fixed sands
31. Holosteum umbellatum	annual	Caryophyllaceae	O-R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
32. Hypecoum pendulum	annual	Papaveraceae	O-R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
33. Iris falcifolia	Perennial	Iridaceae	R	cliffs and eroded slopes of saline depression

34. Iris longiscapa	Perennial	Iridaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
35. Iris songarica	Perennial	Iridaceae	A–R	All natural habitats and majority of survey plots
36. Ixiolirion tataricum	Perennial, ephemeroid	Ixioliriaceae	R	Sandy and sandy-loamy desert plain, relic hills
37. Mausolea eriocarpa	semishrub	Asteraceae	O	fixed and semi-fixed sands
38. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	A-R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
39. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R	All natural habitats and majority of survey plots
40. Phlomoides desertotum	Perennial	Lamiaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
41. Poa bulbosa	Perennial	Poaceae	A-O	All natural habitats and all survey plots
42. Salsola paulsenii	annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
43. Sophora pachycarpa	Perennial	Fabaceae	R	fixed and semi-fixed sands (B005, B006)
44. Stipagrostis pennata	Perennial	Poaceae	O-R	fixed and semi-fixed sands
45. Streptoloma desertorum	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain
46. Tulipa lehmanniana **Nationally red-listed (status 3 – reducing species)**	Perennial	Liliaceae	O–R	All natural habitats and majority of survey plots
47. Tulipa sogdiana	Perennial	Liliaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
48. Xylosalsola arbuscula (Salsola arbuscula.)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
49. Zygophyllum macrophyllum	Perennial	Zygophyllaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression

Annex 2. A check-list of plants recorded in the "Dzhankeldy" site during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum cyrtostegium **Nationally red-listed (status 3 – reducing species), national endemic**	Perennial	Caryophyllaceae	R	Weakly inclined piedmont plain and foothills
2. Acanthophyllum elatius	Perennial	Caryophyllaceae	R	weakly inclined piedmont plain
3. Alhagi pseudalhagi	Perennial	Fabaceae	R–O	Anthropogenic disturbed areas
4. Allium griffithianum	perennial	Amaryllidaceae	R	Foothills, stony slopes
5. Allium karakense	perennial	Amaryllidaceae	R	Stony slopes
6. Allium protensum	perennial	Amaryllidaceae	R	All habitats, except for anthropogenic
7. Allium sabulosum	perennial	Amaryllidaceae	R	Foothills, stony slopes
8. Alyssum desertorum	annual	Brassicaceae	R–O	All habitats
9. Alyssum linifolium (Meniocus linifolius)	annual	Brassicaceae	R–O	Foothills, stony slopes
10. Ammodendron conollyi	Small tree	Fabaceae	R	weakly inclined piedmont plain, foothills
11. Anabasis eriopoda	semishrub	Amaranthaceae	R	All habitats, except for anthropogenic
12. Anabasis turkestanica	semishrub	Amaranthaceae	R	weakly inclined piedmont plain, foothills, outcrops of variegated beds
13. Arnebia decumbens	annual	Boraginaceae	R	All habitats, except for anthropogenic
14. Artemisia diffusa	semishrub	Asteraceae	A–D	All habitats, except for anthropogenic and outcrops of variegated beds
15. Artemisia juncea	semishrub	Asteraceae	R–O	Foothills, stony slopes
16. Artemisia scoparia	Annual, biennial	Asteraceae	A–D	All habitats
17. Artemisia turanica	semishrub	Asteraceae	O–D	All habitats
18. Astragalus ammotrophus	perennial	Fabaceae	R	All habitats, except for anthropogenic
19. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	All habitats, except for anthropogenic
20. Atraphaxis spinosa	shrub	Polygonaceae	R	All habitats, except for anthropogenic

21. Bassia eriophora	annual	Amaranthaceae	O	outcrops of variegated beds
22. Bassia prostrata (*Kochia prostrata)*	semishrub	Amaranthaceae	R	Foothills, outcrops of variegated beds
23. *Bromus tectorum*	annual	Poaceae	R–O	All habitats
24. Calligonum leucocladum	shrub	Polygonaceae	A–R	weakly inclined piedmont plain
25. Calligonum microcarpum	shrub	Polygonaceae	A–R	weakly inclined piedmont plain
26. Calligonum zakirovii **Nationally red-listed (status 1 – endangered species), national endemic**	shrub	Polygonaceae	R	weakly inclined piedmont plain, outcrops of variegated beds
27. Carex pachystylis	Perennial	Cyperaceae	D–A	All habitats, except for anthropogenic
28. Carex subphysodes	Perennial	Cyperaceae	D–O	weakly inclined piedmont plain
29. Carex physodes	Perennial	Cyperaceae	O	weakly inclined piedmont plain
30. Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	Amaranthaceae	O–R	All habitats, except for anthropogenic
31. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	A–R	All habitats, except for anthropogenic
32. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R–O	All habitats, except for anthropogenic
33. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All habitats
34. Ceratocephala falcata	annual	Ranunculaceae	O–R	All habitats
35. Climacoptera sp.	Annual	Amaranthaceae	R	All habitats, except for anthropogenic
36. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	weakly inclined piedmont plain
37. Convolvulus hamadae	semishrub	Convolvulaceae	A–R	All habitats, except for anthropogenic
38. Cousinia hamadae	perennial	Asteraceae	R–O	All habitats, except for anthropogenic
39. Eminium lehmannii	perennial	Araceae	R	Foothills, stony slopes
40. Ephedra intermedia	shrub	Ephedraceae	R–O	Foothills, stony slopes
41. Eremopyrum bonaepartis	annual	Poaceae	R–O	All habitats
42. Eremopyrum distans	annual	Poaceae	R–O	All habitats
43. Ferula foetida	Perennial, ephemeroid	Apiaceae	A–R	All habitats
44. Ferula kyzylkumica	perennial	Apiaceae	A–R	Stony slopes

Nationally red-listed (status 3 – reducing species), national endemic				
45. Fritillaria karelinii	Perennial	Liliaceae	R	Foothills, stony slopes
46. Gagea afghanica	Perennial	Liliaceae	R	Foothills, stony slopes
47. Gagea bergii	Perennial	Liliaceae	R	Foothills, stony slopes
48. Halimocnemis gamocarpa	annual	Amaranthaceae	R	Foothills, stony slopes, outcrops of variegated beds
49. Halimocnemis latifolia	annual	Amaranthaceae	R	Foothills, stony slopes, outcrops of variegated beds
50. Halimocnemis villosa	annual	Amaranthaceae	R–O	Foothills, outcrops of variegated beds
51. Halimodendron halodendron	Shrub	Fabaceae	R	Foothills, outcrops of variegated beds, anthropogenic habitats
52. Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	Amaranthaceae	R–A	All habitats
53. Haplophyllum bungei	perennial	Rutaceae	R	Foothills, outcrops of variegated beds
54. Haplophyllum robustum	perennial	Rutaceae	R	All habitats, except for anthropogenic
55. Heliotropium arguzioides	Perennial	Boraginaceae	R	weakly inclined piedmont plain
56. Holosteum umbellatum	annual	Caryophyllaceae	R	Foothills, stony slopes
57. Hypecoum pendulum	annual	Papaveraceae	R	foothills, stony slopes
58. Iris longiscapa	Perennial	Iridaceae	R	Foothills, stony slopes, outcrops of variegated beds
59. Iris songarica	Perennial	Iridaceae	R–O	weakly inclined piedmont plain, foothills
60. Isatis minima	annual	Brassicaceae	R	stony slopes
61. Koelpinia linearis	annual	Asteraceae	R	All habitats
62. Krascheninnikovia ceratoides	semishrub	Amaranthaceae	R–O	stony slopes
63. Lactuca orientalis	semishrub	Asteraceae	R	All habitats, except for anthropogenic
64. Leontice inserta	perennial	Berberidaceae	R	Stony slopes, outcrops of variegated beds

65. Leptaleum filifolium	annual	Brassicaceae	R–O	foothills, stony slopes
66. Lycium ruthenicum	Shrub	Solanaceae	R–O	All habitats, except for anthropogenic
67. Nanophyton erinaceum	semishrub	Amaranthaceae	R–O	All habitats, except for anthropogenic
68. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	D–O	All habitats, except for anthropogenic
69. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R–A	All habitats
70. Poa bulbosa	Perennial	Poaceae	A–O	All habitats
71. Rheum turkestanicum	Perennial	Polygonaceae	R–O	Stony slopes
72. Salsola paulsenii	annual	Amaranthaceae	R	All habitats
73. Scorzonera gageoides	perennial	Asteraceae	R	foothills, stony slopes
74. Scrophularia leucoclada	semishrub		R–O	All habitats, except for anthropogenic
75. Smirnowia turkestana	Perennial	Fabaceae	R–O	weakly inclined piedmont plain
76. Stipa hohenackeriana	Perennial	Poaceae	R	foothills, stony slopes
77. Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	Asteraceae	R	All habitats, except for anthropogenic
78. Tamarix hispida	shrub	Tamaricaceae	R–O	Anthropogenic habitats
79. Tamarix laxa	shrub	Tamaricaceae	R–O	All habitats
80. Tulipa lehmanniana **Nationally red-listed (status 3 – reducing species)**	Perennial	Liliaceae	R–O	All habitats, except for anthropogenic
81. Tulipa sogdiana	Perennial	Liliaceae	R	All habitats, except for anthropogenic
82. Xylosalsola arbuscula (Salsola arbuscula.)	Shrub	Amaranthaceae	O–R	weakly inclined piedmont plain
83. Ziziphora tenuior	annual	Lamiaceae	R	All habitats, except for anthropogenic
84. Zygophyllum macrophyllum	Perennial	Zygophyllaceae	R	All habitats, except for anthropogenic
85. Zygophyllum miniatum	Perennial	Zygophyllaceae	R	All habitats, except for anthropogenic

Annex 3. A check-list of plants recorded along the planned power line "Bash-Dzhankeldy" during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum cyrtostegium **Nationally red-listed (status 3 – reducing species), national endemic**	Perennial	Caryophyllaceae	R	Weakly inclined piedmont plain and foothills of relic low mountains
2. Acanthophyllum elatius	Perennial	Caryophyllaceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
3. Alhagi pseudalhagi	Perennial	Fabaceae	R–O	Fixed and semi-fixed sands, saline depressions and takyrs
4. Alyssum desertorum	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
5. Ammodendron conollyi	Small tree	Fabaceae	R–A	fixed and semi-fixed sands
6. Anabasis eriopoda	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
7. Anabasis turkestanica	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
8. Arnebia decumbens	annual	Boraginaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds
9. Artemisia diffusa	semishrub	Asteraceae	A–D	All habitats, except for saline depressions and takyrs
10. Artemisia turanica	semishrub	Asteraceae	O–A	weakly inclined piedmont plain,

				eroded foothills with outcrops of variegated beds, saline depressions
11. Astragalus flexus	perennial	Fabaceae	R	fixed and semi-fixed sands
12. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	All habitats, except for saline depressions and takyrs
13. Bassia eriophora	annual	Amaranthaceae	O	Fixed and semi-fixed sands, saline depressions and takyrs
14. Bassia prostrata (*Kochia prostrata)*	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds
15. *Bromus tectorum*	annual	Poaceae	R–O	All habitats, except for saline depressions and takyrs
16. Calligonum leucocladum	shrub	Polygonaceae	A–R	Sandy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
17. Calligonum microcarpum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
18. Calligonum zakirovii **Nationally red-listed (status 1 – endangered species), national endemic**	shrub	Polygonaceae	R	weakly inclined piedmont plain
19. Carex physodes	Perennial	Cyperaceae	D–A	Sandy desert plain, fixed and semi-fixed sands
20. Carex subphysodes	Perennial	Cyperaceae	D–O	Sandy and sandy-loamy desert plain, weakly inclined piedmont plain
21. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	A–R	All habitats
22. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R	weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds,

				saline depressions and takyrs
23. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All habitats
24. Climacoptera sp.	annual	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
25. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands
26. Convolvulus hamadae	semishrub	Convolvulaceae	A–R	All habitats
27. Cousinia hamadae	perennial	Asteraceae	R–O	All habitats
28. Eremopyrum bonaepartis	annual	Poaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
29. Eremopyrum distans	annual	Poaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
30. Euphorbia turczaninowii	annual	Euphorbiaceae	R	fixed and semi-fixed sands
31. Ferula foetida	Perennial, ephemeroid	Apiaceae	A–R	All habitats
32. Halimocnemis villosa	annual	Amaranthaceae	R–O	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
33. Halimodendron halodendron	Shrub	Fabaceae	R	saline depressions and takyrs
34. Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	Amaranthaceae	R–A	All habitats
35. Haloxylon persicum	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
36. Haplophyllum bungei	perennial	Rutaceae	R	eroded foothills with outcrops of variegated beds

37. Haplophyllum ramosissimum	Perennial	Rutaceae	R	fixed and semi-fixed sands
38. Haplophyllum robustum	perennial	Rutaceae	R	eroded foothills with outcrops of variegated beds
39. Heliotropium arguzioides	Perennial	Boraginaceae	R–O	fixed and semi-fixed sands
40. Iris songarica	Perennial	Iridaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
41. Lycium ruthenicum	Shrub	Solanaceae	R–O	saline depressions and takyrs
42. Mausolea eriocarpa	semishrub	Asteraceae	O–A	fixed and semi-fixed sands
43. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	A–R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
44. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R–O	All habitats
45. Poa bulbosa	Perennial	Poaceae	A–O	All habitats, except for saline depressions and takyrs
46. Salsola paulsenii	annual	Amaranthaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
47. Sophora pachycarpa	Perennial	Fabaceae	R–O	fixed and semi-fixed sands
48. Smirnowia turkestana	Perennial	Fabaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain
49. Stipagrostis pennata	Perennial	Poaceae	R–O	fixed and semi-fixed sands
50. Tamarix sp.	Shrub	Tamaricaceae	R	saline depressions and takyrs
51. Tulipa lehmanniana **Nationally red-listed**	Perennial	Liliaceae	R	fixed and semi-fixed sands, saline

(status 3 – reducing species)				depressions and takyrs
52. Xylosalsola arbuscula (Salsola arbuscula.)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
53. Ziziphora tenuior	annual	Lamiaceae	R	weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs

Annex 4. A check-list of plants recorded along the planned power line "Bash-Karakul" during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum elatius	Perennial	Caryophyllaceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
2. Agriophyllum lateriflorum	annual	Amaranthaceae	R–O	Fixed and semi-fixed sands
3. Alhagi pseudalhagi	Perennial	Fabaceae	R–O	All habitats
4. Alyssum desertorum	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
5. Ammodendron conollyi	Small tree	Fabaceae	R–A	fixed and semi-fixed sands
6. Arnebia decumbens	annual	Boraginaceae	R	fixed and semi-fixed sands
7. Artemisia diffusa	semishrub	Asteraceae	A–D	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
8. Artemisia turanica	semishrub	Asteraceae	O–A	Sandy and sandy-loamy desert plain
9. Astragalus flexus	perennial	Fabaceae	R	fixed and semi-fixed sands
10. Astragalus unifoliolatus	dwarf shrub	Fabaceae	O–R	fixed and semi-fixed sands
11. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
12. Atriplex dimorphostegia	annual	Amaranthaceae	R	fixed and semi-fixed sands
13. Bassia eriophora	annual	Amaranthaceae	O	Fixed and semi-fixed sands, saline lands
14. *Bromus tectorum*	annual	Poaceae	R–O	All habitats
15. Calligonum leucocladum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
16. Calligonum microcarpum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
17. Calligonum zakirovii **Nationally red-listed (status 1 – endangered species), national endemic**	shrub	Polygonaceae	R	fixed and semi-fixed sands

18. Carex physodes	Perennial	Cyperaceae	D–A	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
19. Carex subphysodes	Perennial	Cyperaceae	D–O	Sandy and sandy-loamy desert plain
20. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
21. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R	fixed and semi-fixed sands, saline lands
22. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All habitats
23. Climacoptera sp.	annual	Amaranthaceae	R	fixed and semi-fixed sands, saline lands
24. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands
25. Convolvulus hamadae	semishrub	Convolvulaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
26. Cousinia hamadae	perennial	Asteraceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
27. Cousinia resinosa	perennial	Asteraceae	R–O	All habitats
28. Cousinia sogdiana	biennial	Asteraceae	R	fixed and semi-fixed sands
29. Cynodon dactylon **Alien weed**	Perennial	Poaceae	R–O	agricultural lands
30. Descurainia sophia	annual	Brassicaceae	O	agricultural lands
31. Elaeagnus angustifolia	tree	Elaeagnaceae	R–O	Saline and agricultural lands
32. Eremopyrum bonaepartis	annual	Poaceae	R–O	All habitats
33. Eremopyrum distans	annual	Poaceae	R–O	All habitats
34. Erianthus ravennae	perennial	Poaceae	R–O	Saline and agricultural lands
35. Euphorbia cheirolepis	annual	Euphorbiaceae	R	fixed and semi-fixed sands
36. Euphorbia granulata	annual	Euphorbiaceae	R–O	Saline and agricultural lands
37. Euphorbia turczaninowii	annual	Euphorbiaceae	R	fixed and semi-fixed sands
38. Ferula foetida	Perennial, ephemeroid	Apiaceae	A–R	All habitats, except for agricultural

39. Glycyrrhiza glabra	Perennial	Fabaceae	R–O	Saline and agricultural lands
40. Halimocnemis villosa	annual	Amaranthaceae	R–O	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
41. Halimodendron halodendron	Shrub	Fabaceae	R	Saline and agricultural lands
42. Halocnemum strobilaceum	semishrub	Amaranthaceae	R–A	Saline and agricultural lands
43. Halostachys belangeriana	Shrub	Amaranthaceae	R–O	Saline and agricultural lands
44. Halothamnus subaphyllus	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
45. Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	Amaranthaceae	R–A	All habitats
46. Haloxylon persicum	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
47. Haplophyllum ramosissimum	Perennial	Rutaceae	R	fixed and semi-fixed sands
48. Heliotropium arguzioides	Perennial	Boraginaceae	R–O	fixed and semi-fixed sands
49. Heliotropium ellipticum	annual			
50. Iris songarica	Perennial	Iridaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
51. Karelinia caspia	Perennial	Asteraceae	R–A	Saline and agricultural lands
52. Limonium otolepis	Perennial	Plumbaginaceae	R–A	Saline and agricultural lands
53. Limonium suffruticosum	semishrub	Plumbaginaceae	R–O	Saline lands
54. Lycium ruthenicum	Shrub	Solanaceae	R–O	Saline and agricultural lands
55. Mausolea eriocarpa	semishrub	Asteraceae	O–A	fixed and semi-fixed sands
56. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	A–R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs

57. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R–O	All habitats
58. Phragmites australis	Perennial	Poaceae	O–D	Saline and agricultural lands
59. Poa bulbosa	Perennial	Poaceae	A–O	All habitats, except for saline depressions and takyrs
60. Populus pruinosa	tree	Salicaceae	R–O	agricultural lands
61. Salicornia europaea	annual	Amaranthaceae	O	Saline and agricultural lands
62. Salsola paulsenii	annual	Amaranthaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
63. Sophora pachycarpa	Perennial	Fabaceae	R–O	fixed and semi-fixed sands
64. Smirnowia turkestana	Perennial	Fabaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain
65. Stipagrostis pennata	Perennial	Poaceae	R–O	fixed and semi-fixed sands
66. Suaeda altissima	annual	Amaranthaceae	R–O	Saline and agricultural lands
67. Suaeda sp.	Annual	Amaranthaceae	R–O	Saline and agricultural lands
68. Tamarix hispida	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
69. Tamarix laxa	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
70. Tamarix ramosissima	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
71. Tribulus terrestris **Alien weed**	annual	Zygophyllaceae	R–O	agricultural lands
72. Typha latifolia	Perennial	Typhaceae	R–O	Saline and agricultural lands
73. Typha minima	Perennial	Typhaceae	R–O	Saline and agricultural lands
74. Xylosalsola arbuscula (Salsola arbuscula)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
75. Xylosalsola richteri (Salsola richteri)	Shrub	Amaranthaceae	R–O	fixed and semi-fixed sands

76. Zygophyllum oxianum	Perennial	Zygophyllaceae	R–O	Saline and agricultural lands

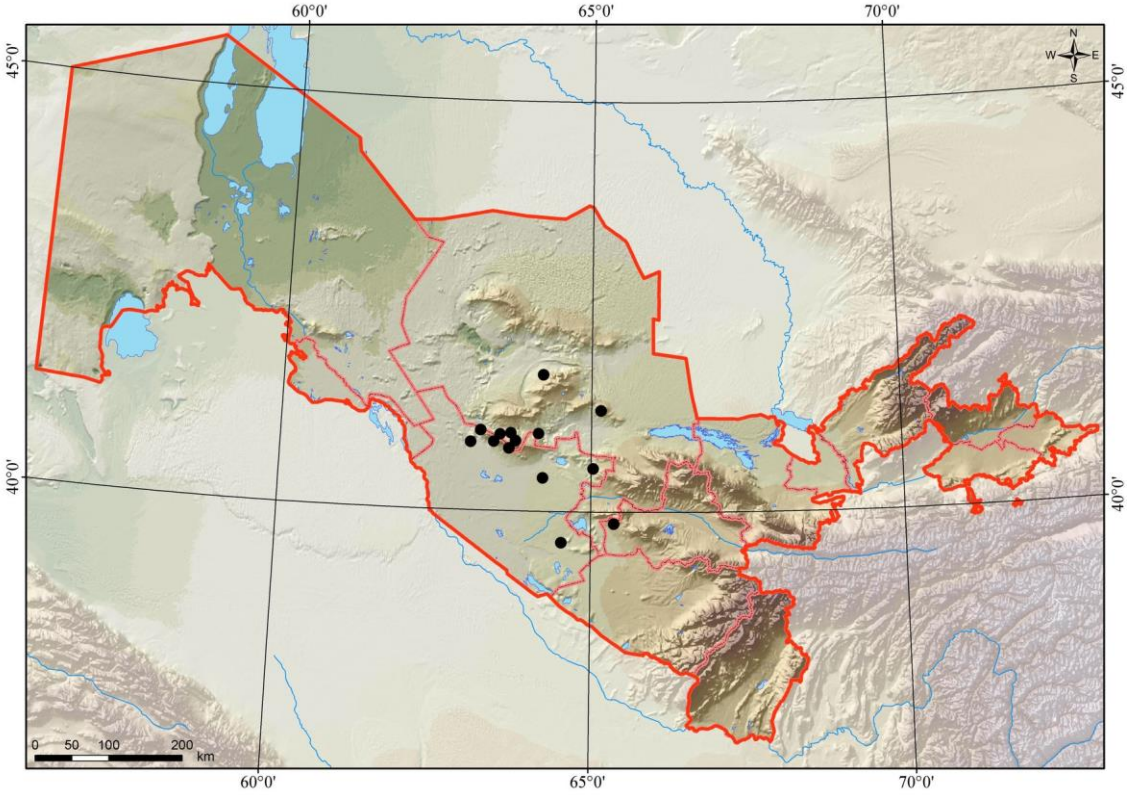
Annex 5. Trigger plant species for critical habitat assessment (recorded during the field survey)

Species	IUCN RL status	National status	Population	Distribution	Data sources	Threats	Criteria	Assessment
Acanthophyllum cyrtostegium Vved.	Not Evaluated (NE)	UzbRDB 2009 – 2 (rare) UzbRDB 2019 – 3 (vulnerable, declining)	Estimated population – about 500–600 individuals	National endemic, endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains, estimated AOO – about 50 hectares. Within the "Dzhankeldy" project site occurs sporadically, solitary or in small groups	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.	Overgrazing, mining, road and infrastructure construction	Critical habitat Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 2

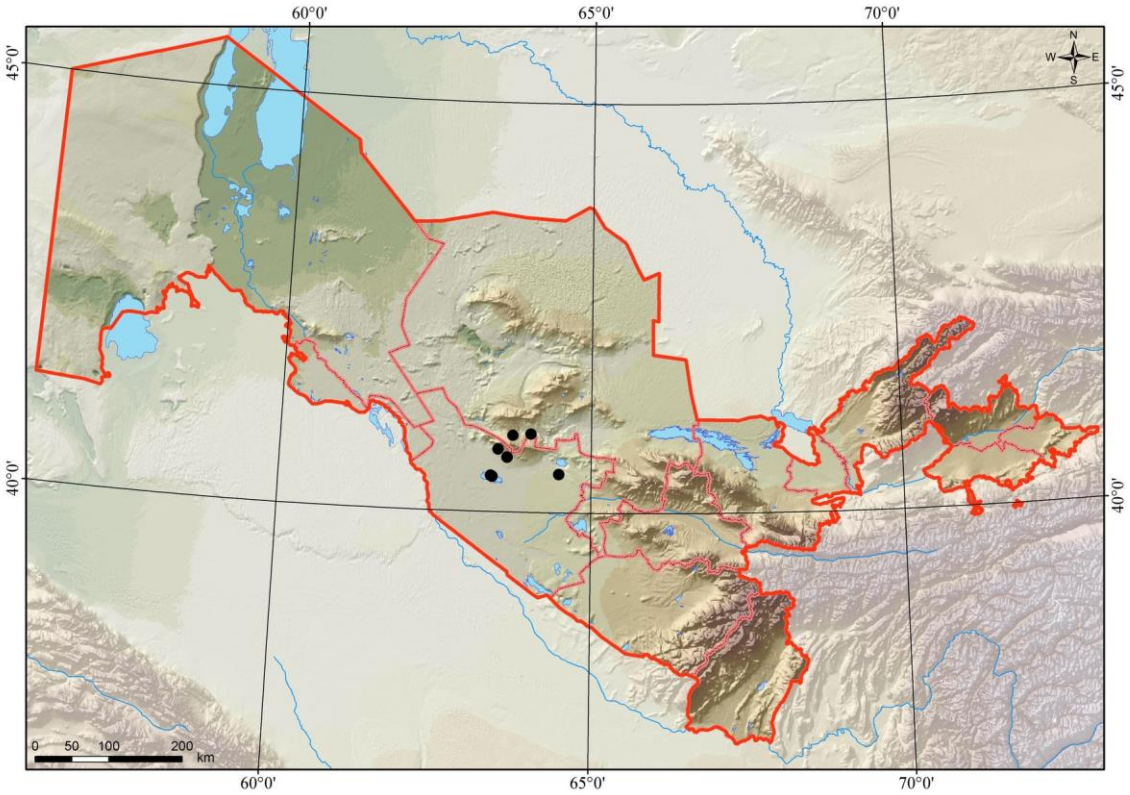
Calligonum zakirovii (Khalk.) Czerep.	Not Evaluated (NE)	UzbRDB 2019 – 1 (endangered)	Estimated population – about 500 individuals	National endemic, endemic to relic mountains of Kyzylkum, estimated AOO – about 50 hectares. Within the "Dzhankeldy" project site occurs sporadically, solitary or in small groups	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.	Overgrazing, mining, road and infrastructure construction	Critical habitat Criterion 1. (i) Habitat of significant importance to species listed as CR or EN on the IUCN Red List, and nationally/regionally listed species assessed using similar criteria. Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the national status, restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 1 and 2
Ferula kyzylkumica Korovin	Not Evaluated (NE)	UzbRDB 2009 – 2 (rare) UzbRDB 2019 – 3 (vulnerable, declining)	Estimated population – about 4000–4500 individuals in Navoi Province and 400–500 in Bukhara Province	National endemic, endemic to relic mountains of Kyzylkum with disjunction in Nuratau Mountains, estimated AOO in Bukhara Province – about 10	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of	Overgrazing, mining	Critical habitat Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 2

				hectares. Within the “Dzhankeldy” project site occurs sporadically, solitary or in groups	Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O’kituvchi Publishers, Tashkent. 128 p.			

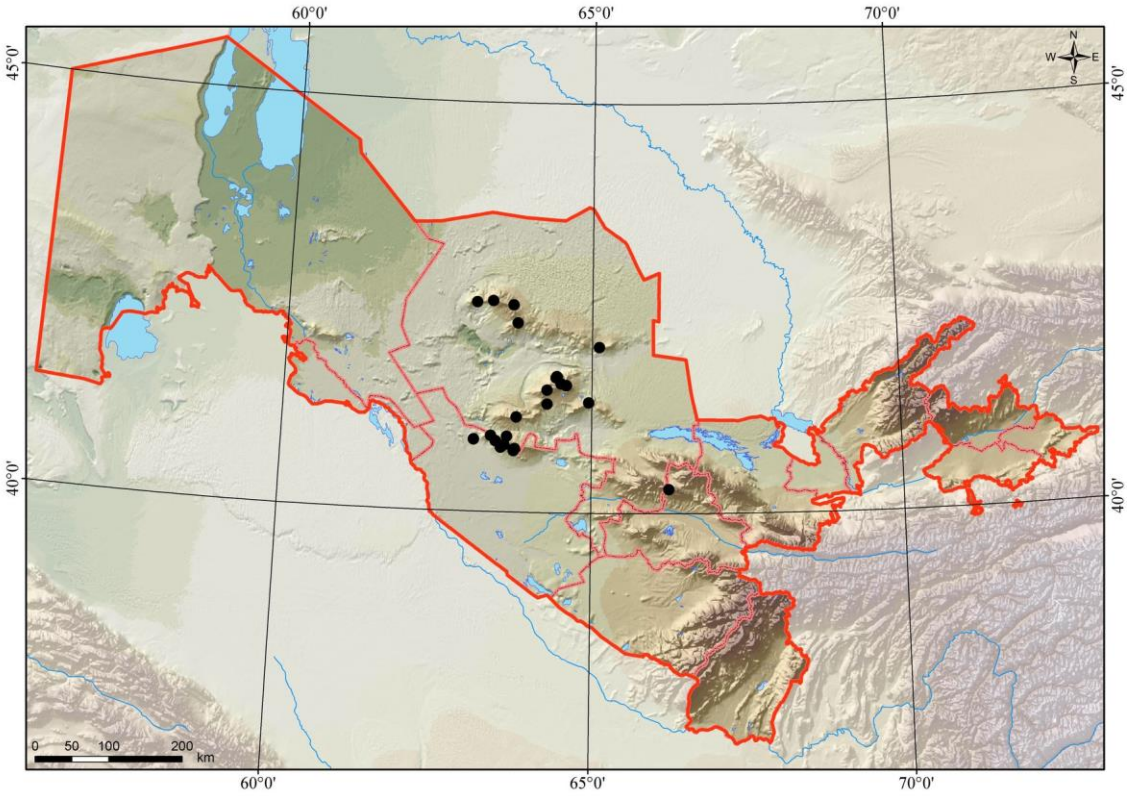
Annex 6. Distribution maps of trigger plant species (based on the field survey, herbarium and published data)



Acanthophyllum cyrtostegium



Calligonum zakirovii



Ferula kyzylkumica

Interim report
of the bird VP monitoring

Report Title	Interim report of the bird VP monitoring
Scope	BIRDS VP
Areas Covered	BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021/ SUMMER 2021
Notes	

Interim report
(May – June)
of the bird VP monitoring
along planned
Bash-Karakul OHTL

BASH WIND FARM PROJECT:

CLIENT: 5 CAPITALS

DATE: JUNE 2021

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Contents

INTRODUCTION

The project facilities are located in the central part of the Kyzylkum desert between the north-eastern shore of Lake Ayakagitma and Karakul settlement (Figure 1) and represent two substations connected by a 140 km long overhead transmission line (OHTL).

The route of the transmission line from the existing Karakul substation to the projected substation "Gijduvan" is located mainly in the desert and partially in the developed area of the Bukhara region.

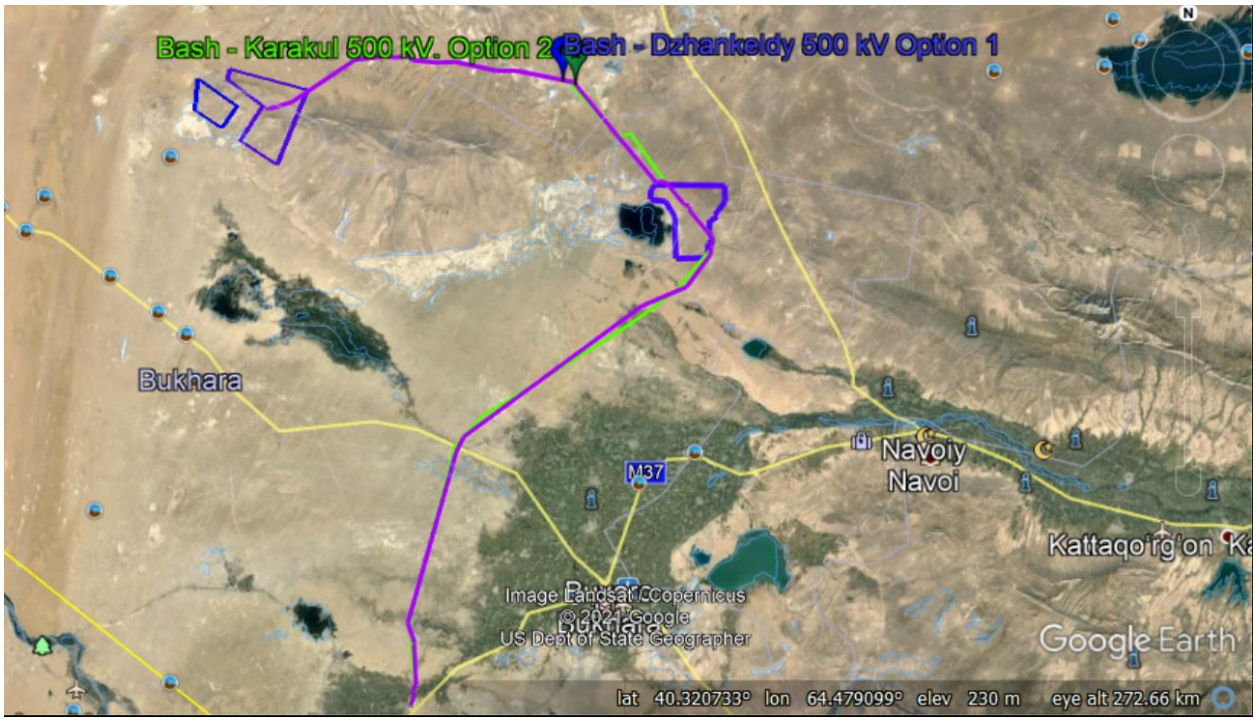

Figure 1.Location of project facilities.

Review of background information and potential impacts

This review provides general information on bird mortality from OHTL as per the existing literature data, as well as lists the species that may be encountered in the project area, and considers potential threats and mitigation measures.

The projected route of the transmission line runs mostly in the fixed sands in the area close to the developed area.
The Gijduvan substation is located on the eastern shore of Lake Ayakagitma, so wetland bird species are also included in this review.
There are also drainage reservoirs and canals in close proximity to the alignment, which attract wetland bird species.

The Lake Ayakagitma is located at the bottom of the like-named depression in the Gijduvan district of Bukhara region. The bottom is a desert landscape with extensive alkaline soil. The sides are flat and steep. The water body was formed in the early 1970s by discharge waters. Most of the shoreline is bare, not covered with reeds. Only in the western part of the lake there are small reeds and jingle shore thickets at the place of discharge canal inflow. Maximum depth in the middle of the lake is 25-30 m. The water surface area is about 10 ha (Google Earth 2021, surveying in 2018).

Lake Ayakagitma and the adjacent desert are included into the network of the most important ornithological territories of Uzbekistan (IBA Uz051). The IBA area is 32854 ha.

Alkaline lands are mainly located near the shallows of the lake's southern part. The alkaline land is one of the poorest habitats for animals and birds. Herbaceous plants are represented by some species of saltwort. There are thickets of tamarisk around the lake, which grows in the saline soil. Generally, animals do not live in alkaline lands, but they visit them from time to time, especially in spring, when salt lands fill with water and turn into shallow salt lakes. Each spring, such wetlands attract many migrating birds, mostly waders, gulls, and common terns. The tamarisk undergrowth serves as a perfect refuge for some animals. When alkaline lands dry up, even halophyte species die.

Table 1 presents general information about birds using the project area based on the available publications and departmental data from the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan and State Biological Control of State Committee on Ecology and Environmental Protection for the period from 2000 to 2011.

Table 1.List of birds using the project area according to the literature data

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
1.	Little Grebe *Tachibaptus ruficollis*	low	B, M			+		
2.	Black-naked Grebe *Podiceps nigricollis*	low	M			+		
3.	Red-necked Grebe *Podiceps grisegena*	rare	M			+		
4.	Slavonian Grebe *Podiceps auritus*	rare	M			+		
5.	Great Crested Grebe *Podiceps cristatus*	common	M			+		
6.	Great white Pelican *Pelecanus onocrotalus*	low	M, W	UzRDB-VU		+		
7.	Dalmatian Pelican *Pelecanus crispus*	low	M, W	UzRDB-EN, IUCN - VU		+		
8.	Great cormorant *Phalacrocorax carbo*	common	M,W			+		
9.	Pygmy cormorant *Phalacrocorax pygmaeus*	common	M, W	UzRDB-NT		+		
10.	Night heron *Nycticorax nycticorax*	low	M			+		
11.	Great Egret *Egretta alba*	common	M, W, B			+		
12.	Little Egret *Egretta garzetta*	low	M, W	UzRDB-VU		+		
13.	Grey Heron *Ardea cinerea*	common	M, W, B			+		
14.	Purple Heron *Ardea purpurea*	rare	M			+ +		
15.	Spoonbill *Platalea leucorodia*	rare	M	UzRDB-VU		+		
16.	Glossy Ibis *Plegadis falcinellus*	rare	M	UzRDB-VU		+		
17.	Greylag Goose *Anser anser*	low	M, W			+		
18.	Greater Flamingo *Phoenicopterus roseus*	rare	M	UzRDB-VU		+		
19.	Mute swan *Cygnus olor*	low	M, W	UzRDB-NT		+		
20.	Whooper swan *Cygnus cygnus*	rare	M, W	UzRDB-VU		+		

21.	Ruddy shelduck *Tadorna ferruginea*	low	M, W			+		
22.	Common Shelduck *Tadorna tadorna*	low	M, B, W			+		
23.	Mallard *Anas platyrhynchos*	common	B, W			+		
24.	Gadwall *Anas strepera*	low	B, W			+		
25.	Eurasian Wigeon *Anas penelope*	low	M, W			+		
26.	Common Teal *Anas crecca*	common	M, W			+		
27.	Gargarney *Anas querquedula*	low	M			+		
28.	Northern Shoveler *Anas clypeata*	low	M, B, W			+		
29.	Marbled Teal *Anas angustirostris*	rare	M	UzRDB-EN IUCN-VU		+		
30.	Red-crested Pochard *Netta rufina*	common	M, W			+		
31.	Common Pochard *Aythya ferina*	common	M, W	IUCN-VU		+		
32.	Ferruginous Duck *Aythya nyroca*	low	M, W	UzRDB-VU IUCN - VU				
33.	Smew *Mergus albellus*	low	M, W			+		
34.	Osprey *Pandion haliaetus*	low	M	UzRDB-VU		+	+	+
35.	Black Kite *Milvus migrans*	low	M		+	+	+	+
36.	Hen Harrier *Circus cyaneus*	low	M, W		+		+	+
37.	Pallid Harrier *Circus macrourus*	rare	M	UzRDB-NT IUCN-NT	+		+	+
38.	Montagu's Harrier *Circus pygargus*	low	M		+		+	+
39.	Marsh Harrier *Circus aeruginosus*	common	R		+	+		+
40.	Long-legged Buzzard *Buteo rufinus*	common	M, B, W		+		+	+
41.	Common Buzzard *Buteo buteo*	rare	M		+		+	+
42.	Short-toed Eagle *Circaetus gallicus*	rare	M	UzRDB -VU	+		+	+
43.	Steppe Eagle *Aquila nipalensis*	rare	M, W	UzRDB-U, IUCN - EN	+		+	+
44.	Golden Eagle *Aquila chrysaetos*	rare	R	UzRDB-VU,	+		+	+
45.	Greater spotted Eagle *Aquila clanga*	rare	M	UzRDB-VU, IUCN-VU	+		+	+
46.	Imperial Eagle *Aquila heliaca*	rare	M	UzRDB-VU, IUCN-VU	+		+	+
47.	White-tailed Sea Eagle *Haliaeetus albicilla*	low	M, W	UzRDB-VU		+		
48.	Cinireous Vulture *Aegupius monachus*	rare	B, M, W	UzRDB-NT, IUCN-NT			+	
49.	Eurasian Griffon *Gyps fulvus*	low	B, M, W	UzRDB-VU			+	
50.	Egyptian Vulture *Neophron percnopterus*	rare	M	IUCN-EN, UzRDB-VU	+		+	+
51.	Saker Falcon *Falco cherrug*	rare	M, B, W	UzRDB-EN, IUCN - EN	+		+	
52.	Peregrine Falcon	rare	M	UzRDB-VU	+		+	

	Falco Peregrinus							
53.	Red-capped Falcon *Falco pelegrinoides*	rare	M, B	UzRDB-VU	+		+	
54.	Eurasian Hobby *Falco subbuteo*	rare	M		+		+	
55.	Lesser Kestrel *Falco naumanni*	rare	M	UzRDB-NT	+		+	
56.	Common Kestrel *Falco tinnunculus*	low	M, B,W		+		+	
57.	Merlin *Falco colubarius*	rare	M, W		+		+	+
58.	Eurasian Sparrowhawk *Accipiter nisus*	rare	M		+		+	+
59.	Common Quail *Coturnix coturnix*	common	M		+		+	+
60.	Chukar *Alectoris chukar*	common	R		+		+	
61.	Common pheasant *Phasianus colchicus*	common	R					+
62.	Common crane *Grus grus*	common	M		+	+	+	+
63.	Demoiselle Crane *Anthropoides virgo*	common	M		+	+	+	+
64.	Common Moorhen *Gallinula chloropus*	rare	R			+		
65.	Common Coot *Fulica atra*	common	M, B, W			+		
66.	Great Bustard *Otis tarda*	rare	M	UzRDB-CR IUCN - VU	+			
67.	Little Bustard *Tetrax tetrax*	rare	M	UzRDB-VU, IUCN - NT	+			
68.	Houbara Bustard *Chlamydotis undulata*	rare	M, B	UzRDB-VU, IUCN - VU	+			
69.	Grey Plover *Pluvialis squatarola*	common	M			+		
70.	Common Ringed Plover *Charadrius hiaticula*	low	M			+		
71.	Great Sand Plover *Charadrius leschenaultii*	common	B, M			+		
72.	Little Ringed Plover *Charadrius dubius*	common	M			+		
73.	Kentish Plover *Charadrius alexandrinus*	low	M, B			+		
74.	White-tailed Lapwing *Vanellochettusia leucura*	common	M, B			+		+
75.	Sociable Lapwing *Vanellus gregaria*	rare	M	IUCN- CR, UzRDB-VU		+		+
76.	*B*lack-winged Stilt *Himantopus himantopus*	common	M, B			+		
77.	Pied Avocet *Recurvirostra avosetta*	common	M, B			+		
78.	Common Oystercatcher *Haematopus ostralegus*	common	M			+		
79.	Green Sandpiper *Tringa ochropus*	low	M			+		
80.	Common Sandpiper *Actitis Hypoleucos*	common	M			+		
81.	Wood Sandpiper *Tringa glareola*	rare	M			+		
82.	Common Greenshunk *Tringa nebularia*	rare	M			+		
83.	Common Redshunk *Tringa totanus*	low	M			+		

84.	Marsh Sandpiper *Tringa stagnatilis*	rare	M			+		
85.	Spotted Redshunk *Tringa erythropus*	low	M			+		
86.	Red-necked Phalarope *Phalaropus lobatus*	low	M			+		
87.	Ruff *Phylomachus pugnax*	low	M			+		
88.	Temminck's Stint *Calidris temminckii*	low	M			+		
89.	Culew Sandpiper *Calidris ferruginea*	low	M			+		
90.	Little Stint *Calidris minuta*	low	M			+		
91.	Dunlin *Calidris alpina*	low	M, W			+		
92.	*Common Snipe Gallinago gallinago*	low	M			+		
93.	Black-tailed Godwit *Limosa limosa*	rare	M	IUCN-NT, UzRDB-VU		+		
94.	Bar-tailed Godwit *Limosa lapponica*	rare	M			+		
95.	Eurasian Curlew *Numenius arquata*	rare	M	IUCN - NT, UzRDB- VU		+		
96.	Whimbrel *Numenius phaeopus*	rare	M			+		
97.	Slender-billed Culew *Numenius tenuirostris*	rare	M	IUCN -CR, UzRDB-CR		+		
98.	Collared Pratincole *Glareola pratincola*	common	M, B			+		+
99.	Black-winged Pratincole *Glareola nordmanni*	rare	M	UzRDB-VU, IUCN-NT		+		
100.	Yellow-legged Gull *Larus cachinnans*	common	M, B, W			+		
101.	Black-headed Gull *Larus ridibundus*	common	M, B, W			+		
102.	Slender-billed Gull *Larus genei*	low	M, B, W			+		
103.	Gull-billed Tern *Gelochelidon nilotica*	low	M, B			+		
104.	Caspian Tern *Hydroprogne caspia*	common	M, B			+		
105.	Common Tern *Sterna hirundo*	common	M, B			+		
106.	Little Tern *Sterna albifrons*	common	M, B			+		
107.	Black-bellied Sandgrouse *Pterocles orientalis*	common	R		+	+		
108.	Rock Dove *Columba livia*	common	R		+	+	+	+
109.	Collared Dove *Streptopelia decaocto*	common	R		+			+
110.	Turtle Dove *Streptopelia turtur*	low	B	IUCN -VU, UzRDB-VU	+			+
111.	*Oriental Turtle Dove Streptopelia orientalis*	low	M		+			+
112.	Laughing Dove *Streptopelia senegalensis*	low	R		+			+
113.	Common Cuckoo *Cuculus canorus*	low	M, B			+		
114.	Eagle Owl	rare	R		+		+	

	Bubo bubo							
115.	Little Owl *Athene noctua*	common	R		+		+	
116.	Europian Nightjar *Caprimulgus europaeus*	low	M		+			
117.	Egyptian Nightjar *Caprimulgus aegyptius*	low	M		+			
118.	Common Swift *Apus apus*	common	M		+		+	+
119.	European Roller *Coracias garrulus*	common	M, B	IUCN - NT	+	+	+	+
120.	European Bee-eater *Merops apiaster*	common	M		+	+	+	+
121.	Blue-cheeked Bee-eater *Merops persicus*	common	M, B		+	+	+	+
122.	Eurasia Hoopoe *Upupa epops*	common	R		+	+	+	+
123.	Sand Martin *Riparia riparia*	common	M		+	+		+
124.	Barn Swallow *Hirundo rustica*	common	M, B		+	+		+
125.	Red-rumped Swallow *Hirundo daurica*	low	M		+	+		+
126.	Crested Lark *Galerida cristata*	common	R		+			
127.	Lesser Short-toed Lark *Calandrella rufescens*	common	M, B		+			+
128.	Red-capped Lark *Calandrella cinerea*	low	M, B		+		+	
129.	Calandra Lark *Melanocorypha calandra*	common	M		+			
130.	Tawny pipit *Anthus campestris*	common	M		+	+	+	+
131.	Tree pipit *Anthus trivialis*	common	M		+	+	+	+
132.	Yellow wagtail *Motacilla flava*	common	M		+	+	+	+
133.	Citrine Wagtail *Motacilla citreola*	common	M		+	+	+	+
134.	White Wagtail *Motacilla alba*	common	M, W		+	+		+
135.	Pied Wagtail *Motacilla personata*	common	M, B		+	+		+
136.	Isabelline shrike *Lanius isabellinus*	low	M		+			+
137.	Long-tailed Shrike *Lanius schach*	rlow	M		+			+
138.	Great grey shrike *Lanius excubitor*	low	M		+			+
139.	Asian Grey Shrike *Lanius pallidirostris*	common	B, M		+			+
140.	Red-backed Srike *Lanius collurio*	common	M		+			+
141.	Turkestan Shrike *Lanius phoenicuroides*	common	M		+			+
142.	Common Starling *Sturnus vulgaris*	common	M,W		+	+		+
143.	Rose Starling *Pastor roseus*	common	M					+
144.	Indian Myna *Acridotheres tristis*	common	R		+			+
145.	Magpie *Pica pica*	common	R		+			+

146.	Eurasian Jackdaw *Corvus monedula*	common	M		+	+		
147.	Rook *Corvus frugilegus*	common	M, W		+	+		
148.	Carrion Crow *Corvus corone*	low	R		+	+		
149.	Hooded Crow *Corvus cornix*	low	M, W		+			
150.	Brown-nacked Raven *Corvus ruficollis*	low	R		+		+	
151.	Eastern Rock Nuthatch *Sitta terphonota*	low	R				+	
152.	Pddyfied Warbler *Acrocephalus agricola*	common	M, B		+	+		+
153.	Clamorous Reed Warbler *Acrocephalus stentoreus*	common	M, B		+	+		+
154.	Grear Reed Warbler *Acrocephalus arundinaceus*	common	M		+	+		+
155.	Booted Warbler *Hippolais caligata*	common	M		+	+		+
156.	Syke's Warbler *Hippolais rama*	low	M, B		+			+
157.	Common Whitethroat *Sylvia communis*	low	M		+			+
158.	Lesser Whitethroat *Sylvia curruca*	low	M		+			+
159.	Desert Warbler *Sylvia nana*	rare	B		+			
160.	Ciffchaff *Phylloscopus collybita*	common	M		+			
161.	Scrub Warbler *Scotocerca inquieta*	low	R		+			
162.	Spotted Flycather *Muscicapa striata*	low	M		+			
163.	Common Stonechat *Saxicola torquata*	low	M		+			+
164.	Pied bushchat *Saxicola caprata*	low	M, B		+			+
165.	Bluethroat *Luscinia svecica*	common	M		+			+
166.	Black Redstat *Phoenicurus ochruros*	common	M		+			+
167.	Nothern Wheater *Oenanthe oenanthe*	rare	M		+		+	
168.	Pied Wheater *Oenanthe pleschanka*	common	M, B		+		+	
169.	Variable wheater *Oenanthe picata*	low	M, B				+	
170.	Finschs Wheater *Oenanthe finschii*	low	M, B				+	
171.	Black-eared Wheater *Oenanthe hispanica*	low	M, B				+	
172.	Deser Wheater *Oenanthe deserti*	low	M,B		+			
173.	Isabelline Wheater *Oenanthe isabellina*	low	M, B		+			
174.	Rufous Scrub Robin *Cercotrichas galactotes*	low	M,B		+			
175.	Common Nightingale *Luscinia megarhynchos*	low	M		+		+	+

176.	Thrush Nightingale *Luscinia luscinia*	low	M		+			
177.	Bearded Reedling *Panurus biarmicus*	common	R			+		
178.	Turkestan Tit *Parus bokharensis*	low	R		+			+
179.	House sparrow *Passer domesticus*	low	M					+
180.	Indian sparrow *Passer indicus*	common	M, B		+			+
181.	Eurasian tree sparrow *Passer montanus*	common	R		+			+
182.	Desert Finch *Rhodospiza obsoleta*	common	R		+			
183.	Reed bunting *Emberiza schoeniclus*	common	M, B		+	+		+
184.	Желчная овсянка *Emberiza bruniceps*	rare	M, B		+	+		+
185.	Corn Bunting *Emberiza calandra*	common	M					+

Note
Nature of stay: M - migration, B - breeding, W - wintering, R - resident
Conservation status:
UzRDB - Red Book of the Republic of Uzbekistan, IUCN - IUCN Red List.

Analysis of existing data showed that ornithologic fauna of the project area is represented by 185 bird species, 22 of which are resident birds (Table 1). About 50 species are nesting. Many birds inhabit the territory during seasonal migrations or post-nesting nomadic migrations. According to the literature data 20 globally endangered species are found here. 35 species are registered in the National Red Book.

The typical inhabitants of the desert are larks, bramblings, pterocles, and small birds of prey.

Uzbekistan is located on the historical Central Asian migration route of birds from Western Siberia and Kazakhstan to Indo-Pakistan, Iran-Caspian and African flyways (Figure 2). The main flyways covering the territory of Uzbekistan are presented in the following scheme. Familiarity with this scheme shows that there are 3 flyways passing through the territory of Uzbekistan: Black Sea-Mediterranean, East African-West Asian and Central Asian.

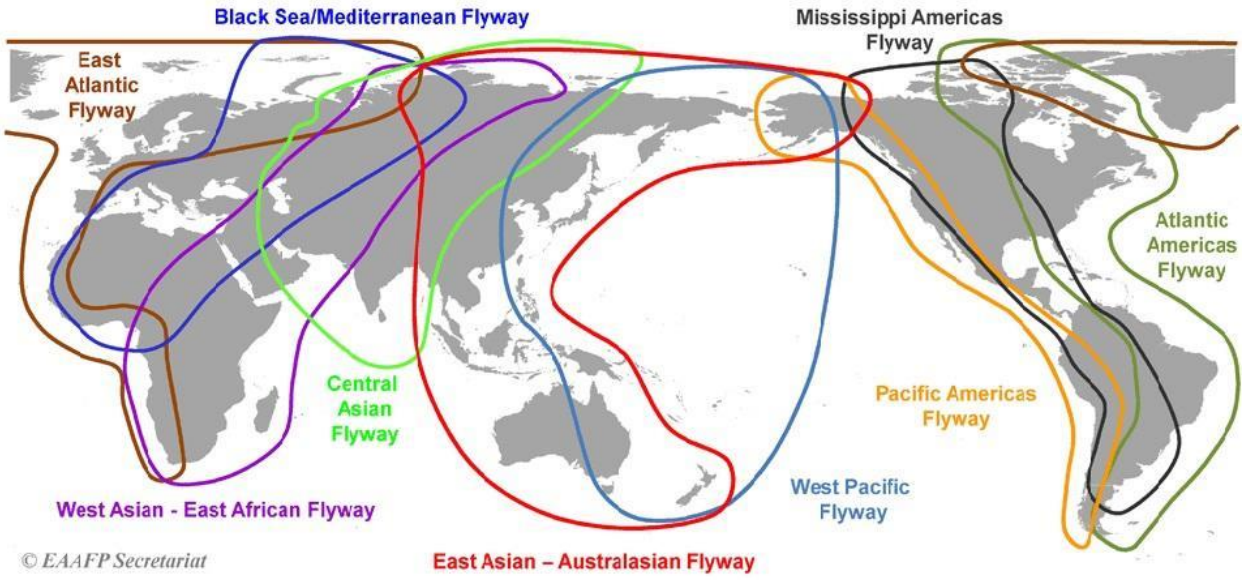

Figure 2.Main flyways (East Asian–Australasian Flyway Partnership Secretariat)

Of the 434 bird species inhabiting Uzbekistan, only 10-15% of the species is settled in different areas. The remaining birds are migratory.

Several major ecological groups can be distinguished among migratory birds according to their nature of stay:

- Species arriving to Uzbekistan for nesting from India, Pakistan, Afghanistan, Iran, North and West Africa.

- Species arriving to Uzbekistan for wintering from Western Siberia, Kazakhstan, Kyrgyzstan, Aral Sea region (outside Uzbekistan), Northern Caspian Sea region.

- Transit migrating birds crossing the territory of Uzbekistan during seasonal migrations and stopping here only for resting and feeding in order to replenish energy resources required to continue their flyway.

The main wintering grounds of birds are located mainly to the south of the average winter isotherm 0°C. In Uzbekistan, it passes approximately along the Zarafshan River. Consequently, all species arriving in Uzbekistan for wintering spend it in the southern regions of the republic, i.e. practically they cross the country in the southern direction.

In Uzbekistan the spring migration period starts from the end of February (in the south) to early March. So-called early migrants fly first and include geese, ducks, crow family species and others. The main flyway of many species through Uzbekistan takes place in March and April. There are also so-called late migrants, represented mainly by insectivore species. These are the birds such as swallows, orioles, Eurasian rollers, typical bee-eaters, nightjars, streptopelias and sparrows. In general, spring migration ends by the end of May. During the summer months, waders continue to migrate and, after reaching the tundra begin their return migration almost immediately.

Autumn migration starts in the second half of August and lasts almost until December. The main wintering grounds of various bird species in Uzbekistan are formed from October to December.

Thus, most of the year (nearly 9 months) in Uzbekistan there is a change in the species composition of birds and their territorial distribution.

Special studies of migration in the Central Asian region under the program "Asia" in the 1980s showed that the night migration of all groups of birds over the mountains and deserts of Central Asia and Kazakhstan passes everywhere from the eastern shore of the Caspian Sea to the eastern border of the Tian Shan. Moreover, up to 90% of all migrating birds fly over Central Asia at night and at considerable altitudes, while the rest fly during daylight time. According to Dolnik V.R. and Bolshakov K.V. (1985), the spring night flight

over deserts passes everywhere in a wide formation without forming densities along ecological waterways.

There are two general directions of night migration over Central Asia. One (northwest) is formed by birds that wintered in South Asia. The other (northeastern) is formed by both migrating birds that wintered from Africa to Iran and by birds that wintered in South Asia, but which go around the mountains and high mountain deserts of Central Asia. The overlapping of these three streams of different origin in the band from the western edge of the Himalayas to the central part of the Kopetdag leads to a sharply increased density of night flight in the area between the southwestern Tian Shan and the Kopetdag, persisting northward as far as the latitude of the Aral Sea. Thus, globally, migratory birds do not fly around the arid and mountainous areas of Central Asia in spring, which increases the likelihood of collisions between birds and OHTL.

In recent years, the world community has paid increasing attention to the conservation of cranes, one of the oldest systematic groups of birds. In Uzbekistan, mainly two species of cranes migrate: Demoiselle Crane *Anthropoides virgo* and Common Crane *Grus grus* (Lanovenko, Kreitzberg, 2002, Gavrilov, Van Der Ven. 2004). They are found during migration in many areas of the republic.

On their way they encounter various threats, including collisions with power lines. If OHTL is located perpendicular to the direction of bird movements, it poses a greater danger to birds than OHTL located parallel. The future OHTL Bash-Karakul is located almost parallel to the prevailing direction of migrating birds, however, the proximity of the water body increases the risks for both wetland birds and desert inhabitants, who use the lake as a watering hole, food base, etc.

Collisions with OHTL

The use of electricity is one of the achievements of technological progress of mankind. Various capacity OHTL (up to 500 kV) are used to transmit it from source to consumer, which pose a certain danger to migratory birds.

On the one hand, OHTL towers serve as roost sites for some species of birds, especially birds of prey, and especially in open landscapes, which attracts them to OHTL. On the other hand, when birds land on towers or fly between the wires, they are at risk of being electrocuted as a result of the resulting short circuit or simply from physical injury from striking wires. An increased risk of electrocution exists if birds have wet or damp feathers. Smaller birds landing on towers or wires are generally not at risk. However, bad weather conditions such as fog, rain or snow, as well as darkness, can make power lines invisible and therefore dangerous for any type of bird to collide with OHTL wires. As a result of the collision, birds can be physically injured, electrocuted, or burned in the resulting electrical arc. Falling burning birds can cause fires, both in natural habitats and in man-made landscapes. An international estimate is that 5 to 15% of all power lines can cause birds to collide with wires (IMBD Information, April 2005).

In Uzbekistan, there are known facts that during spring and autumn migrations medium and large size birds die on power lines, among them prevail mostly rare and endangered species - Steppe eagle, Golden eagle, Eastern imperial eagle, Osprey, Short-toed eagle, Saker falcon, White stork, Dalmatian pelican, Eurasian eagle-owl and others (Abdunazarov, 1987; Shernazarov, Lanovenko,1994; Lanovenko, 2007, Lanovenko, 2017).

Surveys were conducted in Tashkent, Djizak, Surkhandarya, Kashkadarya, Bukhara, Namangan and Ferghana regions of the republic to establish the scale of bird mortality on OHTL (without specifying their capacity). The length of surveyed lines was more than 2000 km in open landscapes (Abdunazarov, 1987). The estimated number of birds mortality on OHTL is up to 50 birds of prey in the Ferghana Valley, Samarkand and Surkhandarya regions (mainly Buzzards and Common kestrels); from 50 to 100 birds in the Tashkent, Syrdarya and Kashkadarya regions (mainly Buzzards and Common

kestrels); from 300 to 500 birds in the Jizzak region (Eagles, Buzzards, Ospreys, Kestrels); from 200 to 500 birds in the Navoi and Bukhara regions (Eagles, Buzzards, large Falcons, Kestrels). Moreover, among them, many species have a high conservation status, as they are listed in the national Red Book, the international list of globally threatened species, as well as in the annexes of international conventions on migratory species (Bonn) and CITES. Birds of prey tend to die by using OHTL towers as roost sites. To expand the geography and specify the species composition of birds of prey that die from electrocution, we will provide some materials of the same author (Abdunazarov, 1990) on birds of prey dying on 6-10 kV OHTL: during 1981-1984 in the Farish steppe (Jizzak region) on a 30 km section 3 Ospreys *Pandion haliaetus*, 16 Steppe Eagles *Aquila nipalensis*, 1 Eastern imperial eagle *Aquila heliaca*, 1 Golden Eagle *Aquila chrysaetus* and 3 Short-toed eagles *Circaetus gallicus* were found dead. On 26/04/89, 64 birds of prey of 12 species were recorded dead in the same area. Among them were 1 Osprey, 2 White-tailed Eagle *Haliaeetus albicilla*, 2 Short-toed eagles, 11 Steppe Eagles, 1 Golden Eagle, 1 Eastern imperial eagle and 2 Saker Falcons *Falco cherrug*. In both cases, all the mentioned species are listed in the Red Book of Uzbekistan (2019).

Birds of prey are generally more often die from electrocution when using OHTL towers as roost sites. In the central part of the Kyzylkum desert in September 2007, a Golden eagle, Steppe eagle, Griffon vulture and Houbara bustard were found dead from electrocution under the OHTL connected to the Navoi Mining and Metallurgical Plant (Kashkarov, 2007; IBA project newsletter in Uzbekistan, 2007). These species are also listed in the Red Book of Uzbekistan.

However, different species of birds often die as a result of direct collision with wires as well. Such species include small passerines (Larks, Warblers), Waders, Rails (Corn crake), Pterocles (black-bellied sandgrouse), quail and others. According to Nazarov A.P. and Zagrebin S.V. (1987), quail regularly collide with OHTL during spring and autumn migrations.

Constant monitoring to analyse the impact of OHTLs on birds was not conducted in Uzbekistan. In the Central part of the Kyzylkum desert in the period from 1997 to 2007, M.G. Mitropolsky (2009) collected remains of birds of prey that died on OHTL in order to collect shoulder bones. In total, he collected 71 specimens of 14 species of birds of prey in this area: *Accipiter gentilis (1 speciment), Buteo buteo (1), Buteo rufinus (22), Circus cyaneus (2), Cyrcus aeruginosus (1), Aquila chrysaetos (19), A. heliaca (2), A.nipalensis (7), A.clanga (5), Aegypyus monachus (2), Gyps fulvus (2), Neophron percnopterus (1), Circaetus gallicus (3), Falco tinnunculus (2).*

OHTLs located near water bodies, which are places of waterfowl concentration, pose a particular danger. According to the Institute of Zoology of the Academy of Sciences of Uzbekistan, Dalmatian Pelicans *Pelicanus crispus* regularly die on the 220 kV OHTL that runs from Kyzyltepa substation along the western shore of Tudakul Lake (Navoi region). During the 2002-2005 winter surveys, up to three dead birds were regularly found here. During the visit to the lake in January 2004, 7 dead burnt birds were found under wires at once (Lanovenko, 2007).

Birds have also been known to cause short-circuits in the electric power industry, causing outage of high voltage lines, resulting in economic losses due to power outages at enterprises, but not leading to bird deaths (Shernazarov & Lanovenko, 1994).

Some birds are killed by mechanical collisions with wires during flight, more often during poor visibility at night or unfavorable weather conditions. It is especially difficult to avoid collision with wires for large birds that do not have good maneuverability or fly with high speed. In Uzbekistan, there are known cases of cranes, black-bellied grouse, kestrel, quail, corncrake and many other species dying from collision with wires.

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avoid collision with wires for large birds that do not have good manoeuvrability or fly with high speed. In Uzbekistan, there are known cases of Demoiselle cranes, Black-bellied sandgrouse, Kestrel, Quail, Corn crake and many other species dying from collision with wires.

One of the features of modern bird ecology is their adaptation to nesting on OHTL towers. In Central Kyzylkum, we have repeatedly found Kestrel *Falco tinnunculus* nests on the OHTL. Researches of O. Mitropolsky, E. Fotteler and G. Tretiakov (1987) established nesting of Golden eagle and Saker falcon on OHTL in Kyzylkum, which allowed these species to expand their breeding ground deep into the desert. According to Zinoviev S. estimate (1990), up to 40% of nests of the Golden Eagle and 33% of nests of the Saker Falcon were located in the Kyzylkum Desert on OHTLs.

Specific data on peculiarities of daily bird migration along the route of the future overhead line are missing. There is no direct evidence that there is any narrow migration route for migrating birds in the Project area. However, analysis of information on existing global bird migration routes and evidence of the existence of wide-frontage migration in the whole territory of Uzbekistan suggests it is passing along the Project route as well. Thus, it is possible to talk about bird migration in the area of the Project route and in the adjacent areas in a broader sense (at region level).

Calculation of bird mortality on OHTLs in the Kyzylkum desert

There are no real statistics on bird deaths on OHTLs in Uzbekistan. There are data on bird mortality on the 220 kV OHTL running through the central part of the Kyzylkum desert from Yangigazgan to Uchkuduk and further to the north-east.

Like the project area, the Kyzylkum desert is an arid zone characterized by an open landscape and small desert lowlands. Bird migration through Kyzylkum is most active in spring. To determine the approximate level of bird mortality, available information on this OHTL was used. The surveyed 220 kV OHTL runs a short distance along a road, the total length of which is about 320 km. In the third decade of October, which is usually the time of late migrants' flyway in Uzbekistan, eight sections of 220 kV OHTLs with a total length of 140 km were surveyed in 2007 (Table 2).

Table 2.Data on birds collected dead under OHTLs in the central part of the Kyzylkum Desert based on the result of the October 2007 survey (Navoi region, Uzbekistan).

Survey date	Section name	OHTL length	Types and number of died birds	OHTL capacity, kV	Comments
18.10.2007	Karakata - Ayakkuduk	20 km	Calandrella rufescens – 4 Galerida cristata – 1 Philloscopus collibita – 1 Sylvia communis 1	220 кВ	(150-130 km)
18.10.2007	Route to Chimbay	15 km	Gyps fulvus – 1 Aquila chrysaetos – 1 A.nipalensis – 1 Falco tonnunculus – 1 Galerida cristata – 1 Buteo rufinus - 1	220 kV	(85-70 km)
19.10.2007	Route to Kyzylkuduk settlement	10 km	Coturnix coturnix – 1 Calandrella rufescens – 2	220 kV	From west to east (460-470 km)
19.10.2007		5 km	Aquila chrysaetos – 2 Calandrella rufescens – 1	220 kV	Under OHTL from north to south
19.10.2007		5 km	Calandrella rufescens – 2	220 kV	Along OHTL parallel to the railway
19.10.2007	Zeravshan - Uchkuduk	10 km	Calandrella rufescens – 1	220 kV	In Kuntay farm area (229-239 km)
19.10.2007	Zeravshan - Uchkuduk	10 km	Calandrella rufescens – 1 Emberiza shoeniclus - 1	220 kV	10 km NW Kuntay (241-251 km)
21.10.2007	Route to Akbaytal	30 км km	Alauda arvensis – 1 Calandrella rufescens – 3	220 kV	In Saginbay coll. area (75-105 km)
22.10.2007	Route to Kulkuduk settlement	10 km	No dead birds	220 kV	(15-25 km)
23.10.2007	Uchkuduk - Navoi	5 km under each, 15 total	No dead birds	220 kV	3 parallel OHTL (telegraph and 2 OHTL). Distance between them is 100-150 m (169-164 km)
24.10.2007	Kenimekh-Yangigazan	10 km	Chlamydotis undulate – 1 Calandrella chelensis – 1 Calandrella rufescens – 1 Philloscopus collibita – 1	220 kV	(40-45 km) from both sides of the road

Bird mortality rate calculated by us on this OHTL was 12.2 birds per 100 km. The dead birds were represented by 9 species. The dominant species is the Mediterranean short-toed lark *Calandrella rufescens*. The mortality rate of this species was 7.77 individuals per 100 km. This figure can be useful in comparative assessment of mortality along the OHTL in the Project area.

Identification of bird concentrations along the Project route and development of measures to reduce potential bird mortality during the Project implementation will reduce the current level of bird mortality.

MATERIALS AND METHODS.

Field studies on the route were carried out to identify details of the landscape characteristic picture, as well as possible places of migratory birds' concentration. Introductory surveys were conducted in May and June 2021.

We were moving along the route between "Vantage Points" directly along the route line or near it depending on the availability of access roads. The distance from the route in some places was generally not more than 1-2 km. However, given the landscape homogeneity of the surveyed section, we deem it acceptable to draw analogies between the surveyed area adjacent to the route and the route itself.

Visual observations of birds were made during the route survey. Bird sighting points were also marked using GPS. Bird species membership was determined visually using field binoculars with 8x magnification and Fujifilm XT-20 digital cameras as well as audio recordings of bird voices (Xeno-canto Asia) and field bird identifiers (Mullarney, Svensson, Zetterstrom, Grant, 1999; Aye, Schweizer, Roth 2012).

Field surveys were conducted from 3 to 4 May and 19-20 June according to the methodology agreed by the client.

Surveys were conducted at 11 selected points, in 1 km radius sections. Duration of observations was not less than 40 minutes at each vantage point.

The territorial location of vantage points is shown in Figure 3 and 4.

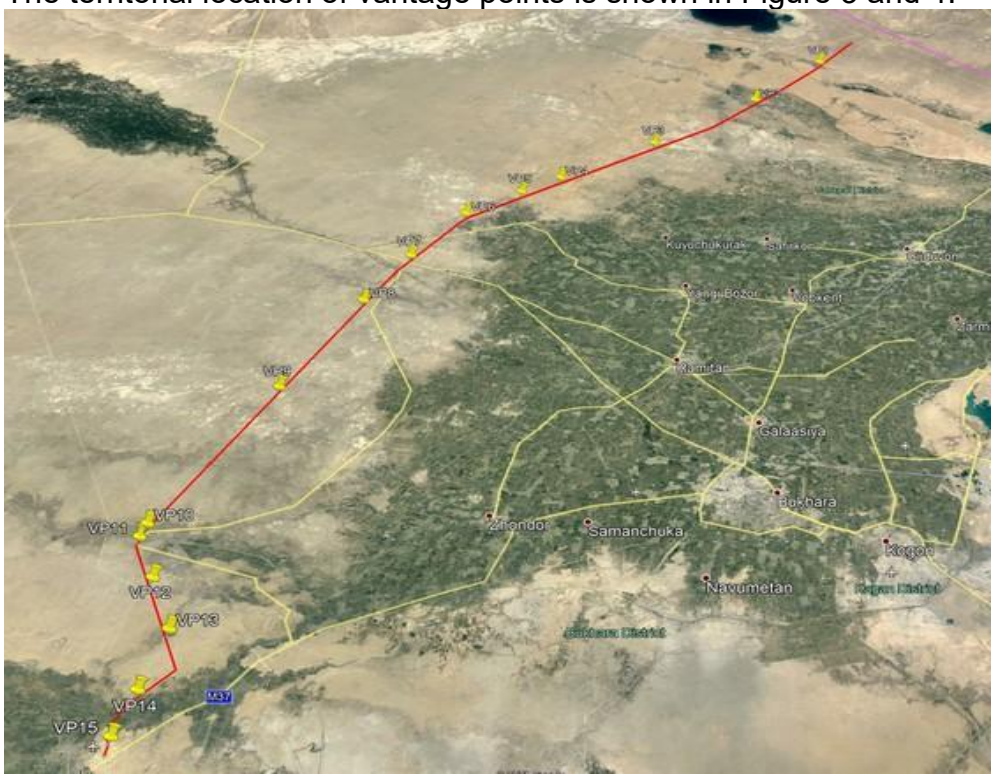

Figure 3 Survey points of the projected OHTL route in May

Figure 4. Survey points of the projected OHTL route in June

A description of the habitats is provided in APPENDIX 1.

SURVEY RESULTS

The Kyzylkum desert is a place of active migration and wintering of some species of large birds of prey, including buzzards, harriers, eagles and large falcons characterized by trophic type of migration. These birds do not migrate far, but constantly move in the right direction, simultaneously making foraging movements. This biological peculiarity of these birds determines the necessity of regular use of roost sites, so in steppe landscape and absence of tree vegetation, OHTL towers are very attractive for birds of prey, which creates a potentially dangerous situation.

Familiarization with the route of Project line showed that the area of the line is represented by open habitats. Due to the fact that the survey of the route took place at the very end of the spring migration, the data presented below are preliminary. However, they indicate the possible impact of OHTL on nesting birds and the need for monitoring surveys during the migration period to identify places of migrating birds' concentration. During the survey along the Project route, we found nests of Common Kestrel on the existing and running parallel to OHTL-220. Nesting of the common myne *Acridotheres tristis* and house sparrow *Passer domesticus* were observed in non-residential nests of this species. None of these species has a high conservation status.

In the course of familiarization with the line route, no potential high-risk areas were identified. Details of the results of the ornithological survey of the route are given in APPENDIX 1 and 2

Two nests of Golden Eagles were found on anchor poles near Ayakagitma Lake, however, the birds were not nesting this year. At the time of the survey, Indian Sparrows were nesting in the remains of one of the nests.

According to survey results 718 birds of 67 species were recorded in May, and 1628 birds of 56 species in June. The number of observed birds was much higher in June, which could be explained by the end of the nesting period in small passerines, appearance of juveniles and less hidden way of life.

Among the mentioned species, 16 are sedentary and 18 are nesting. The rest of the species visit the area during migration.

The greatest species diversity was observed in areas with water bodies and agricultural lands (VP 1,2,5,14,15). Border landscapes attract a greater number of birds due to a greater diversity of shelters, food resources, etc.

The most numerous species were Indian Sparrow and Crested Lark in May, and Indian Sparrow, Blue-cheeked Bee-eater, and Barn Swallow in June.

From rare species Egyptian vulture, Eurasian Curlew, and European Roller were observed during the survey.

Table 3. The summary list of observed species

	Name of species		IUCN /RDB Status	Total No. Observed (May)	Total No. Observed (June)
	Latin	English			
1	*Neophron perncopterus*	Egyptian Vulture	IUCN-EN, UzRDB-VU	-	3
2	*Numenius arquata*	Eurasian Curlew	IUCN - NT, UzRDB- VU	4	2
3	*Coracias garrulus*	Eurasian Roller	IUCN - NT	49	22

No nesting places of the Egyptian Vulture were identified in the project area. The observed birds are probably flying specimens.

Eurasian Curlew seen in May and June are also flying individuals at Lake Ayakagitma.

The Siberian Curlew nests in bluffs throughout the adjoining area.

Encounters of threatened bird species are shown in Figures 5 and 6.

Figure 5.Observation points of Egyptian Vulture (NP) и Eurasian Curlew (NA) in May and June 2021

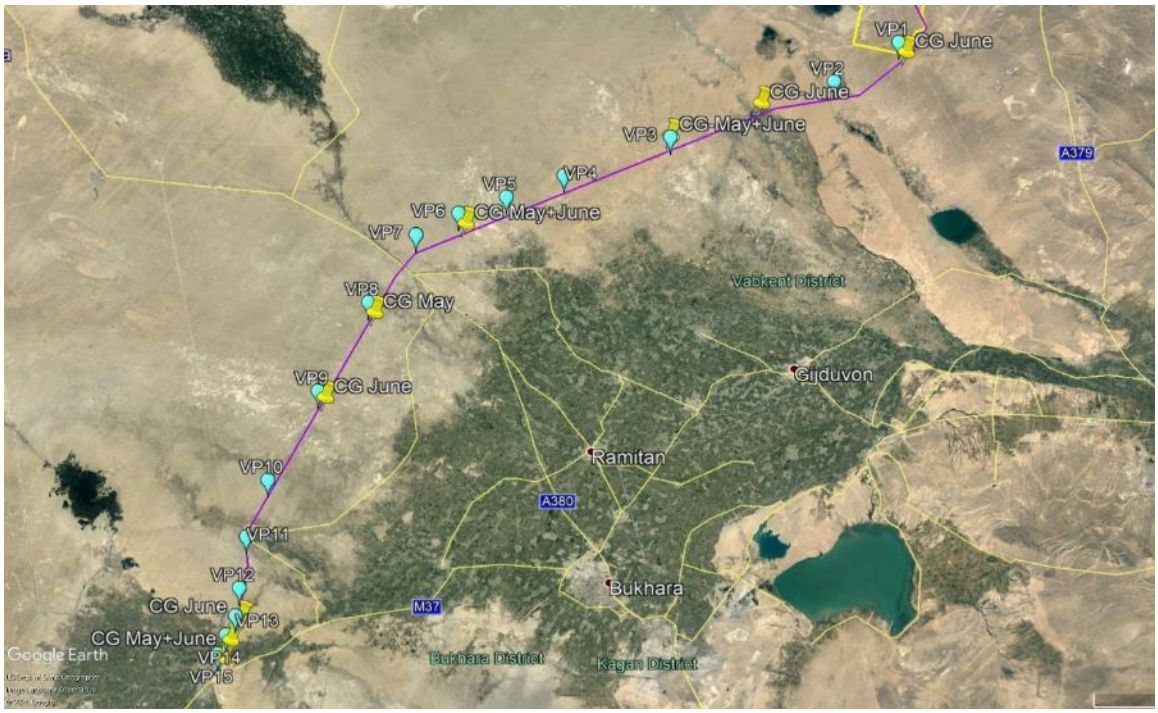

Figure 6.Observation points of Eurasian Roller (CG) in May and June 2021

Other species are common inhabitants of the Kyzylkum desert and the developed area and are widely distributed throughout the adjacent territory. Critical habitats (of

particular importance for nesting or feeding of rare and other bird species) were not identified.

It should be noted that in April, as part of surveys of operating power lines, species of birds of the Falconiformes family (Table 4) with high conservation status were noted. Considering the trophic type of migration of birds of prey, it is reasonable to consider these encounters relevant for the project power line as well.

Table 4. Threatened species observed in the vicinity of the project area.

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Neophron perncopterus*	Egyptian Vulture	IUCN-EN, UzRDB-VU	4
2	*Pandion haliaetus*	Osprey	UzRDB-VU	2
3	*Circaetus gallicus*	Short-toed Snake-eagle	UzRDB-VU	2
4	*Aquila heliaca*	Imperial Eagle	IUCN-VU, UzRDB-VU	1
5	*Aquila chrysaetos*	Golden Eagle	UzRDB-VU	3
6	*Aquila nipalensis*	Steppe Eagle	IUCN-EN, UzRDB-VU	1

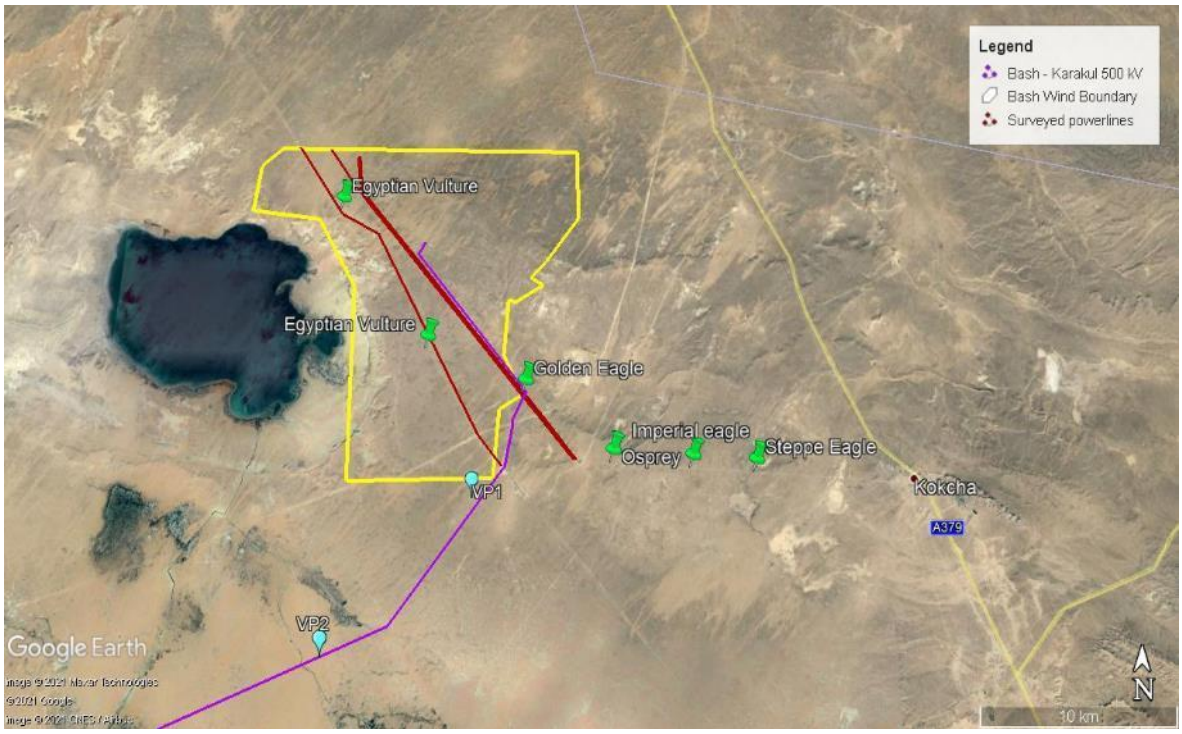

Figure 7.Places of registration of endangered species of birds.

Collection of dead birds under operating OHTL

At the same time with visual observations of birds in selected locations along the project route, route surveys were conducted along existing and already operating OHTL located near the route. The total length of the routes under OHTLs was 64 km.

Table 5.Schedule for surveying sections of existing OHTLs in the project area.

Date	Route length (km)	Route start coordinates	End-of-route coordinates	Dead birds found*
11.03.2021	12	40°35'17.96"N 64°43'51.09"E	40°40'17.16"N 64°38'17.61"E	-
04.04.2021	21	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	1
03.05.2021	5	40°35'17.96"N 64°43'51.09"E	40°37'35.91"N 64°41'16.66"E	-
05.05.2021	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-
14.05.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
25.06.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	1

*- see Table 5

During the survey in spring 2021 the remains of 3 dead birds belonging to 3 species were found.

White Pelican and White-tailed Sea Eagle are included in the Red Book of Uzbekistan. White-tailed Sea Eagle was found outside the planned routes (see Fig. 8), however, considering the significance of the species and the proximity of power lines to Ayakagitma Lake, we consider it acceptable to include this bird in the calculation. The cause of death was electrocution. White Pelican and Rufous Scrub Robin died due to collision with wires.

Table 6. List of dead birds found under operating OHTLs.

№	Latin name	English name	Number of birds	Coordinates	Date
1.	*Pelecanus onoctotalus*	White Pelican	1	40°33'57.13"N 64°45'19.97" E	04.04.2021
2.	*Haliaeetus albicilla**	White-tailed Sea Eagle	1	40°41'06” N 64°31'00" E	06.04.2021
3.	*Cercotrichas galactotes*	Rufous Scrub Robin	1	39°42'52.22"N 63°50'37.47"E	25.06.2021

*- White-tailed Sea Eagle was found out of the established route (near Ayakagitma village)

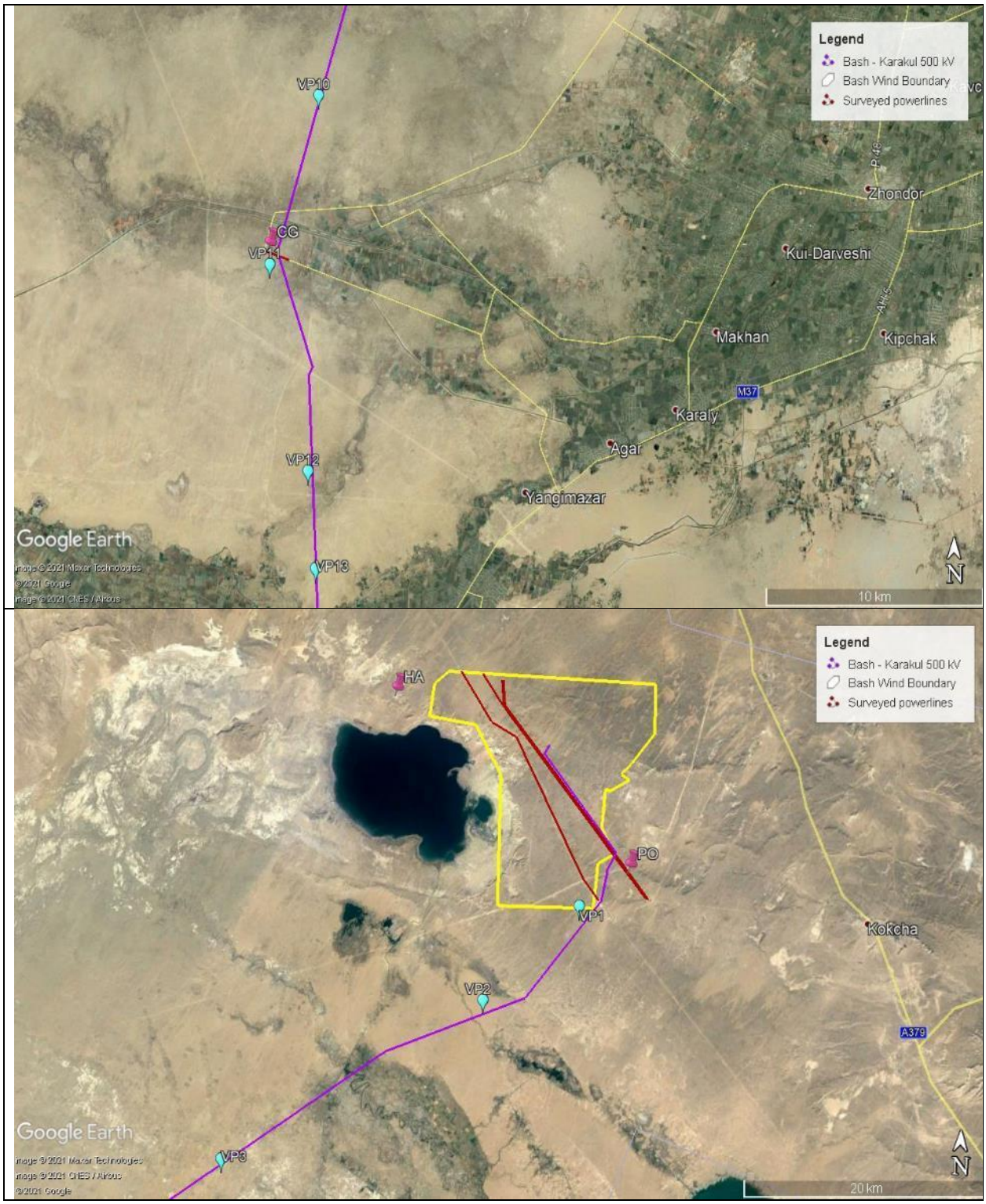

Figure 8. Locations of dead birds: CG - Cercotrichas galactotes, PO - Pelecanus onoctotalus, HA - Haliaeetus albicilla.

Preliminary bird mortality rate is 3.4 birds per 100 km (per month).

ANALYSIS OF IMPACTS AND MITIGATION MEASURES

Power lines are a threat to migrating, nesting and wintering birds during their migration from feeding to resting places. During migration, this threat is greatly increased due to the accumulation of different bird species.

For some species (Falconoformes), the death from collision with OHTL or electrocution is higher than for others.

The impact of these threats can be mitigated through the development of appropriate measures.

Table 7. Analysis of impacts on ornithological fauna and mitigation measures for construction and operation of the Project OHTL

	Impacts:	Mitigation measures:
1	Loss of habitat as a result of construction works.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic. Performing construction works during the non-breeding period. Carrying out land reclamation upon completion of works.
2	Pollution of the territory by construction and household waste. Spreading of Myna over the territory. Reduction of species and quantitative composition of desert species.	Organization and control over the timely collection and disposal of construction and household waste.
3	Disturbance of animals caused by the presence of people, moving vehicles, machinery work.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic and people movements. Performing construction works during the non-breeding period. Limiting visits to bird habitats by construction and operating staff; Informing personnel about the need to preserve biodiversity.
4	Electrocution when birds use OHTL towers for nests and as roost sites (resting places).	Installation of protection boxes that exclude electrocution of birds sitting on OHTL towers. Control the integrity of the insulation and installed boxes.
5	Injury and death due to physical collision of birds with OHTL wires.	Equipping OHTLs with markers to ensure their visibility to birds. Control the integrity of the installed markers.

RECOMMENDED MEASURES FOR CONSERVATION OF ORNITHOLOGICAL FAUNA.

- Obligatory ecological expertise of all project decisions;
- Establishment of a protection zone of at least 1 km around Lake Ayakagitma during the design and construction of all facilities in order to reduce disturbance of waterfowl inhabiting the water-body and preservation of their nesting and feeding places.
- Installation of protection boxes on OHTL towers to prevent accidental electrocution of birds on power lines.
- Installing signal markers on OHTLs in order to reduce bird mortality due to collisions with OHTL wires (markers warn birds of the danger and serve as a signal to change the altitude or direction of flight, thereby preventing collisions of birds with wires).

- Awareness of contractor personnel of vulnerable species of flora and fauna encountered in the project area and in need of protection;
- Regularly monitoring of ornithological fauna to identify and minimize potential adverse impacts during construction and operation of OHTLs and develop mitigation measures in a timely manner.
- Annual analysis of operational activities in the project area in order to identify potential negative impacts on biodiversity and implement appropriate corrective actions.

In general, the expected environmental impacts resulting from Project activities in the Bash-Karakul OHTL area will be of local nature, not exceeding the boundaries of the allotted areas. It is expected that the anthropogenic impact will not exceed the regenerative potential of the ecosystem.

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APPENDIX 1

Table 8.Habitat's description.

	
VP 1 - Fixed sands. Spillage from the canal. Sheep cote.	VP 2 - The salt marsh between the bends of the canal. Alhagi, Harmala, Capparis, Salsola.

	
VP 3 - Fixed sands. Sheep cote. There's rubble in the sand.	VP 4. Sandy desert. Sheep cotes. Vegetation is sparse.

	
VP 5. A quarry with water at the bottom. Cliffs. Indian sparrow colony in the cliffs.	VP 6. Developed area. Collectors, fields.

	
VP 7. Crossroads on the Gazly-Bukhara highway. A quarry for the extraction of rubble, a cafe, residential buildings, a gas station. Active traffic.	VP 8. Sandy desert. Near the religious complex, farmsteads.

	
VP 9. Fixed sands. VP is about 1 km from a sheep cote.	VP 10. Channel. Residential house, trailer, cattle. There are fixed sands all around. Indian sparrow colony under the bridge.

	
VP 11. Fixed sands. Saxaul. The existent power lines.	VP 12. Fixed sands. Artemisia. There's pebble in the sand.

	
VP 13. Sandy desert. Saxaul, Alhagi, Salsola. There's rubble in the sand.	VP 15. Degraded area near the Karakul substation. Residential buildings, roads, pit, garbage, noise. Heavy traffic.

VP 14 - Agricultural land. Canal. There are fields of alfalfa and wheat surrounded by sandy desert and tamarisk bushes. A farmer’s house is nearby.

APPENDIX 2

Table 9. Results of the introductory ornithological survey of the projected route of the 500 kV Karakul - Bash overhead line (05-07.05.2021)

		VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	VP 11	VP 12	VP 13	VP 14	VP 15	
	Coordinates	40° 28. 474 ' 64°37 .917'	40° 23. 112 ' 64°31 .420'	40° 17. 434 ' 64° 22. 493 '	40° 13. 292 ' 64° 14. 868 '	40° 11. 683 ' 64°11 .882'	40°09' 04" 64°08' 15"	40° 4.9 74' 64° 4.0 02'	40° 0.7 10' 64° 1.1 23'	39° 53. 384 ' 63° 56. 604 '	39° 43. 738 ' 63° 50. 727 '	39° 42. 905 ' 63° 50. 500 '	39° 40. 450 ' 63°51 .877'	39° 37. 544 ' 63° 53. 509 '	39° 34. 356 ' 63° 52. 692 '	39° 32. 080 ' 63° 51. 974 '	
	Habitats	Sandy desert / Water body	Saline land	Sandy desert	Sandy desert	Old quarry with water	Agricultural zone	Developed zone	Sandy desert	Sandy desert	Sandy desert / Water body	Sandy desert	Sandy desert	Sandy desert	Agricultural zone	Developed zone	**Total bids number**
	Species	**Number of individuals**															
1.	Grey Heron *Ardea cinerea*		1				1				2						**4**
2.	Marsh harrier *Circus aeruginosus*		2			1					1	1		1			**6**
3.	Black Kite *Milvus migrans*								2								**2**
4.	Long-legged Buzzard *Buteo rufinus*											1	1				**2**
5.	Shikra *Accipiter badius*								1								**1**
6.	Common Kestrel *Falco tinnunculus*											1		1			**2**
7.	Common Pheasant *Phasianus colchicus*						3								2		**5**
8.	Moorhen *Gallinula chloropus*						1										**1**
9.	Black-Winged Stilt					4											**4**

	Himantopus himantopus																
10.	Eurasian Curlew *Numenius arquata*	4															**4**
11.	Green Sandpiper *Tringa ochropus*	3															**3**
12.	Wood Sandpiper *Tringa glareola*	1					1										**2**
13.	Temminck's Stint *Calidris temminckii*					1	1										**2**
14.	Little Ringed Plover *Charadrius dubius*					6											**6**
15.	Sand Plover *Charadrius leschenaultii*	4															**4**
16.	Chettusia leucura *White-tailed lapwing*	6															**6**
17.	Collared Pratincole *Glareola pratincola*						22										**22**
18.	Black-bellied Sandgrouse *Pterocles orientalis*									2							**2**
19.	Rock Dove *Columba livia*						8				1					2	**11**
20.	Oriental Turtle Dove *Streptopelia orientalis*														1		**1**
21.	Collared Turtle Dove *Streptopelia decaocto*															2	**2**
22.	Laughing Turtle Dove *Streptopelia senegalensis*										2						**2**
23.	Little Owl *Athene noctua*							1	2								**3**
24.	Egyptian Nightjar *Caprimulgus aegyptius*				1												**1**
25.	Northern Swift *Apus apus*				4		3							6	1	3	**17**
26.	Eurasian Roller *Coracias garrulus*			3			1		2						4	1	**11**
27.	European Bee-eater *Merops apiaster*													9	12		**21**
28.	Blue-cheeked Bee-eater *Merops persicus*		2	21	4	14					12			6		4	**63**

29.	Hoopoe *Upupa epops*		2			1			1						1	1	**6**
30.	Sand martim *Riparia riparia*										1						**1**
31.	Barn Swallow *Hirundo rustica*		5	2	5			5	8		2	1		5	8	2	**43**
32.	Crested Lark *Galerida cristata*	4	2	5	5	2	2	3	3	9		9	8	11	4		**67**
33.	Lesser Short-toed Lark *Calandrella rufescens*						10										**10**
34.	Black-headed Wagtail *Motacilla feldegg*	1					1										**2**
35.	Citrine Wagtail Motacilla citreola					3											**3**
36.	White Wagtail *Motacilla alba*					2											**2**
37.	Pied Wagtail *Motacilla personata*					6											**6**
38.	Lesser Grey Shrike *Lanius minor*								1								**1**
39.	Red-backed Shrike *Lanius collurio*								1	1							**2**
40.	Turkestan Shrike *Lanius phoenicuroides*	1															**1**
41.	Indian Myna *Acridotheres tristis*			3	2			4	6		1					5	**21**
42.	Magpie *Pica pica*						2								1	2	**5**
43.	Brown-necked Raven *Corvus ruficillis*			1	4												**5**
44.	Eurasian Rook *Corvus frugilegus*				28											7	**35**
45.	Northern Wheatear *Oenanthe oenanthe*		2														**2**
46.	Black-necked Wheatear *Oenanthe finschii*	1	1		1							1			2		**6**
47.	Isabelline Wheatear *Oenanthe isabellina*							1	2								**3**
48.	Desert Wheatear *Oenanthe deserti*	1															**1**

49.	Streaked Scrub Warbler *Scotocerca inquieta*			2						1				3			**6**
50.	Clamorous Reed Warbler *Acrocephalus stentoreus*	3	7									3	2		6		**21**
51.	Southern Booted Warbler *Hippolais rama*	1															**1**
52.	Common whitethroat *Sylvia communis*	1															**1**
53.	Orphean Warbler *Sylvia hortensis*						1						2		3		**6**
54.	Desert Warbler *Sylvia nana*												1	1			**2**
55.	Barred Warbler *Sylvia nisoria*						1										**1**
56.	Lesser whitethroat *Sylvia curruca*						1			2					1		**4**
57.	Chiffchaff *Phylloscopus collybita*									3			2		1		**6**
58.	Bluethroat *Luscinia svecica*	1															**1**
59.	Thrush nightingale *Luscinia luscinia*													1			**1**
60.	Common stonechat Saxicola maurus		1				1										**2**
61.	Pied Stonechat *Saxicola caprata*									1							**1**
62.	Tree Sparrow *Passer montanus*															8	**8**
63.	Spanish Sparrow *Passer hispanolensis*										22						**22**
64.	Indian Sparrow *Passer indicus*			18		80		9		7	26		3		8	23	**174**
65.	Corn Bunting *Emberiza calandra*						3	1									**4**
66.	Red-headed Bunting *Emberiza bruniceps*						3						1				**4**
67.	Desert Finch *Rhodospiza obsoleta*	2										16					**18**
	Total birds number	**34**	**25**	**55**	**55**	**120**	**66**	**24**	**29**	**26**	**70**	**33**	**20**	**46**	**55**	**60**	**718**

	Total species	**15**	**10**	**8**	**9**	**11**	**19**	**7**	**11**	**8**	**10**	**8**	**8**	**10**	**15**	**12**	**67**

Table 10.List of species observed along planned OHTL, outside the VPs.

Species	Number	Notes
Short-toed Eagle *Circaetus gallicus*	1	Near the Ayakagitma lake
Houbara bustard Chlamidotis undulata	3	Near the Ayakagitma lake
Common Kestrel Falco tinnunkulus	3	Between VP 10 и VP 11
Long-legged Buzzard Buteo rufinus	1	2.5 km from VP 10 to VP9
Rufous-tailed Rock Thrush Monticola saxatilis	1	2.5 km from VP 10 to VP9
Spotted Flycather *Muscicapa striata*	1	2.5 km from VP 10 to VP9
Streaked Scrub Warbler *Scotocerca inquieta*	4	2 км from VP 6 to VP 5
Isabelline Wheatear *Oenanthe isabellina*	4	2.5 km from VP 10 to VP9
Finch’s Wheater *Oenanthe Finchii*	2	2.5 km from VP 10 to VP9
Cresed Lark Galerida cristata	11	2 km from VP 6 to VP 5

APPENDIX 3

Table 11. Results of the introductory ornithological survey of the projected route of the 500 kV Karakul - Bash overhead line (21-23.06.2021)

		VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	VP 11	VP 12	VP 13	VP 14	VP 15	Total
	Coordinates	40° 28. 474 ' 64°37 .917'	40° 23. 112 ' 64°31 .420'	40° 17. 434 ' 64° 22. 493 '	40° 13. 292 ' 64° 14. 868 '	40° 11. 683 ' 64°11 .882'	40°09' 04" 64°08' 15"	40° 4.9 74' 64° 4.0 02'	40° 0.7 10' 64° 1.1 23'	39° 53. 384 ' 63° 56. 604 '	39° 43. 738 ' 63° 50. 727 '	39° 42. 905 ' 63° 50. 500 '	39° 40. 450 ' 63°51 .877'	39° 37. 544 ' 63° 53. 509 '	39° 34. 356 ' 63° 52. 692 '	39° 32. 080 ' 63° 51. 974 '	
	Habitats	Sandy desert / Water body	Saline land	Sandy desert	Sandy desert	Old quarry with water	Agricultural zone	Developed zone	Sandy desert	Sandy desert	Sandy desert / Water body	Sandy desert	Sandy desert	Sandy desert	Agricultural zone	Developed zone	
	Species	**Number of individuals**															
1.	Grey Heron *Ardea cinerea*	2	1			1		1			1	2					**8**
2.	Great Egret *Casmerodius albus*	2					5				1				3		**11**
3.	Purple Heron *Ardea purpurea*		2												1		**3**
4.	Marsh harrier *Circus aeruginosus*	1	1			3					1	1			1	1	**9**
5.	Egyptian Vulture *Neophron percnopterus*	2															**2**
6.	Long-legged Buzzard *Buteo rufinus*		1	1	1					1							**4**
7.	Common Kestrel *Falco tinnunculus*		2		1			1	1							1	**6**
8.	Common Pheasant *Phasianus colchicus*					2	2										**4**
9.	Moorhen *Gallinula chloropus*	1	1				3				2				4		**11**
10.	Black-Winged Stilt					13									5		**18**

	Himantopus himantopus																
11.	Eurasian Curlew *Numenius arquata*	2															**2**
12.	Green Sandpiper *Tringa ochropus*		2			2											**4**
13.	Little Ringed Plover *Charadrius dubius*				3												**3**
14.	Sand Plover *Charadrius leschenaultii*		6		2												**8**
15.	Chettusia leucura *White-tailed lapwing*	5	3			4											**12**
16.	Caspian Tern *Sterna hirundo*										3						**3**
17.	Collared Pratincole *Glareola pratincola*					2	11										**13**
18.	Black-bellied Sandgrouse *Pterocles orientalis*	2		6	2					4			2				**16**
19.	Rock Dove *Columba livia*					26	35								46	12	**119**
20.	Collared Turtle Dove *Streptopelia decaocto*														15	6	**21**
21.	Laughing Turtle Dove *Streptopelia senegalensis*										2				2	4	**8**
22.	Little Owl *Athene noctua*								2			1		1			**4**
23.	Egyptian Nightjar *Caprimulgus aegyptius*														2	1	**3**
24.	Northern Swift *Apus apus*		6												15	22	**43**
25.	Eurasian Roller *Coracias garrulus*	2		2			2			3				2	4	2	**17**
26.	European Bee-eater *Merops apiaster*													14	8		**22**
27.	Blue-cheeked Bee-eater *Merops persicus*	14	23	6	2	3		4	5		2	7		8	45	38	**157**
28.	Hoopoe *Upupa epops*		1						1						2		**4**
29.	Sand martim *Riparia riparia*										30				18		**48**

30.	Barn Swallow *Hirundo rustica*	6	8	7	11	5	10	6	12	4	22	16	9	18	50	60	**244**
31.	Crested Lark *Galerida cristata*	3	2	4	3	6	6	5	8	3	5	4	5	7	11	8	**80**
32.	Lesser Short-toed Lark *Calandrella rufescens*		4				8	13				11	18	7			**61**
33.	Black-headed Wagtail *Motacilla feldegg*	1	2			4									3		**10**
34.	Motacilla citreola *Citrine Wagtail*		3			2											**5**
35.	White Wagtail *Motacilla alba*	2	2			5									2	4	**15**
36.	Pied Wagtail *Motacilla personata*		3			9										3	**15**
37.	Red-backed Shrike *Lanius collurio*								1								**1**
38.	Indian Myna *Acridotheres tristis*	4	8	4	7			5	4	11					9	15	**67**
39.	Magpie *Pica pica*				2			3	2		3				3	5	**18**
40.	Brown-necked Raven *Corvus ruficollis*			2											4		**6**
41.	Eurasian Rook *Corvus frugilegus*		4		4										8	3	**19**
42.	Northern Wheatear *Oenanthe oenanthe*			1	2					2		2					**7**
43.	Black-necked Wheatear *Oenanthe finschii*	1	1			1		2	1		2	1		1			**10**
44.	Isabelline Wheatear *Oenanthe isabellina*	2		3	2	1	2	2	1	1	2	3	4	2			**25**
45.	Desert Wheatear *Oenanthe deserti*	2		2				1				2	1				**8**
46.	Streaked Scrub Warbler *Scotocerca inquieta*			2	1			1	2	3			1	2	1		**13**
47.	Clamorous Reed Warbler *Acrocephalus stentoreus*		5				10				12				7		**34**
48.	Southern Booted Warbler *Hippolais rama*	2									2						**4**
49.	Orphean Warbler									1				1	2		**4**

	Sylvia hortensis																
50.	Desert Warbler *Sylvia nana*			1			1	1									**3**
51.	Lesser whitethroat *Sylvia curruca*		1														**1**
52.	Common stonechat *Saxicola maurus*	1	2				1								2		**6**
53.	Tree Sparrow *Passer montanus*															14	**14**
54.	Spanish Sparrow *Passer hispanolensis*										32				30		**62**
55.	Indian House Sparrow *Passer indicus*			14		66					85			22	40	50	**277**
56.	Desert Finch *Rhodospiza obsoleta*	12	9									4			11		**36**
	Total birds number	**69**	**103**	**55**	**43**	**155**	**96**	**45**	**40**	**33**	**207**	**54**	**40**	**85**	**354**	**249**	**1628**
	Total species	**21**	**26**	**14**	**14**	**18**	**13**	**13**	**12**	**10**	**17**	**12**	**7**	**12**	**30**	**18**	**56**

Table 12.List of bird species recorded in the project area outside VPs

Species	Number	Notes
Egyptian Vulture *Neophron percnopterus*	1	Between VP 3 and 4
Common Kestrel *Falco tinnunculus*	2	Between VP 8 and VP 9
Little Owl *Athene noctua*	1	Between VP 2 and VP 3
Eurasian Roller *Coracias garrulus*	5	
Wood Pigeon *Columba palumbus*	7	Between VP 5 and VP 6

APPENDIX 4.

Table 13.List of birds recorded during the spring survey of the existing power lines

	Latin names	English names	IUCN	Uzb Red Book	Nature of stay	Numberof individuals and Notes
1.	*Pelecanus onocrotalus*	Great White Pelican	LC	2 (VU:D)	NMW	1 remains
2.	*Pandion haliaetus*	Osprey	LC	2 (VU:R)	NM	2 individuals
3.	*Circus cyaneus*	Hen Harrier	LC	-	MW	1 individual
4.	*Buteo rufinus*	Long-legged Buzzard	LC	-	NMW	5 individuals
5.	*Circaetus gallicus*	Short-toed Snake-eagle	LC	2 (VU:D)	NM	2 individuals
6.	*Aquila heliaca*	Imperial Eagle	VU	2 (VU:D)	NMS	1 individual
7.	*Aquila chrysaetos*	Golden Eagle	LC	2 (VU: R)	R	2 nests, 3 individuals
8.	*Neophron percnopterus*	Egyptian Vulture	EN	2 (VU:D)	NMW	4 individuals
9.	*Falco tinnunculus*	Kestrel	LC	-	NMW	38 nests
10.	*Pterocles orientalis*	Black-bellied Sandgrouse	LC	-	NMW	21 individuals in total, from 2 to 6 individuals at a time
11.	*Columba livia*	Rock Dove	LC	-	R	A few dozens
12.	*Athene noctua*	Little Owl	LC	-	R	5 individuals we observed sitting on the power lines
13.	*Caprimulgus aegyptius*	Egyptian Nightjar	LC	-	NM	2 sat on the ground under the power line
14.	*Apus apus*	Northern Swift	LC	-	NM	38 circled over the power lines
15.	*Coracias garrulus*	Eurasian Roller	LC	-	NM	8 individuals, some of them sat on the power lines
16.	*Merops persicus*	Blue-cheeked Bee-eater	LC	-	NM	30 individuals
17.	*Upupa epops*	Hoopoe	LC	-	NMW	2 individuals on the ground
18.	*Hirundo daurica*	Red-rumped Swallow	LC	-	NM	12 individuals
19.	*Cercotrichas galactotes*	Rufous Scrub Robin	LC	-	NM	1 remains
20.	*Rhodospiza obsoleta*	Black-billed Desert Finch	LC	-	R	6 individuals sat on the power lines
21.	*Oenanthe deserti*	Desert Wheatear	LC	-	NM	4 individuals
22.	*Oenanthe oenanthe*	Northern Wheatear	LC	-	NM	3 individuals
23.	*Passer indicus*	Indian House Sparrow	LC	-	NM	About 12 individuals, nest in a golden eagle's old nest

Final report
of the bird VP monitoring

Report Title	Final report (May – November) of the bird VP monitoring along planned Bash-Karakul OHTL
Scope	BIRDS VP
Areas Covered	BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021 / AUTUMN 2021
Notes	

Final report
(May – November)
of the bird VP monitoring
along planned
Bash-Karakul OHTL

BASH WIND FARM PROJECT:

CLIENT: 5 CAPITALS

DATE: DECEMBER 2021

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Contents

INTRODUCTION

The project facilities are located in the central part of the Kyzylkum desert between the north-eastern shore of Lake Ayakagitma and Karakul settlement (Figure 1) and represent two substations connected by a 140 km long overhead transmission line (OHTL).

The route of the transmission line from the existing Karakul substation to the projected substation "Gijduvan" is located mainly in the desert and partially in the developed area of the Bukhara region.

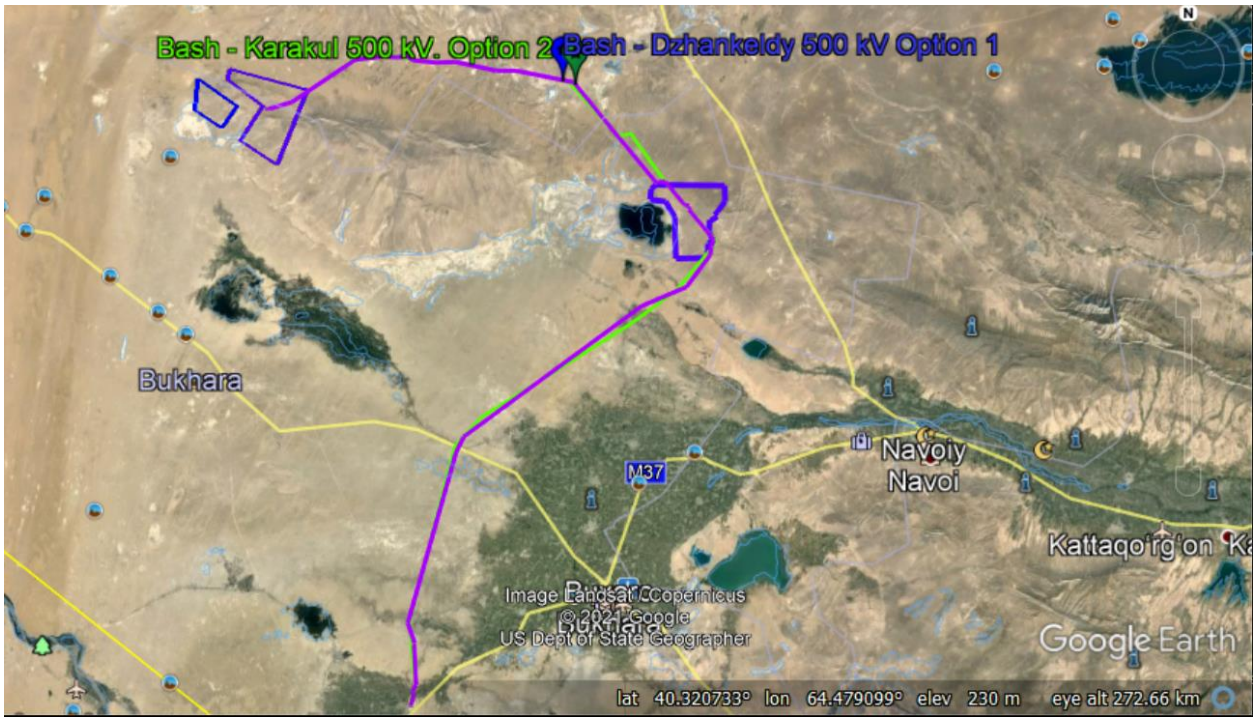

Figure 1.Location of project facilities.

Review of background information and potential impacts

This review provides general information on bird mortality from OHTL as per the existing literature data, as well as lists the species that may be encountered in the project area, and considers potential threats and mitigation measures.

The projected route of the transmission line runs mostly in the fixed sands in the area close to the developed area.

The Gijduvan substation is located on the eastern shore of Lake Ayakagitma, so wetland bird species are also included in this review.

There are also drainage reservoirs and canals in close proximity to the alignment, which attract wetland bird species.

The Lake Ayakagitma is located at the bottom of the like-named depression in the Gijduvan district of Bukhara region. The bottom has a desert landscape with extensive alkaline soil. The sides are flat and steep. The water body was formed in the early 1970s by discharge waters. Most of the shoreline is bare, not covered with reeds. Only in the western part of the lake there are small reeds and tamarix shore thickets at the place of discharge canal inflow. Maximum depth in the middle of the lake is 25-30 m. The water surface area is about 10 ha (Google Earth 2021, surveying in 2018).

Lake Ayakagitma and the adjacent desert are included into the network of the most important ornithological territories of Uzbekistan (IBA Uz051). The IBA area is 32854 ha.

Alkaline lands are mainly located near the shallows of the lake's southern part. The alkaline land is one of the poorest habitats for animals and birds. Herbaceous plants are represented by some species of saltwort. There are thickets of tamarisk around the lake, which grows in the saline soil. Generally, animals do not live on alkaline lands, but they visit them from time to time, especially in spring, when salt lands fill with water and turn into shallow salt lakes. Each spring, such wetlands attract many migrating birds, mostly waders, gulls, and terns. The tamarisk undergrowth serves as a perfect refuge for some animals. When alkaline lands dry up, even halophyte plants die.

Table 1 presents general information about the birds using the project area based on the available publications and departmental data from the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan and State Biological Control of State Committee on Ecology and Environmental Protection for the period from 2000 to 2011.

Table 1.List of birds using the project area according to the literature data

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
1.	Little Grebe *Tachibaptus ruficollis*	low	B, M			+		
2.	Black-naked Grebe *Podiceps nigricollis*	low	M			+		
3.	Red-necked Grebe *Podiceps grisegena*	rare	M			+		
4.	Slavonian Grebe *Podiceps auritus*	rare	M			+		
5.	Great Crested Grebe *Podiceps cristatus*	common	M			+		
6.	Great white Pelican *Pelecanus onocrotalus*	low	M, W	UzRDB-VU		+		
7.	Dalmatian Pelican *Pelecanus crispus*	low	M, W	UzRDB-EN, IUCN - VU		+		
8.	Great cormorant *Phalacrocorax carbo*	common	M,W			+		
9.	Pygmy cormorant *Phalacrocorax pygmaeus*	common	M, W	UzRDB-NT		+		
10.	Night heron *Nycticorax nycticorax*	low	M			+		
11.	Great Egret *Egretta alba*	common	M, W, B			+		
12.	Little Egret *Egretta garzetta*	low	M, W	UzRDB-VU		+		
13.	Grey Heron *Ardea cinerea*	common	M, W, B			+		
14.	Purple Heron *Ardea purpurea*	rare	M			+ +		
15.	Spoonbill *Platalea leucorodia*	rare	M	UzRDB-VU		+		
16.	Glossy Ibis *Plegadis falcinellus*	rare	M	UzRDB-VU		+		
17.	Greylag Goose *Anser anser*	low	M, W			+		
18.	Greater Flamingo *Phoenicopterus roseus*	rare	M	UzRDB-VU		+		
19.	Mute swan *Cygnus olor*	low	M, W	UzRDB-NT		+		
20.	Whooper swan *Cygnus cygnus*	rare	M, W	UzRDB-VU		+		
21.	Ruddy shelduck *Tadorna ferruginea*	low	M, W			+		

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
22.	Common Shelduck *Tadorna tadorna*	low	M, B, W			+		
23.	Mallard *Anas platyrhynchos*	common	B, W			+		
24.	Gadwall *Anas strepera*	low	B, W			+		
25.	Eurasian Wigeon *Anas penelope*	low	M, W			+		
26.	Common Teal *Anas crecca*	common	M, W			+		
27.	Gargarney *Anas querquedula*	low	M			+		
28.	Northern Shoveler *Anas clypeata*	low	M, B, W			+		
29.	Marbled Teal *Anas angustirostris*	rare	M	UzRDB-EN IUCN-VU		+		
30.	Red-crested Pochard *Netta rufina*	common	M, W			+		
31.	Common Pochard *Aythya ferina*	common	M, W	IUCN-VU		+		
32.	Ferruginous Duck *Aythya nyroca*	low	M, W	UzRDB-VU IUCN - VU				
33.	Smew *Mergus albellus*	low	M, W			+		
34.	Osprey *Pandion haliaetus*	low	M	UzRDB-VU		+	+	+
35.	Black Kite *Milvus migrans*	low	M		+	+	+	+
36.	Hen Harrier *Circus cyaneus*	low	M, W		+		+	+
37.	Pallid Harrier *Circus macrourus*	rare	M	UzRDB-NT IUCN-NT	+		+	+
38.	Montagu's Harrier *Circus pygargus*	low	M		+		+	+
39.	Marsh Harrier *Circus aeruginosus*	common	R		+	+		+
40.	Long-legged Buzzard *Buteo rufinus*	common	M, B, W		+		+	+
41.	Common Buzzard *Buteo buteo*	rare	M		+		+	+
42.	Short-toed Eagle *Circaetus gallicus*	rare	M	UzRDB -VU	+		+	+
43.	Steppe Eagle *Aquila nipalensis*	rare	M, W	UzRDB-U, IUCN - EN	+		+	+
44.	Golden Eagle *Aquila chrysaetos*	rare	R	UzRDB-VU,	+		+	+
45.	Greater spotted Eagle *Aquila clanga*	rare	M	UzRDB-VU, IUCN-VU	+		+	+
46.	Imperial Eagle *Aquila heliaca*	rare	M	UzRDB-VU, IUCN-VU	+		+	+
47.	White-tailed Sea Eagle *Haliaeetus albicilla*	low	M, W	UzRDB-VU		+		
48.	Cinireous Vulture *Aegupius monachus*	rare	B, M, W	UzRDB-NT, IUCN-NT			+	
49.	Eurasian Griffon *Gyps fulvus*	low	B, M, W	UzRDB-VU			+	
50.	Egyptian Vulture *Neophron percnopterus*	rare	M	IUCN-EN, UzRDB-VU	+		+	+
51.	Saker Falcon *Falco cherrug*	rare	M, B, W	UzRDB-EN, IUCN - EN	+		+	

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
52.	Peregrine Falcon *Falco Peregrinus*	rare	M	UzRDB-VU	+		+	
53.	Red-capped Falcon *Falco pelegrinoides*	rare	M, B	UzRDB-VU	+		+	
54.	Eurasian Hobby *Falco subbuteo*	rare	M		+		+	
55.	Lesser Kestrel *Falco naumanni*	rare	M	UzRDB-NT	+		+	
56.	Common Kestrel *Falco tinnunculus*	low	M, B,W		+		+	
57.	Merlin *Falco colubarius*	rare	M, W		+		+	+
58.	Eurasian Sparrowhawk *Accipiter nisus*	rare	M		+		+	+
59.	Common Quail *Coturnix coturnix*	common	M		+		+	+
60.	Chukar *Alectoris chukar*	common	R		+		+	
61.	Common pheasant *Phasianus colchicus*	common	R					+
62.	Common crane *Grus grus*	common	M		+	+	+	+
63.	Demoiselle Crane *Anthropoides virgo*	common	M		+	+	+	+
64.	Common Moorhen *Gallinula chloropus*	rare	R			+		
65.	Common Coot *Fulica atra*	common	M, B, W			+		
66.	Great Bustard *Otis tarda*	rare	M	UzRDB-CR IUCN - VU	+			
67.	Little Bustard *Tetrax tetrax*	rare	M	UzRDB-VU, IUCN - NT	+			
68.	Houbara Bustard *Chlamydotis undulata*	rare	M, B	UzRDB-VU, IUCN - VU	+			
69.	Grey Plover *Pluvialis squatarola*	common	M			+		
70.	Common Ringed Plover *Charadrius hiaticula*	low	M			+		
71.	Great Sand Plover *Charadrius leschenaultii*	common	B, M			+		
72.	Little Ringed Plover *Charadrius dubius*	common	M			+		
73.	Kentish Plover *Charadrius alexandrinus*	low	M, B			+		
74.	White-tailed Lapwing *Vanellochettusia leucura*	common	M, B			+		+
75.	Sociable Lapwing *Vanellus gregaria*	rare	M	IUCN- CR, UzRDB-VU		+		+
76.	*B*lack-winged Stilt *Himantopus himantopus*	common	M, B			+		
77.	Pied Avocet *Recurvirostra avosetta*	common	M, B			+		
78.	Common Oystercatcher *Haematopus ostralegus*	common	M			+		
79.	Green Sandpiper *Tringa ochropus*	low	M			+		
80.	Common Sandpiper *Actitis Hypoleucos*	common	M			+		
81.	Wood Sandpiper *Tringa glareola*	rare	M			+		

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
82.	Common Greenshunk *Tringa nebularia*	rare	M			+		
83.	Common Redshunk *Tringa totanus*	low	M			+		
84.	Marsh Sandpiper *Tringa stagnatilis*	rare	M			+		
85.	Spotted Redshunk *Tringa erythropus*	low	M			+		
86.	Red-necked Phalarope *Phalaropus lobatus*	low	M			+		
87.	Ruff *Phylomachus pugnax*	low	M			+		
88.	Temminck's Stint *Calidris temminckii*	low	M			+		
89.	Culew Sandpiper *Calidris ferruginea*	low	M			+		
90.	Little Stint *Calidris minuta*	low	M			+		
91.	Dunlin *Calidris alpina*	low	M, W			+		
92.	*Common Snipe* *Gallinago gallinago*	low	M			+		
93.	Black-tailed Godwit *Limosa limosa*	rare	M	IUCN-NT, UzRDB-VU		+		
94.	Bar-tailed Godwit *Limosa lapponica*	rare	M			+		
95.	Eurasian Curlew *Numenius arquata*	rare	M	IUCN - NT, UzRDB- VU		+		
96.	Whimbrel *Numenius phaeopus*	rare	M			+		
97.	Slender-billed Culew *Numenius tenuirostris*	rare	M	IUCN -CR, UzRDB-CR		+		
98.	Collared Pratincole *Glareola pratincola*	common	M, B			+		+
99.	Black-winged Pratincole *Glareola nordmanni*	rare	M	UzRDB-VU, IUCN-NT		+		
100.	Yellow-legged Gull *Larus cachinnans*	common	M, B, W			+		
101.	Black-headed Gull *Larus ridibundus*	common	M, B, W			+		
102.	Slender-billed Gull *Larus genei*	low	M, B, W			+		
103.	Gull-billed Tern *Gelochelidon nilotica*	low	M, B			+		
104.	Caspian Tern *Hydroprogne caspia*	common	M, B			+		
105.	Common Tern *Sterna hirundo*	common	M, B			+		
106.	Little Tern *Sterna albifrons*	common	M, B			+		
107.	Black-bellied Sandgrouse *Pterocles orientalis*	common	R		+	+		
108.	Rock Dove *Columba livia*	common	R		+	+	+	+
109.	Collared Dove *Streptopelia decaocto*	common	R		+			+
110.	Turtle Dove *Streptopelia turtur*	low	B	IUCN -VU, UzRDB-VU	+			+

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
111.	*Oriental Turtle Dove* *Streptopelia orientalis*	low	M		+			+
112.	Laughing Dove *Streptopelia senegalensis*	low	R		+			+
113.	Common Cuckoo *Cuculus canorus*	low	M, B			+		
114.	Eagle Owl *Bubo bubo*	rare	R		+		+	
115.	Little Owl *Athene noctua*	common	R		+		+	
116.	Europian Nightjar *Caprimulgus europaeus*	low	M		+			
117.	Egyptian Nightjar *Caprimulgus aegyptius*	low	M		+			
118.	Common Swift *Apus apus*	common	M		+		+	+
119.	European Roller *Coracias garrulus*	common	M, B	IUCN - NT	+	+	+	+
120.	European Bee-eater *Merops apiaster*	common	M		+	+	+	+
121.	Blue-cheeked Bee-eater *Merops persicus*	common	M, B		+	+	+	+
122.	Eurasia Hoopoe *Upupa epops*	common	R		+	+	+	+
123.	Sand Martin *Riparia riparia*	common	M		+	+		+
124.	Barn Swallow *Hirundo rustica*	common	M, B		+	+		+
125.	Red-rumped Swallow *Hirundo daurica*	low	M		+	+		+
126.	Crested Lark *Galerida cristata*	common	R		+			
127.	Lesser Short-toed Lark *Calandrella rufescens*	common	M, B		+			+
128.	Red-capped Lark *Calandrella cinerea*	low	M, B		+		+	
129.	Calandra Lark *Melanocorypha calandra*	common	M		+			
130.	Tawny pipit *Anthus campestris*	common	M		+	+	+	+
131.	Tree pipit *Anthus trivialis*	common	M		+	+	+	+
132.	Yellow wagtail *Motacilla flava*	common	M		+	+	+	+
133.	Citrine Wagtail *Motacilla citreola*	common	M		+	+	+	+
134.	White Wagtail *Motacilla alba*	common	M, W		+	+		+
135.	Pied Wagtail *Motacilla personata*	common	M, B		+	+		+
136.	Isabelline shrike *Lanius isabellinus*	low	M		+			+
137.	Long-tailed Shrike *Lanius schach*	rlow	M		+			+
138.	Great grey shrike *Lanius excubitor*	low	M		+			+
139.	Asian Grey Shrike *Lanius pallidirostris*	common	B, M		+			+

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
140.	Red-backed Srike *Lanius collurio*	common	M		+			+
141.	Turkestan Shrike *Lanius phoenicuroides*	common	M		+			+
142.	Common Starling *Sturnus vulgaris*	common	M,W		+	+		+
143.	Rose Starling *Pastor roseus*	common	M					+
144.	Indian Myna *Acridotheres tristis*	common	R		+			+
145.	Magpie *Pica pica*	common	R		+			+
146.	Eurasian Jackdaw *Corvus monedula*	common	M		+	+		
147.	Rook *Corvus frugilegus*	common	M, W		+	+		
148.	Carrion Crow *Corvus corone*	low	R		+	+		
149.	Hooded Crow *Corvus cornix*	low	M, W		+			
150.	Brown-nacked Raven *Corvus ruficollis*	low	R		+		+	
151.	Eastern Rock Nuthatch *Sitta terphonota*	low	R				+	
152.	Pddyfied Warbler *Acrocephalus agricola*	common	M, B		+	+		+
153.	Clamorous Reed Warbler *Acrocephalus stentoreus*	common	M, B		+	+		+
154.	Grear Reed Warbler *Acrocephalus arundinaceus*	common	M		+	+		+
155.	Booted Warbler *Hippolais caligata*	common	M		+	+		+
156.	Syke's Warbler *Hippolais rama*	low	M, B		+			+
157.	Common Whitethroat *Sylvia communis*	low	M		+			+
158.	Lesser Whitethroat *Sylvia curruca*	low	M		+			+
159.	Desert Warbler *Sylvia nana*	rare	B		+			
160.	Ciffchaff *Phylloscopus collybita*	common	M		+			
161.	Scrub Warbler *Scotocerca inquieta*	low	R		+			
162.	Spotted Flycather *Muscicapa striata*	low	M		+			
163.	Common Stonechat *Saxicola torquata*	low	M		+			+
164.	Pied bushchat *Saxicola caprata*	low	M, B		+			+
165.	Bluethroat *Luscinia svecica*	common	M		+			+
166.	Black Redstat *Phoenicurus ochruros*	common	M		+			+
167.	Nothern Wheatear *Oenanthe oenanthe*	rare	M		+		+	
168.	Pied Wheatear *Oenanthe pleschanka*	common	M, B		+		+	

№	Species	Number	Nature of stay	Conserva-tion status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
169.	Variable wheatear *Oenanthe picata*	low	M, B				+	
170.	Finschs Wheatear *Oenanthe finschii*	low	M, B				+	
171.	Black-eared Wheatear *Oenanthe hispanica*	low	M, B				+	
172.	Deser Wheatear *Oenanthe deserti*	low	M,B		+			
173.	Isabelline Wheatear *Oenanthe isabellina*	low	M, B		+			
174.	Rufous Scrub Robin *Cercotrichas galactotes*	low	M,B		+			
175.	Common Nightingale *Luscinia megarhynchos*	low	M		+		+	+
176.	Thrush Nightingale *Luscinia luscinia*	low	M		+			
177.	Bearded Reedling *Panurus biarmicus*	common	R			+		
178.	Turkestan Tit *Parus bokharensis*	low	R		+			+
179.	House sparrow *Passer domesticus*	low	M					+
180.	Indian sparrow *Passer indicus*	common	M, B		+			+
181.	Eurasian tree sparrow *Passer montanus*	common	R		+			+
182.	Desert Finch *Rhodospiza obsoleta*	common	R		+			
183.	Reed bunting *Emberiza schoeniclus*	common	M, B		+	+		+
184.	Желчная овсянка *Emberiza bruniceps*	rare	M, B		+	+		+
185.	Corn Bunting *Emberiza calandra*	common	M					+

Note
Nature of stay: M - migration, B - breeding, W - wintering, R - resident
Conservation status:
UzRDB - Red Book of the Republic of Uzbekistan, IUCN - IUCN Red List.

Analysis of existing data showed that ornithologic fauna of the project area is represented by 185 bird species, 22 of which are resident birds (Table 1). About 50 species are nesting. Many birds inhabit the territory during seasonal migrations or post-nesting nomadic migrations. According to the literature data 20 globally endangered species are found here. 35 species are registered in the National Red Book.

The typical inhabitants of the desert are larks, wheatears, finches, sandgrouse and small birds of prey.

Uzbekistan is located on the historical Central Asian migration route of birds from Western Siberia and Kazakhstan to Indo-Pakistan, Iran-Caspian and African flyways (Figure 2). The main flyways covering the territory of Uzbekistan are presented in the following scheme. Familiarity with this scheme shows that there are 3 flyways passing through the territory of Uzbekistan: Black Sea-Mediterranean, East African-West Asian and Central Asian.

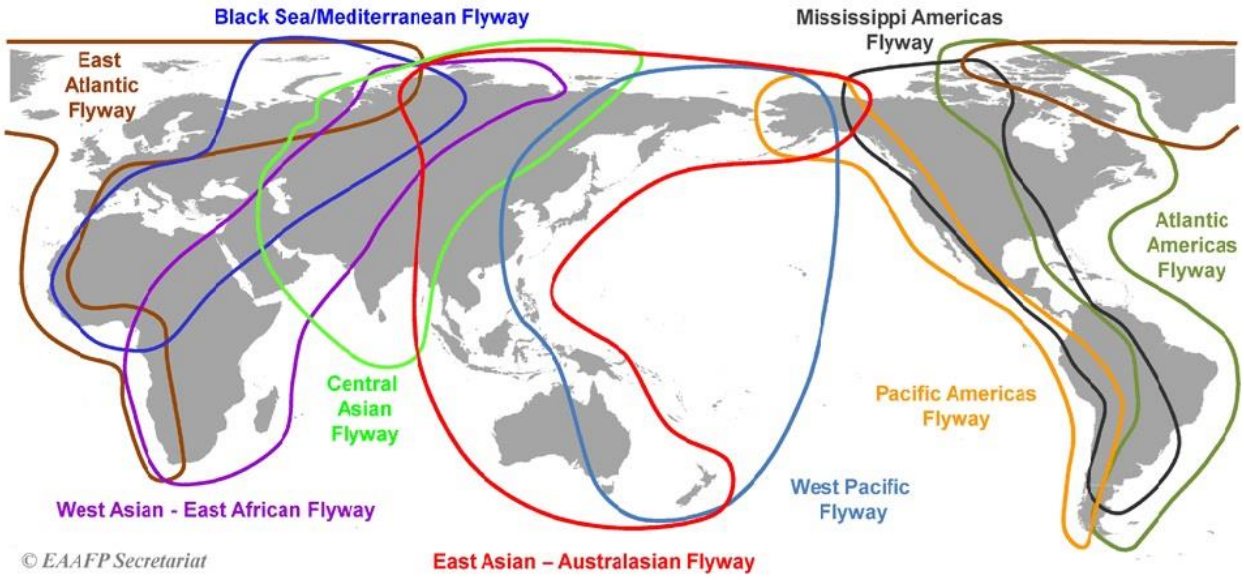

Figure 2.Main flyways (East Asian–Australasian Flyway Partnership Secretariat)

Of the 434 bird species inhabiting Uzbekistan, only 10-15% of the species is settled in different areas. The remaining birds are migratory.

Several major ecological groups can be distinguished among migratory birds according to their nature of stay:

- Species arriving to Uzbekistan for nesting from India, Pakistan, Afghanistan, Iran, North and West Africa.
- Species arriving to Uzbekistan for wintering from Western Siberia, Kazakhstan, Kyrgyzstan, Aral Sea region (outside Uzbekistan), Northern Caspian Sea region.
- Transit migrating birds crossing the territory of Uzbekistan during seasonal migrations and stopping here only for resting and feeding in order to replenish energy resources required to continue their flyway.

The main wintering grounds of birds are located mainly to the south of the average winter isotherm 0°C. In Uzbekistan, it passes approximately along the Zarafshan River. Consequently, all species arriving in Uzbekistan for wintering spend it in the southern regions of the republic, i.e. practically they cross the country in the southern direction.

In Uzbekistan the spring migration period starts from the end of February (in the south) to early March. Early migrants fly first and include geese, ducks, crow family species and others. The main flyway of many species through Uzbekistan takes place in March and April. There are also late migrants, represented mainly by insectivore species. These are the birds such as swallows, orioles, Eurasian rollers, bee-eaters, nightjars, doves and sparrows. In general, spring migration ends by the end of May. During the summer months, waders continue to migrate and after reaching the tundra begin their return migration almost immediately.

Autumn migration starts in the second half of August and lasts almost until December. The main wintering grounds of various bird species in Uzbekistan are formed from October to December.

Thus, most of the year (nearly 9 months) in Uzbekistan there is a change in the species composition of birds and their territorial distribution.

Special studies of migration in the Central Asian region under the program "Asia" in the 1980s showed that the night migration of all groups of birds over the mountains and deserts of Central Asia and Kazakhstan passes everywhere from the eastern shore of the Caspian Sea to the eastern border of the Tian Shan. Moreover, up to 90% of all migrating birds fly over Central Asia at night and at considerable altitudes, while the rest fly during daylight time. According to Dolnik V.R. and Bolshakov K.V. (1985), the spring night flight

over deserts passes everywhere in a wide formation without forming densities along ecological waterways.

There are two general directions of night migration over Central Asia. One (northwest) is formed by birds that wintered in South Asia. The other (northeastern) is formed by both migrating birds that wintered from Africa to Iran and by birds that wintered in South Asia, but which go around the mountains and high mountain deserts of Central Asia. The overlapping of these three streams of different origin in the band from the western edge of the Himalayas to the central part of the Kopetdag leads to a sharply increased density of night flight in the area between the southwestern Tian Shan and the Kopetdag, persisting northward as far as the latitude of the Aral Sea. Thus, globally, migratory birds do not fly around the arid and mountainous areas of Central Asia in spring, which increases the likelihood of collisions between birds and OHTL.

In recent years, the world community has paid increasing attention to the conservation of cranes, one of the oldest systematic groups of birds. In Uzbekistan, mainly two species of cranes migrate: Demoiselle Crane *Anthropoides virgo* and Common Crane *Grus grus* (Lanovenko, Kreitzberg, 2002, Gavrilov, Van Der Ven. 2004). They are found during migration in many areas of the republic.

It is defined, that migrating birds cross the territory of Uzbekistan mainly from the south-west to the north-east in spring and in the opposite direction in autumn. On their way they encounter various threats, including collisions with power lines. If OHTL is located perpendicular to the direction of bird movements, it poses a greater danger to birds than OHTL located parallel. The future OHTL Bash-Karakul is located almost parallel to the prevailing direction of migrating birds, however, the proximity of the water body increases the risks for both wetland birds and desert inhabitants, who use the lake as a watering здфсу, food base, etc.

Collisions with OHTL

The use of electricity is one of the achievements of technological progress of mankind. Various capacity OHTL (up to 500 kV) are used to transmit it from source to consumer, which pose a certain danger to migratory birds.

On the one hand, OHTL towers serve as roost sites for some species of birds, especially birds of prey, and especially in open landscapes, which attracts them to OHTL. On the other hand, when birds land on poles or fly between the wires, they are at risk of being electrocuted as a result of the resulting short circuit or simply from physical injury from striking wires. An increased risk of electrocution exists if birds have wet or damp feathers. Smaller birds landing on towers or wires are generally not at risk. However, bad weather conditions such as fog, rain or snow, as well as darkness, can make power lines invisible and therefore dangerous for any type of bird to collide with OHTL wires. As a result of the collision, birds can be physically injured, electrocuted, or burned in the resulting electrical arc. Falling burning birds can cause fires, both in natural habitats and in man-made landscapes. An international estimate is that 5 to 15% of all power lines can cause birds to collide with wires (IMBD Information, April 2005).

In Uzbekistan, there are known facts that during spring and autumn migrations medium and large size birds die on power lines, among them prevail mostly rare and endangered species - Steppe eagle, Golden eagle, Eastern imperial eagle, Osprey, Short-toed eagle, Saker falcon, White stork, Dalmatian pelican, Eurasian eagle-owl and others (Abdunazarov, 1987; Shernazarov, Lanovenko,1994; Lanovenko, 2007, Lanovenko, 2017).

Surveys were conducted in Tashkent, Djizak, Surkhandarya, Kashkadarya, Bukhara, Namangan and Ferghana regions of the republic to establish the scale of bird mortality on OHTL (without specifying their capacity). The length of surveyed lines was more than 2000 km in open landscapes (Abdunazarov, 1987). The estimated number of birds mortality on OHTL is up to 50 birds of prey in the Ferghana Valley, Samarkand and

Surkhandarya regions (mainly Buzzards and Common kestrels); from 50 to 100 birds in the Tashkent, Syrdarya and Kashkadarya regions (mainly Buzzards and Common kestrels); from 300 to 500 birds in the Jizzak region (Eagles, Buzzards, Ospreys, Kestrels); from 200 to 500 birds in the Navoi and Bukhara regions (Eagles, Buzzards, large Falcons, Kestrels). Moreover, among them, many species have a high conservation status, as they are listed in the national Red Book, the international list of globally threatened species, as well as in the annexes of international conventions on migratory species (Bonn) and CITES. Birds of prey tend to die by using OHTL towers as roost sites. To expand the geography and specify the species composition of birds of prey that die from electrocution, we will provide some materials of the same author (Abdunazarov, 1990) on birds of prey dying on 6-10 kV OHTL: during 1981-1984 in the Farish steppe (Jizzak region) on a 30 km section 3 Ospreys *Pandion haliaetus*, 16 Steppe Eagles *Aquila nipalensis*, 1 Eastern imperial eagle *Aquila heliaca*, 1 Golden Eagle *Aquila chrysaetus* and 3 Short-toed eagles *Circaetus gallicus* were found dead. On 26/04/89, 64 birds of prey of 12 species were recorded dead in the same area. Among them were 1 Osprey, 2 White-tailed Eagle *Haliaeetus albicilla*, 2 Short-toed eagles, 11 Steppe Eagles, 1 Golden Eagle, 1 Eastern imperial eagle and 2 Saker Falcons *Falco cherrug*. In both cases, all the mentioned species are listed in the Red Book of Uzbekistan (2019).

Birds of prey are generally more often die from electrocution when using OHTL towers as roost sites. In the central part of the Kyzylkum desert in September 2007, a Golden eagle, Steppe eagle, Griffon vulture and Houbara bustard were found dead from electrocution under the OHTL connected to the Navoi Mining and Metallurgical Plant (Kashkarov, 2007; IBA project newsletter in Uzbekistan, 2007). These species are also listed in the Red Book of Uzbekistan.

However, different species of birds often die as a result of direct collision with wires as well. Such species include small passerines (Larks, Warblers), Waders, Rails (Corn crake), Pterocles (black-bellied sandgrouse), quail and others. According to Nazarov A.P. and Zagrebin S.V. (1987), quail regularly collide with OHTL during spring and autumn migrations.

Constant monitoring to analyse the impact of OHTLs on birds was not conducted in Uzbekistan. In the Central part of the Kyzylkum desert in the period from 1997 to 2007, M.G. Mitropolsky (2009) collected remains of birds of prey that died on OHTL in order to collect shoulder bones. In total, he collected 71 specimens of 14 species of birds of prey in this area: *Accipiter gentilis (1 speciment), Buteo buteo (1), Buteo rufinus (22), Circus cyaneus (2), Cyrcus aeruginosus (1), Aquila chrysaetos (19), A. heliaca (2), A.nipalensis (7), A.clanga (5), Aegypyus monachus (2), Gyps fulvus (2), Neophron percnopterus (1), Circaetus gallicus (3), Falco tinnunculus (2).*

OHTLs located near water bodies, which are places of waterfowl concentration, pose a particular danger. According to the Institute of Zoology of the Academy of Sciences of Uzbekistan, Dalmatian Pelicans *Pelicanus crispus* regularly die on the 220 kV OHTL that runs from Kyzyltepa substation along the western shore of Tudakul Lake (Navoi region). During the 2002-2005 winter surveys, up to three dead birds were regularly found here. During the visit to the lake in January 2004, 7 dead burnt birds were found under wires at once (Lanovenko, 2007).

Birds have also been known to cause short-circuits in the electric power industry, causing outage of high voltage lines, resulting in economic losses due to power outages at enterprises, but not leading to bird deaths (Shernazarov & Lanovenko, 1994).

Some birds are killed by mechanical collisions with wires during flight, more often during poor visibility at night or unfavorable weather conditions. It is especially difficult to avoid collision with wires for large birds that do not have good maneuverability or fly with high speed. In Uzbekistan, there are known cases of cranes, black-bellied grouse, kestrel, quail, corncrake and many other species dying from collision with wires.

Some birds are killed by mechanical collisions with wires during flight, more often during poor visibility at night or unfavorable weather conditions. It is especially difficult to avoid collision with wires for large birds that do not have good manoeuvrability or fly with high speed. In Uzbekistan, there are known cases of Demoiselle cranes, Black-bellied sandgrouse, Kestrel, Quail, Corn crake and many other species dying from collision with wires.

One of the features of modern bird ecology is their adaptation to nesting on OHTL towers. In Central Kyzylkum, we have repeatedly found Kestrel *Falco tinnunculus* nests on the OHTL. Researches of O. Mitropolsky, E. Fotteler and G. Tretiakov (1987) established nesting of Golden eagle and Saker falcon on OHTL in Kyzylkum, which allowed these species to expand their breeding ground deep into the desert. According to Zinoviev S. estimate (1990), up to 40% of nests of the Golden Eagle and 33% of nests of the Saker Falcon were located in the Kyzylkum Desert on OHTLs.

Specific data on peculiarities of daily bird migration along the route of the future overhead line are missing. There is no direct evidence that there is any narrow migration route for migrating birds in the Project area. However, analysis of information on existing global bird migration routes and evidence of the existence of wide-frontage migration in the whole territory of Uzbekistan suggests it is passing along the Project route as well. Thus, it is possible to talk about bird migration in the area of the Project route and in the adjacent areas in a broader sense (at region level).

Calculation of bird mortality on OHTLs in the Kyzylkum desert

There are no real statistics on bird deaths on OHTLs in Uzbekistan. There are data on bird mortality on the 220 kV OHTL running through the central part of the Kyzylkum desert from Yangigazgan to Uchkuduk and further to the north-east.

Like the project area, the Kyzylkum desert is an arid zone characterized by an open landscape and small desert lowlands. Bird migration through Kyzylkum is most active in spring. To determine the approximate level of bird mortality, available information on this OHTL was used. The surveyed 220 kV OHTL runs a short distance along a road, the total length of which is about 320 km. In the third decade of October, which is usually the time of late migrants' flyway in Uzbekistan, eight sections of 220 kV OHTLs with a total length of 140 km were surveyed in 2007 (Table 2).

Table 2.Data on birds collected dead under OHTLs in the central part of the Kyzylkum Desert based on the result of the October 2007 survey (Navoi region, Uzbekistan).

Survey date	Section name	OHTL length	Types and number of died birds	OHTL capacity, kV	Comments
18.10.2007	Karakata - Ayakkuduk	20 km	Calandrella rufescens – 4 Galerida cristata – 1 Philloscopus collibita – 1 Sylvia communis 1	220 кV	(150-130 km)
18.10.2007	Route to Chimbay	15 km	Gyps fulvus – 1 Aquila chrysaetos – 1 A.nipalensis – 1 Falco tonnunculus – 1 Galerida cristata – 1 Buteo rufinus - 1	220 kV	(85-70 km)
19.10.2007	Route to Kyzylkuduk settlement	10 km	Coturnix coturnix – 1 Calandrella rufescens – 2	220 kV	From west to east (460-470 km)
19.10.2007		5 km	Aquila chrysaetos – 2 Calandrella rufescens – 1	220 kV	Under OHTL from north to south
19.10.2007		5 km	Calandrella rufescens – 2	220 kV	Along OHTL parallel to the railway
19.10.2007	Zeravshan - Uchkuduk	10 km	Calandrella rufescens – 1	220 kV	In Kuntay farm area (229-239 km)
19.10.2007	Zeravshan - Uchkuduk	10 km	Calandrella rufescens – 1 Emberiza shoeniclus - 1	220 kV	10 km NW Kuntay (241-251 km)
21.10.2007	Route to Akbaytal	30 km	Alauda arvensis – 1 Calandrella rufescens – 3	220 kV	In Saginbay coll. area (75-105 km)
22.10.2007	Route to Kulkuduk settlement	10 km	No dead birds	220 kV	(15-25 km)
23.10.2007	Uchkuduk - Navoi	5 km under each, 15 total	No dead birds	220 kV	3 parallel OHTL (telegraph and 2 OHTL). Distance between them is 100-150 m (169-164 km)
24.10.2007	Kenimekh-Yangigazan	10 km	Chlamydotis undulate – 1 Calandrella chelensis – 1 Calandrella rufescens – 1 Philloscopus collibita – 1	220 kV	(40-45 km) from both sides of the road

Bird mortality rate calculated by us on this OHTL was 12.2 birds per 100 km. The dead birds were represented by 9 species. The dominant species is the Short-toed lark *Calandrella rufescens*. The mortality rate of this species was 7.77 individuals per 100 km. This figure can be useful in comparative assessment of mortality along the OHTL in the Project area.

Identification of bird concentrations along the Project route and development of measures to reduce potential bird mortality during the Project implementation will reduce the current level of bird mortality.

MATERIALS AND METHODS.

Field surveys on the route were carried out to identify details of the landscape characteristic picture, as well as possible places of migratory birds' concentration.

Field surveys were conducted in period from May to November 2021 according to the methodology agreed by the client.

We were moving along the route between "Vantage Points" directly along the project route line or near it depending on the availability of access roads. The distance from the project route in some places was generally not more than 1-2 km. However, given the landscape homogeneity of the surveyed section, we deem it acceptable to draw analogies between the surveyed area adjacent to the route and the route itself.

Visual observations of birds were made during the route survey. Bird sighting points were also marked using GPS. Bird species were identificated visually using field binoculars with 8x magnification and Fujifilm XT-20 digital cameras as well as audio recordings of bird voices (Xeno-canto Asia) and field bird identifiers (Mullarney, Svensson, Zetterstrom, Grant, 1999; Aye, Schweizer, Roth 2012).

Surveys were conducted at 15 selected points, in 1 km radius sections. Duration of observations was not less than 40 minutes at each vantage point.

The territorial location of vantage points is shown in Figure 3.

Figure 3. Survey points on the project OHTL route.

A description of the habitats is provided in APPENDIX 1.

SURVEY RESULTS

The Kyzylkum desert is a place of active migration and wintering of some species of large birds of prey, including buzzards, harriers, eagles and large falcons characterized by the trophic type of migration. These birds do not migrate in a way of a “strait throw”, but constantly move in the right direction, simultaneously making foraging movements. This biological peculiarity of these birds determines the necessity of regular use of roost sites, so in steppe landscape and absence of tree vegetation, OHTL poles are very attractive for birds of prey, which creates a potentially dangerous situation.

Surveys of the route of Project line showed that the area of the line is represented by open habitats. The survey of the route of the Project Line took place at the very end of the spring migration, summer period and autumn migration. These data indicate the possible impact of OHTL on migrating and nesting birds and the need for further monitoring surveys during the migration period to control project impact and avoiding any serious affections. During the survey along the Project route, we found nests of Common Kestrel on the existing powerlines 220kW, which are running parallel to the Project OHTL. Nesting of the Common Myna *Acridotheres tristis* and House Sparrow *Passer domesticus* were observed in non-residential nests of this species. None of these species has a high conservation status.

In the course of familiarization with the line route, no potential high-risk areas were identified. Details of the results of the ornithological survey of the route are given in monthly reports (may-november).

Two nests of Golden Eagles were found on anchor poles near Ayakagitma Lake, however, the birds were not nesting this year. At the time of the survey, Indian Sparrows were nesting in the remains of one of the nests.

95 species of birds were recorded during the survey period. The number of observed birds was higher in June, which could be explained by the end of the nesting period in small passerines, appearance of juveniles and less hidden way of life.

Among the mentioned species 20 are resident and 18 are nesting. The rest of the species visit the area during migration periods.

The greatest species diversity was observed in areas with water bodies and agricultural lands (VPs 1,2,13,14,15). These are areas near the Ayakagitma lake and Karakul oasis. Border landscapes attract a greater number of birds due to a greater diversity of shelters, food resources, etc.

Table 3. The summary list of observed species

Species		Month						
		may	jun	jul	aug	sep	oct	nov
Great Egret	Egretta alba		11	1		2	3	2
Grey Heron	Ardea cinerea	4	8	3	3	1	2	3
Purple Heron	Ardea purpurea		3	2	2		1	
Mallard	Anas platyrhynchos						12	11
Black Kite	Milvus migrans	2						3
Hen Harrier	Circus cyaneus						2	1
Marsh Harrier	Circus aeruginosus	6	9	9	8	5	5	6
Shikra	Accipiter badius	1						
Long-legged Buzzard	Buteo rufinus	3	4	3	2	5	3	3
Common Buzzard	Buteo buteo				2	1	1	1
Short-toed Eagle*	Circaetus gallicus	1						
Golden Eagle*	Aquila chrysaetos				1			

White-tailed Sea-eagle*	Haliaeetus albicilla						1	
Egyptian Vulture*	Neophron percnopterus		3	2	2			
Eurasian Hobby	Falco subbuteo					1		
Common Kestrel	Falco tinnunculus	5	8	5	6	4	5	4
Common Pheasant	Phasianus colchicus	5	4	1		3	1	2
Moorhen	Gallinula chloropus	1	11	6		3	6	9
Houbara bustard*	Chlamydotis undulata	3		1	1	2	5	
Little Ringed Plover	Charadrius dubius	6	3					
Sand Plover	Charadrius leschenaultii	4	8					
White-tailed lapwing	Chettusia leucura	6	12					
Black-Winged Stilt	Himantopus himantopus	4	18	6				
Green Sandpiper	Tringa ochropus	3	4					
Wood Sandpiper	Tringa glareola	2						
Temminck's Stint	Calidris temminckii	2						
Eurasian Curlew*	Numenius arquata	4	2					
Collared Pratincole	Glareola pratincola	22	13					
Black-Headed Gull	Larus ridibundus						4	11
Caspian Tern	Sterna hirundo		3	1				2
Black-bellied Sandgrouse	Pterocles orientalis	2	16	12	12	14	9	4
Wood Pigeon	Columba palumbus		7	3		3	2	
Rock Dove	Columba livia	11	119	107	224	66	235	147
Collared Dove	Streptopelia decaocto	2	21	39	29	2	23	29
Oriental Turtle Dove	Streptopelia orientalis	1			84	8	7	
Laughing Dove	Streptopelia senegalensis	2	8	2	4	5	9	31
Common Cuckoo	Cuculus canorus					2		
Little Owl	Athene noctua	3	5	1	3	2	3	3
Egyptian Nightjar	Caprimulgus aegyptius	1	3		2			
Northern Swift	Apus apus	17	43					
Eurasian Roller*	Coracias garrulus	11	22	14	31	3		
Common Kingfisher	Alcedo atthis			3	1	2	2	
European Bee-eater	Merops apiaster	21	22	44	62	11		
Blue-cheeked Bee-eater	Merops superciliosus	63	157	204	58	207	35	
Hoopoe	Upupa epops	6	4	1	1		3	1
Sand martin	Riparia riparia	1	48					
Barn Swallow	Hirundo rustica	43	244	144	135	31		
Crested Lark	Galerida cristata	78	80	61	49	47	28	69
Lesser Short-toed Lark	Calandrella rufescens	10	61		33	22	26	44
Yellow Wagtail	Motacilla flava			2				
Black-headed Wagtail	Motacilla feldegg	2	10		2			
Citrine Wagtail	Motacilla citreola	3	5		1			
White Wagtail	Motacilla alba	2	15	4	4			2
Pied Wagtail	Motacilla personata	6	15	2	8	7	6	3
Lanius collurio	Lanius collurio	2	1		3			
Lesser Grey Shrike	Lanius minor	1		2	3	2		
Great (Gray) Shrike	Lanius excubitor							2
Steppe Grey Shrike	Lanius pallidirostris			4	4	4		
Turkestan Shrike	Lanius phoenicuroides	1						
Starling	Sturnus vulgaris						46	286
Indian Myna	Acridotheres tristis	21	67	19	35	46	43	44

Magpie	Pica pica	5	18	20	11	5	13	23
Pander's ground Jay	Podoces panderi					3	1	
Jackdaw	Corvus monedula							22
Eurasian Rook	Corvus frugilegus	35	19	49	75	110		706
Eurasian Hooded Crow	Corvus cornix							142
Brown-necked Raven	Corvus ruficollis	5	6	4	7	5	3	2
Common Raven	Corvus corax							3
Clamorous Reed Warbler	Acrocephalus stentoreus	21	34	16	27			
Southern Booted Warbler	Hippolais rama	1	4					
Sylvia nisoria	Sylvia nisoria	1						
Orphean Warbler	Sylvia hortensis	6	4					
Common whitethroat	Sylvia communis	1						
Lesser whitethroat	Sylvia curruca	4	1					
Desert Warbler	Sylvia nana	2	3					
Chiffchaff	Phylloscopus collybita	6		2				
Streaked Scrub Warbler	Scotocerca inquieta	10	13	2	6	2		2
Spotted Flycather	Muscicapa striata	1						
Common stonechat	Saxicola maurus	2	6					
Pied Stonechat	Saxicola carpata	1						
Northern Wheatear	Oenanthe oenanthe	2	7					
Black-necked Wheatear	Oenanthe finschii	8	10	5	7	5	2	2
Desert Wheatear	Oenanthe deserti	1	8	5	11	2		
Isabelline Wheatear	Oenanthe isabellina	7	25	37	35	16	15	13
Rufous-tailed Rock Thrush	Monticola saxatilis	1						
Thrush nightingale	Luscinia luscinia	1						
Bluethroat	Luscinia svecica	1						
Indian Sparrow	Passer indicus	174	277		42			
Spanish Sparrow	Passer hispaniolensis	22	62	196	70	24	45	205
Tree Sparrow	Passer montanus	8	14					77
Chaffinch	Fringilla coelebs						7	29
Brambling	Fringilla montifringilla							15
Desert Finch	Rhodospiza obsoleta	18	36	7	14	18		8
Corn Bunting	Emberiza calandra	4						
Red-headed Bunting	Emberiza bruniceps	4						
Total bird number		**746**	**1644**	**1051**	**1120**	**701**	**614**	**1972**
Total species		**70**	**57**	**43**	**43**	**39**	**36**	**40**

From the threatened species Egyptian vulture, Short-toed Eagle, Golden Eagle, White-tailed sea Eagle, Eurasian Curlew, Houbara bustard and European Roller were observed during the survey.

Table 4. Distribution of the threatened species on a project territory.

		Observation place (VP)						
Species	**Status**	**may**	**jun**	**jul**	**aug**	**sep**	**oct**	**nov**
Short-toed Eagle Circaetus gallicus	UzRDB -VU	AA*						
Golden Eagle Aquila chrysaetos	UzRDB-VU				VP10			
White-tailed Sea-eagle Haliaeetus albicilla	UzRDB-VU						VP2	
Egyptian Vulture Neophron percnopterus	IUCN-EN, UzRDB-VU		VP1, VP3-4	VP1	VP 3-4			

Houbara bustard Chlamydotis undulata	UzRDB-VU, IUCN - VU	AA*		VP 3-4		VP2, VP6	VP2	
Eurasian Curlew Numenius arquata	IUCN - NT, UzRDB- VU	VP1	VP1					
Eurasian Roller Coracias garrulus	IUCN - NT	everywhere					-	-

*AA – Ayakagitma Lake

No nesting places of the Egyptian Vulture were identified on the project area. The observed birds are probably nonbreeding nomadic individuals. As we can see from the table the individuals of Egyptian Vulture were recorded in the same places during the survey period. Probably they are attracted by sheepfolds.

Eurasian Curlew seen in May and June are also late migrating or summering individuals at the Ayakagitma Lake.

White-tailed Eagle is one of the wintering species of Ayakagitma Lake.

Golden Eagle is a resident species. Nesting on OHTL poles is possible in future.

Houbara bustard also breeds and visit the adjoining territories during migration period.

The Eurasian Roller breeds in cliffs throughout the adjoining area.

Other species are common inhabitants of the Kyzylkum desert and the developed area and are widely distributed throughout the adjacent territory.

Critical habitats (of particular importance for nesting or feeding of rare and other bird species) were not identified.

It should be noted that in April, as part of surveys of operating power lines, species of birds of the *Falconiformes* family (Table 5) with high conservation status were noted. Considering the trophic type of migration of birds of prey, it is reasonable to consider these encounters relevant for the project power line as well.

Table 5. Threatened species observed in the vicinity of the project area.

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Neophron perncopterus*	Egyptian Vulture	IUCN-EN, UzRDB-VU	4
2	*Pandion haliaetus*	Osprey	UzRDB-VU	2
3	*Circaetus gallicus*	Short-toed eagle	UzRDB-VU	2
4	*Aquila heliaca*	Imperial Eagle	IUCN-VU, UzRDB-VU	1
5	*Aquila chrysaetos*	Golden Eagle	UzRDB-VU	3
6	*Aquila nipalensis*	Steppe Eagle	IUCN-EN, UzRDB-VU	1

Places of registation of threatened species during the surveys are shown on fig.7.

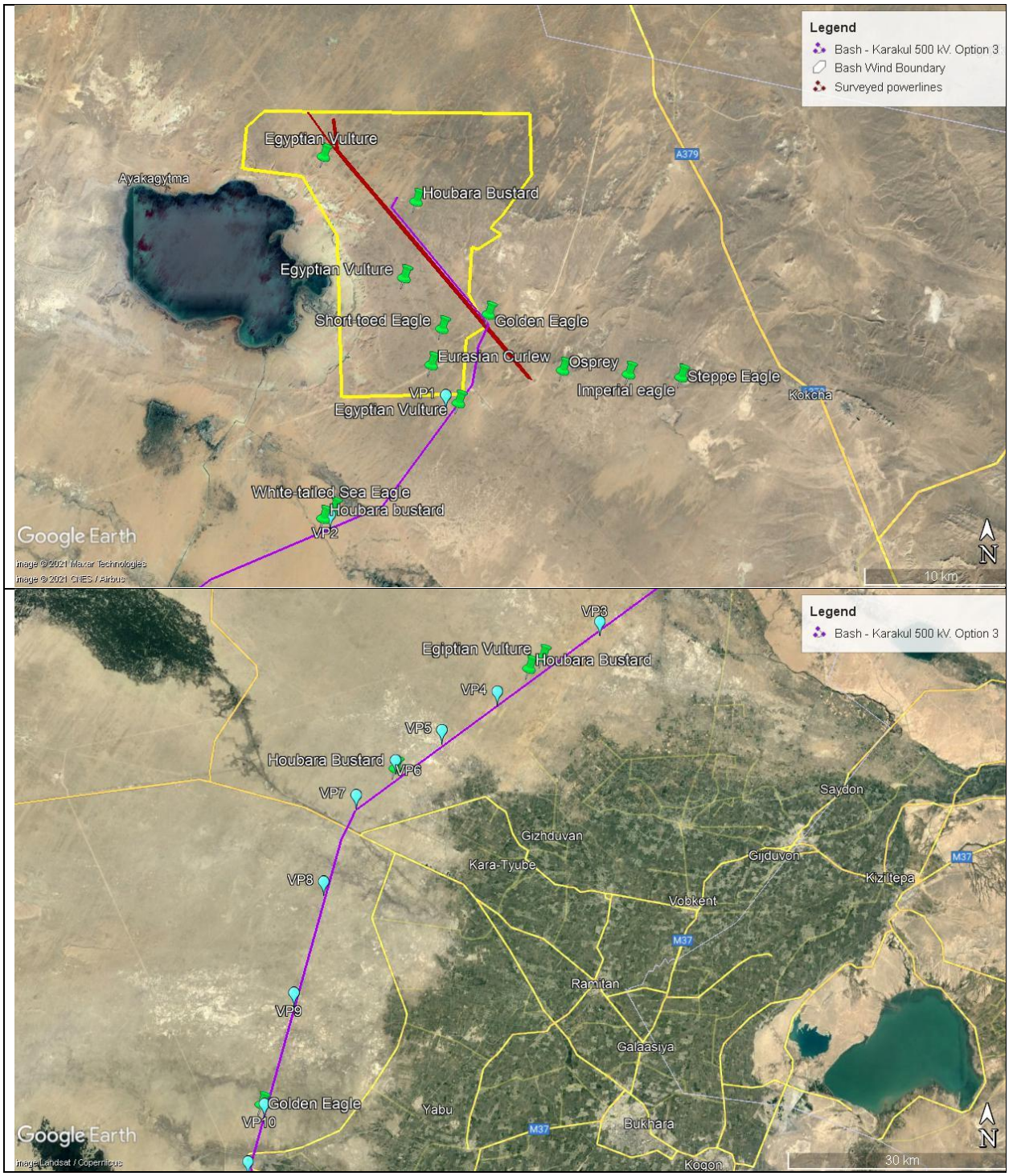

Figure 3. Places of registration of endangered species of birds (may-november 2021).

At present moment no special measures for conservation of threatened species required.

Collection of dead birds under operating OHTL

At the same time with visual observations of birds in selected locations along the project route, route surveys were conducted along existing and already operating OHTL located near the project route. The total length of the routes under OHTLs was 129 km.

Table 6. Schedule for surveying sections of existing OHTLs in the project area.

Date	Route length (km)	Route start coordinates	End-of-route coordinates	Dead birds found*
11.03.2021	12	40°35'17.96"N 64°43'51.09"E	40°40'17.16"N 64°38'17.61"E	-
04.04.2021	21	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	1
03.05.2021	5	40°35'17.96"N 64°43'51.09"E	40°37'35.91"N 64°41'16.66"E	-
05.05.2021	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-
14.05.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
25.06.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	1
27.07.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-
23.08.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-
26.09.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-
15.10.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-
24.11.2021	12	40°32'55.47"N 64°46'30.61"E	40°42'5.56"N 64°37'21.00"E	-
	1	39°42'53.78"N 63°50'31.51"E	39°42'40.96"N 63°51'19.48"E	-

*- see Table 7

During the survey in spring 2021 the remains of 3 dead birds belonging to 3 species were found.

White Pelican and White-tailed Sea Eagle are included in the Red Book of Uzbekistan. White-tailed Sea Eagle was found outside the planned routes (see Fig. 8), however, considering the significance of the species and the proximity of power lines to Ayakagitma Lake, we consider it acceptable to include this bird in the calculation. The cause of death was electrocution. White Pelican and Rufous Scrub Robin died due to collision with wires.

Table 7. List of dead birds found under operating OHTLs.

№	Latin name	English name	Number of birds	Coordinates	Date
1.	*Pelecanus onoctotalus*	White Pelican	1	40°33'57.13"N 64°45'19.97" E	04.04.2021
2.	*Haliaeetus albicilla*	White-tailed Sea Eagle	1	40°41'06" N 64°31'00" E	06.04.2021
3.	*Cercotrichas galactotes*	Rufous Scrub Robin	1	39°42'52.22"N 63°50'37.47"E	25.06.2021

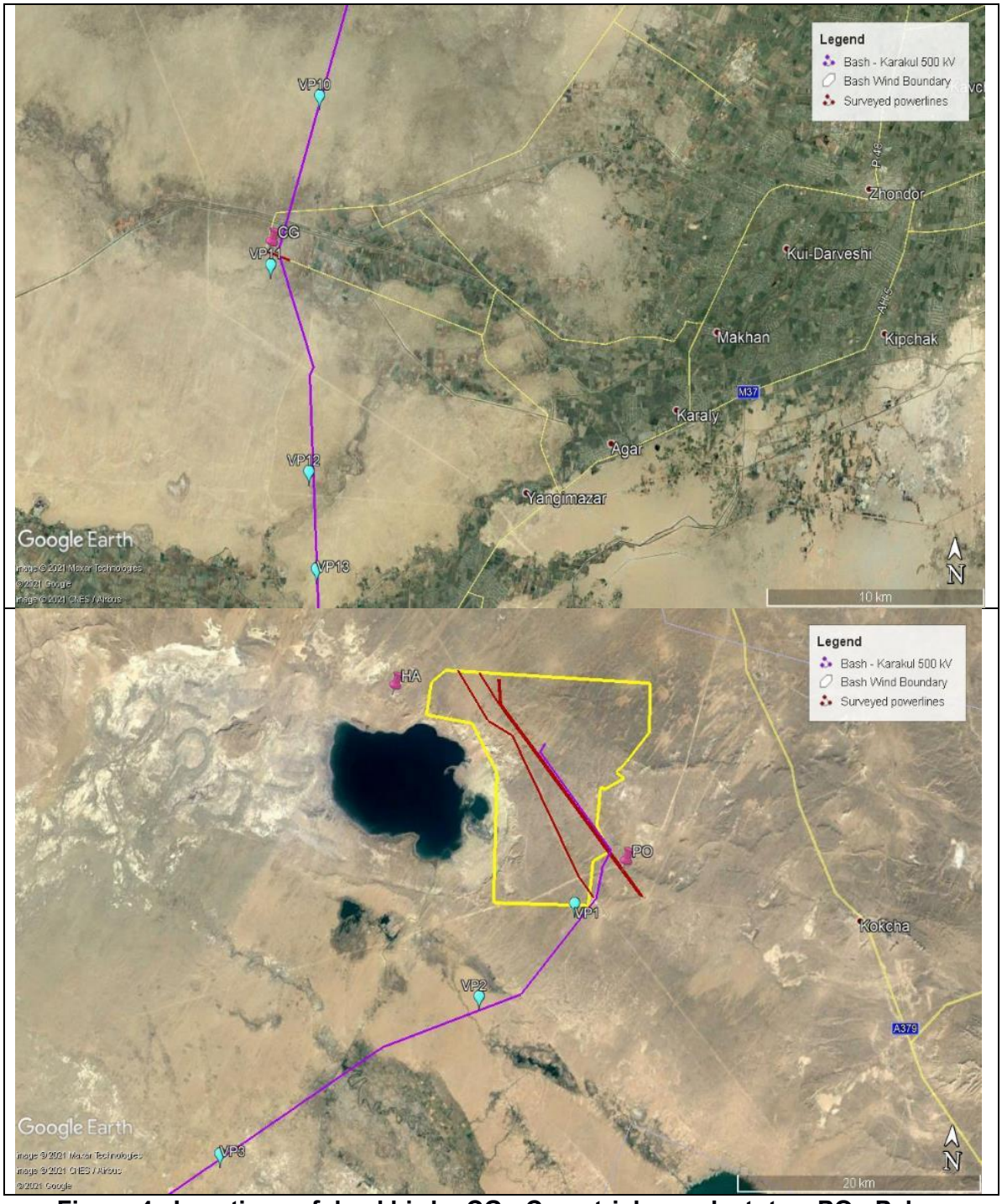

Figure 4. Locations of dead birds: CG - Cercotrichas galactotes, PO - Pelecanus onoctotalus, HA - Haliaeetus albicilla.

No dead birds or they remains were found during July-November period.

ANALYSIS OF IMPACTS AND MITIGATION MEASURES

Power lines are a threat to migrating, nesting and wintering birds during their migration from feeding to resting places. During migration, this threat is greatly increased due to the accumulation of different bird species.

For some species (Falconiformes), the death from collision with OHTL or electrocution is higher than for others.

The impact of these threats can be mitigated through the development of appropriate measures.

Table 8. Analysis of impacts on ornithological fauna and mitigation measures for construction and operation of the Project OHTL

	Impacts:	Mitigation measures:
1	Loss of habitat as a result of construction works.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic. Performing construction works during the non-breeding period. Carrying out land reclamation upon completion of works.
2	Pollution of the territory by construction and household waste. Spreading of Indian Myna over the territory. Reduction of species and quantitative composition of desert species.	Organization and control over the collection and disposal of construction and household waste.
3	Disturbance of animals caused by the presence of people, moving vehicles, machinery work.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic and people movements. Performing construction works during the non-breeding period. Limiting visits to bird habitats by construction and operating staff; Informing personnel about the need to preserve biodiversity.
4	Electrocution when birds use OHTL towers for nests and as roost sites (resting places).	Installation of protection cases that exclude electrocution of birds sitting on OHTL towers. Control of the integrity of the insulation and installed boxes.
5	Injury and death due to physical collision of birds with OHTL wires.	Equipping OHTLs with markers to ensure their visibility to birds. Control of the integrity of installed markers.

RECOMMENDED MEASURES FOR CONSERVATION OF ORNITHOLOGICAL FAUNA.

- Obligatory ecological expertise of all project decisions;
- Establishment of a protection zone of at least 1 km around Lake Ayakagitma during the design and construction of all facilities in order to reduce disturbance of waterfowl inhabiting the water-body and preservation of their nesting and feeding places.
- Installation of protection cases on OHTL towers to prevent accidental electrocution of birds on power lines.
- Installing signal markers on OHTLs in order to reduce bird mortality due to collisions with OHTL wires (markers warn birds of the danger and serve as a signal to change the altitude or direction of flight, thereby preventing collisions of birds with wires).

- Awareness of contractor personnel of vulnerable species of flora and fauna encountered in the project area and in need of protection;
- Regular ornithological monitoring (for example 4-6 times a year according to birds biological cycles) on project territories to identify and minimize potential adverse impacts during construction and operation of OHTLs and develop mitigation measures in a timely manner.
- Annual analysis of operational activities in the project area in order to identify potential negative impacts on biodiversity and implement appropriate corrective actions.

In general, the expected environmental impacts resulting from Project activities in the Bash-Karakul OHTL area will be of local nature, not exceeding the boundaries of the allotted areas. It is expected that the anthropogenic impact will not exceed the regenerative potential of the ecosystem.

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APPENDIX 1

Habitat's description.

	
VP 1 - Fixed sands. Spillage from the canal. Sheep cote.	VP 2 - The salt marsh between the bends of the canal. Alhagi, Harmala, Capparis, Salsola.

	
VP 3 - Fixed sands. Sheep cote. There's rubble in the sand.	VP 4. Sandy desert. Sheep cotes. Vegetation is sparse.

	
VP 5. A quarry with water at the bottom. Cliffs. Indian sparrow colony in the cliffs.	VP 6. Developed area. Collectors, fields.

	
VP 7. Crossroads on the Gazly-Bukhara highway. A quarry for the extraction of rubble, a cafe, residential buildings, a gas station. Active traffic.	VP 8. Sandy desert. Near the religious complex, farmsteads.

	
VP 9. Fixed sands. VP is about 1 km from a sheep cote.	VP 10. Channel. Residential house, trailer, cattle. There are fixed sands all around. Indian sparrow colony under the bridge.

	
VP 11. Fixed sands. Saxaul. The existent power lines.	VP 12. Fixed sands. Artemisia. There's pebble in the sand.

	
VP 13. Sandy desert. Saxaul, Alhagi, Salsola. There's rubble in the sand.	VP 15. Degraded area near the Karakul substation. Residential buildings, roads, pit, garbage, noise. Heavy traffic.

VP 14 - Agricultural land. Canal. There are fields of alfalfa and wheat surrounded by sandy desert and tamarisk bushes. A farmer’s house is nearby.

Juru Energy

Mammal survey report

Report Title	Mammal survey report
Scope	MAMMALS
Areas Covered	BASH WF/ BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Juru Energy

MAMMAL SURVEY

BASH WIND FARM PROJECT

CLIENT: 5CAPITALS

Date: July 2021

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Contents

INTRODUCTION

The survey for terrestrial mammals (excluding bats) was **aimed** to establish the presence/absence, status and distribution of mammal species within the Bash project territory and its surrounding areas. In order to accomplish this the following steps were taken:

- Conducting a ground survey on mammal species (except for bats) throughout the study area including AoI and EAAA in Spring and Summer;
- Collecting data from camera traps (from April to June 2021) installed in the most suitable locations and collecting data from camera traps to get information about mammal species presence, distribution, seasonal dynamic and behavior;
- Collecting questionnaire data from local people on mammal species presence/absence, status and threats;
- Analysis of the preliminary field data including number of species and distribution; and
- Compiling a mammal species list based on field data, questionnaire data and data from literature sources, including endangered and non-endangered species.

The field surveys within the Bash project territory and its surrounding areas were conducted twice: in Spring (on April 18-21, 2021) and Summer (June 26-28, 2021).

LITERATURE REVIEW

The project area includes Ayakagitma lake and surrounding areas of South Kyzyl Kum desert at the project area of Bash wind farm, not far from the Kuldzhuktau mountain range. Lake formed in the center of the Ayakagitma saline depression. The level of the coastline of this lake is not constant and varies greatly depending on the season. Ayakagitma saline depression was characterized by the presence of typical salt marshes and the so-called ‘chokolaks’ - hills overgrown with Tamarix and Saxaul. In the 80s of the 20th century, the basin of Ayakagitma saline depression was filled with waste water from the irrigated fields of the Bukhara oasis along the 70-kilometer Agytma collector. Ayakagitma lake is surrounded by salt marshes, sandy desert, clay and gypsum cliffs and deep (over 10 m) canyons, which are excellent habitats for many species.

Historic data on mammal fauna of the Ayakagitma lake and surrounding areas of South Kyzyl Kum desert, particularly within the area of planned Bash WF project is fragmentarily described in the fundamental works of I.I. Kolesnikov (1953) and G.I. Ishunin (1961, 1987), Heptner & Sludskii (1972), which provide information on the distribution and biology of rodents, carnivores and ungulates, including those in our study area. In the monograph by T.Z. Zakhidov (1971) a description of the ecosystems of the Kyzyl Kum desert is given, and specific information about animals - vertebrates, including mammals of the South and Central Kyzyl Kum is provided. It is important to note, that in that time Ayakagitma Lake did not exist, and authors described mammal fauna typical for saline desert and sandy desert. Currently we have newly created environment - artificial water reservoir and some fragments of different types of desert in the surrounded territories. Creation of a lake resulted in the creation of the new habitats – wetlands, that gave start for natural succession. Currently some hydrophilic species like badgers and jackals joined the list of mammals of this region.

Totally, the list of mammals (except for bats) of the study area includes 24 species of 5 orders: *Insectivora* (3 species), *Lagomorpha* (1 species), *Rodentia* (11 species), *Carnivora* (8 species) and *Artiodactyla* (1 species). Brandt's hedgehog, Marbled polecat and Goitered gazelle are included in the Red Book of Uzbekistan (2019) and the IUCN Red List. https://www.iucnredlist.org (Table 1), the presence of three more endangered species - Sand cat, Corsac fox and Steppe polecat require additional confirmation.

MATERIAL AND METHODS

The survey was carried out in the South (Southeast) Kyzylkum dessert, in area of Ayakagitma lake and adjacent territories (Fig. 1)

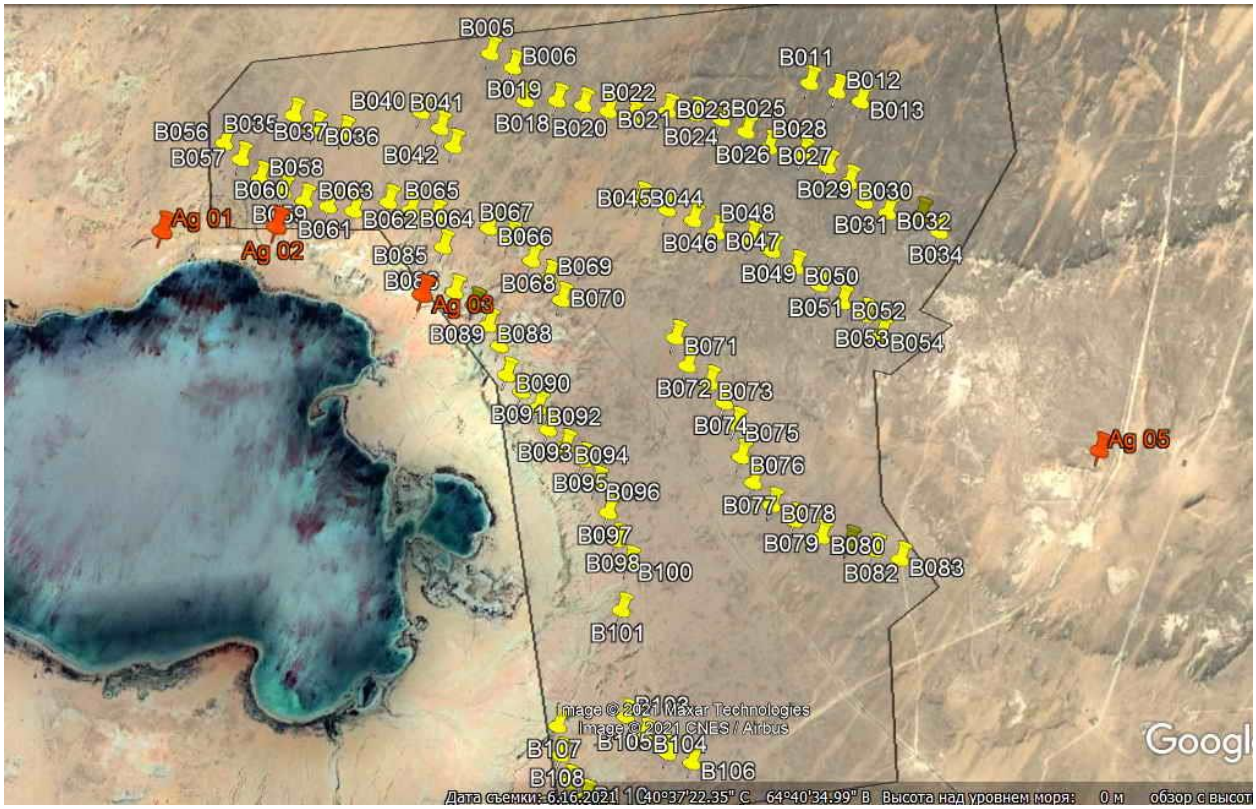

Figure 1 Map of the Monitoring locations (red points –camera traps locations, yellow points - wind turbines locations)

During our survey we used two basic methods:

1. Ground transect survey;
2. Camera trapping

During ground transect survey we studied about mammal species number and species composition in walking transect survey. Total length of the walking transect was 25 km, vehicle transect – 75 km, vehicle transect survey with headlight – 22 km (tables 2, 3).

During the field survey, non-invasive approach was implemented, not related to the capture and killing of wild animals, including:

- visual observation of mammals both by eye and using 10x binocular;
- registration of tracks of the vital activity of wild mammals, including animal tracks (paw footprints on the ground), feces, diggings, burrows, dead animals, etc.;

- taking photo of the animals, their tracks and traces of their vital activity, typical habitats.

Figure 2 Camera trap setting at Ag 01 monitoring location at the shore of Ayakagitma lake, April 2021. Photo by Elena Bykova

Five standard Bushnell 119936C camera traps were installed from April, 18 to June 26, 2021. Totally cameras were installed for a 2.5 months at 5 locations in various types of biotopes in the places of the most probable visit of wild animals (trails, watering points, animal marking places, and places of natural constrictions of relief) (Fig 1). Two of five camera traps worked for almost the entire period from start to finish (67-68 days), one camera worked for 49 days, after which the memory card was filled as a result of long photo sessions of Asian wildcat and Eagle owl, one camera was turned over by a Brandt's hedgehog, having worked only 5 days. One camera trap was stolen by local people. Totally we carried out camera trapping during 189 camera traps/days. As a result 11039 total captures including 1143 effective captures with animal records were obtained (table 4, 5). In addition, we interviewed local people – citizens from Ayakagitma village and shepherds.

Figure 3 Shepherd's questionnaire at Ayakagytma lake. Photo by Elena Bykova

RESULTS AND DISCUSSION

Mammal species review

The **Order Insectivora** is represented by 3 species: **Long-eared and Brandt's hedgehogs, Lesser white-toothed shrew** (table 1.).

The **Long-eared hedgehog** is a eurytopic species inhabiting all types of ecosystems from foothills to deserts, it does not avoid anthropogenic landscapes. We recorded hedgehog's skins in Egyptian vulture *Neophron percnopterus* nesting place (Ag 03) in April and June (4 skins). Two skins also were recorded in resting place of Eagle owl *Bubo bubo* (Ag 05) in June 2021 (table 2, 3).

Figure 4 Brandt's hedgehog near Ayakagitma lake (Ag 01). Photo by Alexander Esipov

Brandt's hedgehog, near threatened (NT) species included in the Red Data Book of Uzbekistan (2019). During vehicle transect survey with headlight one hedgehog was found (black form, 0,08 indi/ha). Also black hedgehogs were captured by camera traps (4 captures in two locations) (table 4, 5) in clay and gypsum cliffs and caves in vicinity of Ayakagitma lake. In addition, skins and skulls of the Brandt's hedgehogs (black and white forms) were found in Egyptian vulture nesting place in April and June (5 skins and 2 skulls) (table 2, 3). One dead hedgehogs (black form) was found on the road in the vicinity of Zafarabad (Kukcha) town close to project area.

Figure 5 Female Brandt's hedgehog killed by road accident in Zafarabad town. Photo by Elena Bykova

Lesser white-toothed shrew was recorded by Zakhidov (1971) in Agytma area. The small shrew is a hydrophilic species, and usually it inhabits along the banks of water reservoirs, near wells, in oases. We didn't found this species because this required special traps but we found good habitat conditions in *Tamarix* scrublands along the lake.

Tolai hare is the only representative of the Order **Lagomorpha** in the project area (table 1). It is a typical inhabitant of river forests and reed thickets, it also occurs in the foothills and deserts. We recorded one hare during nocturnal survey with headlight in monitoring site Ag_05 (table 2, 3). In addition, shepherds informed that 10-20 hares inhabited the hilly area outside of Ayakagitma lake.

10 **rodents** were recorded in the project area (table 1). The rodent community includes the synanthropic species - **House mouse** that indicate human presence (shepherd's stops, fishery houses, Ayakagitma village), as well as common inhabitants of the clay desert - **Small five-toed jerboa** we observed during survey with headlight in April 2021 (monitoring site Ag 01). We also observed **Yellow ground squirrels** in gravelly and clay deserts in sites Ag 02 and Ag 04. **Severtsov's jerboa** we recorded in the vicinity of Ayakagitma village. Typical inhabitants of sandy desert - **Long-clawed suslik** and

Northern three-toed jerboa was recorded in Ayakagitma area by authors (Zakhidov, 1971; Burnside et al, 2014)

Zaisan mole vole, **Grey dwarf hamster**, and three species of gerbils, including **Great gerbil**, the **Libyan** and **Midday jirds** were also recorded in project area. Colonies of these species were observed in the surveyed area. Also we found dead Libyan jird in nesting place of Egyptian vulture. All gerbils were recorded by Tisha Zakhidov in Ayakogitma area (1971).

Three species of **Mustelidae** inhabited in project area according to the literature data (Ishunin, 1961, 1987; Zakhidov, 1971). We recorded only **Asian badger** by footprints in shrub land (Tamarix sp.) and sandy shore of the Ayakagitma lake (Table 2, 3). The presence of two other species including endangered **Marbled** and **Steppe polecats** were noted in the literature and requires confirmation.

Figure 6 Asian badger footprints near the Ayakagitma lake (Ag 02). Photo by Elena Bykova

From **Canidae** family three species presented at the project area including **Golden jackal** (Zakhidov, 1971; our questionnaire data), **Red fox** (Zakhidov, 1971; data of our ground survey and camera trapping), **Corsac fox** (Zahkidov, 1971). **Red fox** is the most common and widely distributed predator in desert biotopes, cliffs and cages in the survey

area. We have recorded foxes by footprints, feces, and by camera traps (25 captures time in one location (Ag 01) (table, 4, 5).

Felidae represented by **Asiatic wildcat** and probably S**and cat**. **Asiatic wildcat** is the most common cat species. During camera trapping it was spotted 10 times by two cameras in locations Ag 01 and Ag 05 (table 4, 5). **Sand cat** is one of the most rare species, his status in Uzbekistan is unknown. But authors reported about Sand cat from Southern Kyzylkum (Zakhidov, 1971; Burnside et al, 2014). During the Soviet period, there appears to have been a well-established presence of the cat in the Kyzylkum Desert of Uzbekistan where it was also hunted (Heptner & Sludskii 1972). Records in recent years reported by Robert Burnside with co-authors (2014) by three separate sightings of Sand cats - two in 2013 and one in 2014 in sandy semi-desert and shrub on a clay and gravel plain vegetated with Salsola spp. Threats for sand cat in Southern Kyzylkum are disturbance from the high density of sheep flocks, severe winters, food competitors of the sand cat are Red fox and Asiatic wildcat (Bogdanov, 1992; Gritsina, 2014; Gritsina et al., 2016; Burnside et al, 2014).

Figure 7 Young fox in a small cave in vicinity Ayakagitma lake

Table 1 - Characteristics of non-bat mammals in the project area and adjacent areas of the Southern Kyzylkum (Ayakagitma ridge, Navoi province, Bash WF project site)

№ п/п	Species	Conditional population estimate	Status of threat IUCN RedList/Uzbekistan RDB	Sources
1	Long-eared hedgehog *Hemiechinus auritus* Gmelin, 1770	O-M	LC/-	Ground survey
2	Brandt's hedgehog *Paraechinus hypomelas* (Brandt, 1836)	P-E	LC/3NT	Camera trapping; road accident (Zafarabad);
3	Lesser white-toothed shrew *Crocidura suaveolens* Pallas, 1811	O-H	LC/-	Zakhidov, 1971; Volozheninov, 1981
4	Tolai hare *Lepus totai* Pallas, 1778	O-M	-/ game species	Ground survey, camera trapping, road accident (OHTL 115 km); Zakhidov, 1971
5	Long-clawed ground squirrel *Spermophilopsis leptodactylus* (Lichtenstein, 1823)	O-H	LC/-	Zakhidov, 1971; Burnside et al, 2014
6	Yellow ground squirrel *Spermophilus fulvus* (Lichtenstein, 1823)	O-M	LC/-	Ground survey; Zakhidov, 1971
7	Small five-toed jerboa *Allactaga elater* (Lichtenstein, 1825)	O-M	-	Ground survey; Zakhidov, 1971
8	Severtzov's jerboa *Allactaga severtzovi* Vinogradov, 1925	O-H	LC/-	Zakhidov, 1971; road accident (near Agytma village)
9	Northern three-toed jerboa *Dipus sagitta* (Pallas, 1773)	O-H	LC/-	Zakhidov, 1971
10	Great gerbil *Phombomys opimus* (Lichtenstein)	O-M	LC/-	Ground survey; Zakhidov, 1971
11	Libyan jird *Meriones libycus* Lichtenstein, 1823	O-M	LC/-	Ground survey; camera trapping; Zakhidov, 1971
12	Midday jird *Meriones meridianus* (Pallas, 1773)	O-M	LC/-	Ground survey; Zakhidov, 1971
13	Grey dwarf hamster *Cricetulus migratorius* Pallas, 1773	O-H	LC/-	Zakhidov, 1971
14	Zaisan Mole Vole *Ellobius tancrei* Blasius, 1884	O-M	LC/-	Ground survey; Zakhidov, 1971
15	House mouse *Mus musculus* Linnaeus, 1758	O-H	-/-	Ground survey; Zakhidov, 1971
16	Golden Jackal *Canis aureus* (Linnaeus, 1758)	O-H	LC/game species	questionattie data

17	Corsac Fox Vulpes corsac (Linnaeus, 1768)	P-E	LC/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019; need to be confirmed
18	Red fox *Vulpes vulpes* Linnaeus, 1758	O-M	LC/ game species	Ground survey; camera trapping; Zakhidov, 1971
19	Marbled Polecat *Vormela peregusna* (Güldenstädt, 1770)	P-E	VU/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019
20	Steppe Polecat *Mustela eversmanii* Lesson, 1827	P-E	LC/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019
21	Asian Badger *Meles leucurus* (Hodgson, 1847)	O-H	LC/game species	Ground survey
22	Asiatic wildcat *Felis sylvestris ornate* Gray, 1830	O-M	-/ game species	Ground survey, camera trapping; Ishunin, 1961, 1987; Zakhidov, 1971
23	Sand cat *Felis margarita* Loche, 1858	P-E	LC/3NT	Zakhidov, 1971; Burnside et al, 2014
24	Goitered Gazelle *Gazella subgutturosa* (Güldenstädt, 1780)	P-H	VU/3(VU)	Ground survey; questionattie data; Marmazinskaya & Gritsina, 2017; Gritsina et al, 2017; Red data book of Uzbekistan, 2019; Bykova et al, 2020

Notes: *Conditional estimate of the number: E - single, H - few, M - Numerous; O - common, R - rare. IUCN Red List categories: Extinct (EX); Extinct in the Wild (EW); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threat (NT); Least concern (LC); Data Deficient (DD); Categories of the Red Data Book of the Republic of Uzbekistan (2019): Extinct 0 (EX); Extinct in the Wild 0 (EW); Critically Endangered 1 (CR); Endangered 1 (EN); Vulnerable 2 (VU: D); Naturally Rare 2 (VU: R); Near Threat 3 (NT); Data Deficient (DD).*

Figure 8 Goitered gazelle in a desert near Ayakagitma lake. Photo by Alexander Esipov

The area of the planned Bash WF project is inhabited by the only species of wild ungulates - the **Goitered gazelle**. The animals inhabiting in Ayakagitma lake belong to the Central Kyzylkum population, the total number of which is about 3000-5000 individuals (Gritsina et al., 2016; Marmazinskaya, Gritsyna, 2017; Bykova et al., 2020). During our survey, we recorded single Goitered gazelle in vegetation in sandy desert close to Ayakagitma lake. During camera trapping we also captured three gazelles (male, female with calf) in dry canyon connecting desert plain and lake. Gazelles use this area as daily migratory corridor (monitoring site Ag-03). We also obtained questionnaire data from local shepherds on the constant records of small groups of gazelles – groups of 2-5 individual in Ayakagitma area and surrounded areas. According to our expert assessment, about 125-150 individuals are present in the project area. Since the presence of a wolf has not been confirmed in the project area, it seems that Goitered gazelle has no natural predators in the area. The main threats are poaching, habitat loss, habitat degradation and fragmentation due to economic development of the region, lack of forage in snowy winters, shepherd's dog's depredation of calves, and human disturbance.

Ground transect survey

On April 18-21, and June 23-25 we conducted ground transect survey to collect spring data with focus on seasonal species (ground squirrels). Additionally, we used information about animals killed by predators, or accidentally killed on the road in project area, particularly main road in the vicinity of Zafarabad (Kukcha) town. We also used questionnaire data from local people.

Figure 9 Skins of *Paraechinus hypomelas and Hemiechinus auritus* in nesting place of Egyptian vulture (Ag 03). Photo by Elena Bykova

Totally 13 mammal species have been registered visually and by the tracks of the vital activity (table 2, 3), including 2 insectivores (Paraechinus hypomelas, Hemiechinus auritus), 1 hare, five rodents, four carnivores and one ungulate species. Two species - Brandt's hedgehog and Goitered gazelle are listed as endangered species. We also got questionnaire data on mammals, including common species – jackal, red fox, Asian badger, wild cat, tolai hare, and endangered species – goitered gazelle.

Figure 10 Colony of Great gerbil in clay hills of Ayakagitma. Photo by Alexander Esipov

Figure 11 Libyan jird found under the nest of Egyptian vulture. Photo by Elena Bykova

Table 2 – Mammals recorded in monitoring locations during field survey in the project area (Ayakagitma ridge, Navoi province, Bash project site) in April, 2021

# Monitoring site	Coordinates, WGS-84, grade/min/sec	Data	Biotope	Mammals recorded in monitoring site	Notes
Ag_01	40°40'09.0" 64°32'11.8"	18.04.21	Degraded mountain, sandy desert, shrub land (*Tamarix* sp.) in Ayakagitma lake shore	*Rhombomys opimus* *Paraechinus hypomelas* *Allactaga elater* *Meles leucurus* *Vulpes vulpes*	livestock (domestic goats and sheep) tracks
Ag_02	40°40'02.4" 64°34'05.6"	19.04.2021	Stony-sandy mountain desert, degraded mountains with rocks, niches, caves 227 m asl	*Spermophilus fulvus* *Rhombomys opimus* *Ellobius tancrei* *Meles leucurus* *Canis auritus* *Vulpes vulpes*	livestock (domestic goats and sheep) tracks and scats
				Meles leucurus - common *Canis auritus – a few* *Vulpes vulpes - common* *Gazella subgutturosa – 2 females in NE Ayakagitma lake in March 2021*	Questionnaire data by local shepherd
Ag_03	40°38'58.4' 64°36'22.6"	19.04.2021	Clay semi desert, dry gorge with cliff heights up to 10 m	*Rhombomys opimus* *Paraechinus hypomelas* *Hemiechinus auritus*	

				Meriones libycus *Ellobius tancrei* *Vulpes vulpes* *Gazella subgutturosa*	
Ag_04	40°36'54.5" 64°36'25.0"	20.04.2021	Sandy and clay desert and *Tamarisk* shabland along lake. Area covered foothills of degraded mountains and bank of Ayakagitma	*Rhombomys opimus* *Ellobius tancrei*	
				Meles leucurus *Canis auritus* *Vulpes vulpes* *Felis silvestris ornate*	Questionnaire data by fisherman Kholmurad Azimov
	40°35'27.1" 64°41'12.1"		Area between Ayakagitma lake and railway. Sandy desert with Saxaul shrubs	*Rhombomys opimus* *Ellobius tancrei* *Gazella subgutturosa*	Natural gas pipelines and infrastructure in some points of survey area Vehicle transect survey
	40°38'30.7" 64°39'12.9"		Trail along railway. Sandy desert with semi-shrubs	*Paraechinus hypomelas* *Spermophilus fulvus* *Rhombomys opimus* *Ellobius tancrei*	Vehicle transect survey
Ag_05	40°36'01.9" 64°47'15.7"	21.04.2021	The eastern slope of a solitary peak with numerous rocky outcrops and grottoes on opposite side from Ayakagitma lake	*Hemiechinus auritus* *Paraechinus hypomelas* *Lepus totai* *Meriones libycus*	High pressure by domestic livestock, and anthropogenic factor – all area covered with network of ground roads and

				Ellobius tancrei *Rhombomys opimus*	industrial objects (railway, railway stations, power lines). Vehicle transect survey
				Lepus totai *Felis silvestris ornate* *Gazella subgutturosa*	Questionnaire data by local shepherd Maksud Sherimov

Table 3 – Species composition and number in the project area (Ayakagitma ridge, Navoi province, Bash project site) in April, 2021 gathered during ground survey and questionnaires

№№	Species	Monitoring site	route length (km) / surveyed area (ha)	Number, individuals/colonies/ burrows	Survey methods	Number assessment
Mammals						
1	*Hemiechinus auritus*	Ag_03 Ag_05	3 km NA	4 skins in nesting place of Egyptian vulture; 2 skins in resting place of eagle owl	Ground transect survey	A few, locally distributed
2	*Paraechinus hypomelas (black and white forms)*	Ag_01, Ag_03, Ag_05	12 km; 3 km; 10 km	1 indi (black form, visually) + 5 indi (5 skins and 2 skulls in nest of Egyptian vulture)	Vehicle transect survey with headlight; Ground transect survey; vehicle transect survey	A few, widely distributed
3	*Lepus totai*	Ag_05	10 km	1 indi, 10-20 indi (questionnaire data)	Vehicle transect survey with headlight; questionnaire data	A few, widely distributed
4	*Spermophilus fulvus*	Ag_02 Ag_04	3 km 50 km	3 indi 3 indi	Ground transect survey; Vehicle survey	Common, locally distributed
5	*Ellobius tancrei*	Ag_02 Ag_04 Ag_05	4 km 50 km 10 km	1+10 +2 + 5 inhabited colonies+2 inhabited colonies 2 inhabited colonies+2 inhabited colonies	Ground transect survey Vehicle transect survey	Common, widely distributed
6	*Allactaga elater*	Ag_01	12 km	1 indi	Vehicle transect survey with headlight	A few, widely distributed

7	*Rhombomys opimus*	Ag_01, Ag_02, Ag_03 Ag_04 Ag_05	3 + 3 + 3+3 km 50 km 10 km	4 (inhabited) + 9 (5 inhabited + 4 uninhabited) + 5 (inhabited) + 25 (inhabited)+5 (inhabited) 28 inhabited colonies and 2 indi visually+5 inhabited colonies	Ground transect survey Vehicle transect survey	Common, widely distributed
8	*Meriones libycus*	Ag_03 Ag_05	3 km 10 km	1 individual killed by Egyptian vulture + 2 inhabited colonies	Ground transect survey Vehicle transect survey	Common, widely distributed
9	*Canis auritus*	Ag_04	NA	1-2 indi (questionnaire data)	Questionnaire data	A few, locally distributed
10	*Vulpes vulpes*	Ag_02	3 km + 3 km	1 +2 scats	Questionnaire data	Common, widely distributed
11	*Meles leucurus*	Ag_01, Ag_02 Ag_04	3 + 3 km NA	1+1 indi (visually) 10 indi (questionnaire data)	Ground transect survey Questionnaire data	Common, locally distributed
12	*Felis silvestris ornate*	Ag_04	NA	Single individuals by questionnaire data	Questionnaire data	A few, widely distributed
13	*Gazella subgutturosa*	Ag_02, Ag_03, Ag_05	3 km 15 km NA	1-2 indi per group (questionnaire data) 1 indi visually	Ground transect survey Vehicle transect survey Questionnaire data	A few, widely distributed

Camera trapping

Camera trapping was conducted from April, 18 till June, 26 in different biotopes of South East Kyzylkum desert in the area of Ayakagitma lake in Bash WF project area, including rocky cliffs with numerous grottoes, caves, rocky canyons, dry stream in Saxaul forest. Area visited by shepherds and railway workers. One of five camera traps was stolen by local people (more likely), so we analysed data from 4 camera traps, which recorded 4 species of wild mammals, including two endangered species – Brandt's hedgehog and Goitered gazelle (Table 4, 5).

Table 4 - List of mammals captured by camera traps in the Bash WF project area (Ayakogitma lake), April, 18 - June, 26, 2021

##	Species	Captures number					
		Ag 01	Ag 02	Ag 03	Ag 04	Ag 05	всего:
1	Brandt's hedgehog *Paraechinus hypomelas*	1	3	-	-	-	4
2	Red fox *Vulpes vulpes*	25 / 2	-	-	-	-	25
3	Asiatic wildcat *Felis sylvestris ornate*	2	-	-	-	8	10
4	Goitered Gazelle *Gazella subgu*	-	-	7 / 2	-	-	7
	Total captures	**28**	**3**	**7**	**-**	**8**	**46**

The total number of registrations of wild mammals was 46. The number of captures of wild mammals per camera trap ranged from 3 (Ag 02) to 28 (Ag 01). The number of wild mammal species recorded by one camera trap ranged from 1 (Ag 02, Ag 03, Ag 05) to 3 (Ag 01).

The largest number of records was made of Red fox (25 captures by one camera, including in one case there were 2 individuals interacted in one point). Asiatic wildcat was spotted 10 times by two cameras. Goitered gazelle was captured by one camera seven times, including once two animals (female and calf). Brandt's hedgehog has been recorded four times by two cameras.

In addition, camera traps recorded a large number of livestock (sheep, goats, horses), people (on foot and on motorcycles), as well as birds (e.g. endangered Egyptian vulture), reptiles and invertebrates.

Camera trapping is a very good method for the capturing endangered species such Brandt's hedgehog and Goitered gazelle. Our survey also showed that cameras are very

successful in registering foxes, hedgehogs, wild cats and a number of animals that use shelters in the summer time (see Appendix).

Cameras also help to observe some features of animal biology, for example, the marking behavior of young foxes, one of which marked with urine, another sniffed a urinary tag. We were also able to obtain information on the daily activity of different species, including Goitered gazelles. Cameras recorded how gazelles in the morning walked towards the watering place on the Ayakagitma lake, and in the evening they returned back to the desert using canyon created in dry river bed as a corridor. In addition, using these images, we obtained data on the age and sex ratio of captured gazelles - our cameras recorded a single male and a female with a calf. We also observed food behavior of two birds of prey - a little owl *Athene noctua* eating a steppe agama *Trapelus sanguinolentus* and Egyptian vulture *Neophron percnopterus* walking from the corpse of a dead sheep (we observed this corpse at the moment of taking the camera off and realized that the vulture was returning from a meal) (see Appendix).

Table 5 – Camera trap locations, nearest wind turbines and mammals recorded in monitoring sites by camera traps in the Bash WF project area (Ayakogitma lake) in April, 18 - June, 26, 2021

# Monitoring site	Coordinates, WGS-84, (N E A)	## turbine / dist (km)	Biotop	Start /finish records	Camera traps / days	total captures/ effective captures	Mammals recorded in monitoring site	Number of records / max number of individuals
Ag 01	40°40'09.0" 64°32'11.8" 200	B057 / 2.54 B056 / 2.55 B058 / 2.61	Degraded mountain, sandy desert, shrub land (*Tamarix* sp.) in Ayakagitma lake bank	18. 04/ 23.06	67	5076 / 492	Brandt's hedgehog Red fox Asian wildcat	1 25 / 2 2
Ag 02	40°40'02.5" 64°34'05.7" 227	B059 / 0.85 B060 / 0.90 B058 / 1.20	Stony-sandy mountain desert, degraded mountains with rocks, niches, caves 227 m asl	19.04 / 23.06	5	111 / 31	Brandt's hedgehog	3
Ag 03	41°38'58.4" 64°36'22.7" 165	B086 / 0.77 B085 / 1.20 B087 / 1.21	Clay semi desert, dry gorge with cliff heights up to 10 m	19.04/ 25.06	68	684 / 206	Goitered gazelle	7 / 2
Ag 04	40°38'30.7" 64°39'12.9" 247	B070 / 0.81 B069 / 1.28 B068 / 1.78	Dry stream bed under railway. Sandy desert with semi-shrubs	20.04 / -	-	-	-	-
Ag 05	40°36'01.9" 64°47'15.7" 228	B083 / 5.24 B082 / 5.68 B054 / 5.77	The eastern slope of a solitary peak with numerous rocky outcrops and grottoes on opposite side from Ayakagitma lake	21.04 / 8.06	49	5168 / 414	Asian wildcat	8

Planned Bash WF – Karakul SS OHTL survey

On June 29-31, 2021 we conducted ground transect survey to collect data about mammal species along planned Bash WF - Karakul SS OHTL in Navoi and Bukhara districts.

We used a method of ground transect survey with walking transects each 15 km (Bash WF - Karakul SS). We stopped each 15 km and walked approximately 1 km from the planned OHTL line, to gather information about mammals (and other animals) including:

- visual observation of mammals both by eye and using 10x binocular;
- registration of tracks of the vital activity of wild mammals, including animal tracks (paw foot prints on the ground), feces, digging, burrows, dead animals, etc.;
- taking photo of the animals, their tracks and traces of their vital activity, typical habitats.

Totally we conducted walked transects at Bash WF - Karakul SS with total length 8 km (table 6). Also we conducted vehicle survey with headlight at Bash WF - Karakul SS (10 km).

Table 6. Data on mammals (and other vertebrates) inhabited along planned OHTLs collected along planned Dzankeldy WF-Bash WF OHTL and Bash WF - Karakul SS OHTL in June 2021

# transect	Biotop	Mammals	Other wild and domestic animals
Bash WF - Karakul SS OHTL, June, 2021 (interval 15 km)			
Transect 1	Semi-shrub steppe, furrows from old saxaul plantations	Small five-toed jerboa (2 inhabited barrows) Libyan jird (1 inhabited colony) Red fox (1 indi, diggings)	Sunwatcher *Phrynocephalus helioscopus* Many tracks and dungs of domestic livestock
Transect 2	*Tamarix* spp. shrub land, reeds	Tolai hare (1 indi)	Many tracks and dungs of domestic livestock
Transect 3	Canal with *Tamarix* spp. shrubs and reeds	No any signs of mammals	Long-legged buzzard *Buteo rufinus* Tracks and dungs of domestic livestock
Vehicle transect survey with headligh, 10 km	Sandy desert with *Ferula assa-foetida* and saxaul *Haloxylon* spp.	Mammals didn't recorded	Flock of domestic sheep
Transect 4	Sandy desert with *Ferula assa-foetida* and saxaul *Haloxylon* spp.	No any signs of mammals	Passeriformes
Transect 5	Road along canal: *Tamarix* spp., reed overgrazing rice paddy fields	No any signs of mammals	Glossy ibis *Plegadis falcinellus* (10 indi), purple heron *Ardea purpurea* (2 indi), Charadriformes, Passeriformes
Transect 6	Vegetation desert with Alhagi and Carelinia	Long-clawed ground squirrel (2 inhabited barrows, tracks) Small five-toed jerboa (1 indi, tracks) Great gerbil (2 inhabited colony) Midday jird (3 inhabited colony)	Eremias scripta (1 indi), Passeriformes
Transect 7	Canal and crops overgrazing by reed and Alhagi	No any signs of mammals	Purple heron *Ardea purpurea* (1 indi), European roller Coracias garrulous (1 indi), Passeriformes

Transect 8	Old craps overgrazing by reed, Alhagi and Carelinia	Yellow ground squirrel (2 indi) Red fox (1 indi, tracks)	Blue-cheeked bee-eater *Merops superciliosus* (6 indi), carrion crow *Corvus corone* (3 indi), Passeriformes

Figure 12 Sand dunes overgrazed by Alhagi and Carelinia, Bash WF - Karakul SS. Photo by Elena Bykova

Figure 13 Canal grazed by Tamarix and reeds – covered project area at the OHTL Bash WF - Karakul SS. Photo by Elena Bykova

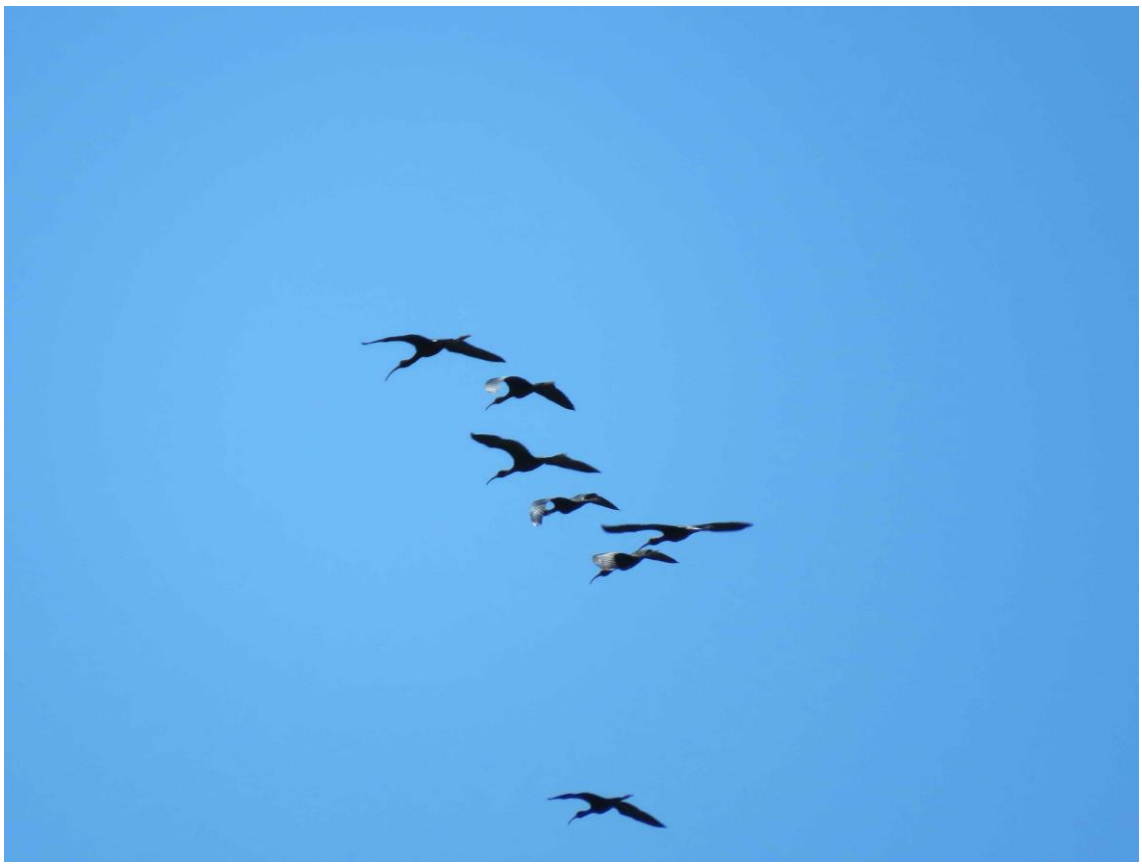

Figure 14 Glossy ibises near planned Bash WF - Karakul SS OHTL. Photo by Elena Bykova

Figure 15 Domestic livestock in the project area along planned Bash WF - Karakul SS OHTL. Photo by Elena Bykova

CONCLUSION

As a result of the survey (Table 6), 13 of 24 mammalian species were observed in the Bash WF project area, including 2 species Brandt's Hedgehog and Goitered Gazelle listed in Red Data Book of Uzbekistan and IUCN Red List. General diversity of observed area is rich, because it conisists of different landscapes including different types of desert, desert clay and gypsum hills with some rocky sites, niches and caves, canyons, scrublands and coastal zone and Ayakagitma lake itself. All this creates a wide variety of biotopes, and good natural conditions for the different species of animals, including mammals.

Table 6. Summary list on the mammals recorded in area of the Bash WF project (ground survey, April/June 2021; camera trapping, April - June, 2021)

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Hemiechinus auritus*	Long-eared hedgehog	LC/-	6 individuals
2	*Paraechinus hypomelas*	Brandt's hedgehog	LC/3NT	6 individuals/4 camera trap captures
3	*Lepus totai*	Tolai hare	-/game sp	1 individuals
4	*Spermophilus fulvus*	Yellow ground squirrel	LC/-	6 individuals
5	*Ellobius tancrei*	Zaisan Mole Vole	LC/-	24 inhabited colonies
6	*Allactaga elater*	Small five-toed jerboa	-	1 individuals
7	*Allactaga severtzovi*	Severtzov's jerboa	LC/-	1 individuals
8	*Phombomys opimus*	Great gerbil	LC/-	2 individuals; 77 inhabited colonies
9	*Meriones libycus*	Libyan jird	LC/-	1 individual; 2 inhabited colonies
10	*Vulpes vulpes*	Red fox	LC/ game sp	3 individuals/25 camera trap captures
11	*Meles leucurus*	Asian Badger	LC/game sp	2 individuals
12	*Felis silvestris ornate*	Asiatic wildcat	-/game sp	10 camera trap captures
13	*Gazella subgutturosa*	Goitered Gazelle	VU/3(VU)	1 individual /7 camera trap captures (1 male: 1 femail:1 young)

Critical habitats located in trans zonal area including coastal zone and Ayakagitma lake, desert hills and plain between them. This area is inhabited by Brandt's Hedgehog and Goitered gazelle. Also this area is inhabited by other mammal species including such important and interesting species as Asiatic wildcat, Asian badger, Fox, Jackal, Tolai

hare, Long-eared hedgehog, Gerbils, Ground squirrels etc. Ayakagitma lake plays a significant role as a resting and feeding place for migratory birds. Lake attracts a large number of waterfowl and near-water birds (e.g. we observed flocks of the endangered flamingo, mute swans), clay cliffs bordering the Ayakagitma depression are excellent nesting places for birds of prey (e.g. we observed endangered Egyptian vulture, Eagle owl and Liittle owl). In addition, this area is inhabited by numerous reptiles including endangered species - Desert monitor and Russian tortoise. From another hand this area is impacted by overgrazing, and human disturbance near the settlement and linear infrastructure - railway, water and gas pipelines and assisted infrastructure. All of this clearly demonstrate that Ayakagitma lake and surrounded areas (desert plain up to railway and Zafarabad railway station) is a critical area for biodiversity and requires protection.

Our data from Bash WF - Karakul SS OHTL demonstrated very low diversity of mammals due to very strong development of land for agriculture. This led for habitat loss, fragmentation and degradation. Almost all existing virgin lands looks transformed or degraded. List of mammals includes 8 species: 1 hare, 6 rodents, 1 carnivore (table 7). We didn't record any endangered mammals. Glossy Ibis is the only endangered bird species was found.

Table 7. Summary list of the mammals recorded in area of the Bash WF - Karakul SS OHTL (ground transect survey, each 15 km 1 km transect, June 2021)*

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Lepus totai*	Tolai hare	-	1 individual
2	*Spermophilus fulvus*	Yellow ground squirrel	LC/-	2 individuals
3	*Spermophilopsis leptodactylus*	Long-clawed ground squirrel	LC/-	2 individuals
4	*Phombomys opimus*	Great gerbil	LC/-	2 inhabited colonies
5	*Meriones libycus*	*Libyan jird*	LC/-	1 inhabited colony
6	*Meriones meridianus*	*Midday jird*	LC/-	3 inhabited colonies
7	*Allactaga elater*	Small five-toed jerboa	-	1 individual, 2 inhabited burrows
8	*Vulpes vulpes*	Red fox	LC/-	2 individuals

Notes: *8 transects

RECOMENDATIONS

- to move first line of wind turbines (B01-B056) that are nearest to the lake to the distance up to the railway

- to continue monitoring of mammals both during construcrion and after commissioning of the wind turbines

- to develop conservation measures to protect sub-populations of globally threatened Goitered gazelle and other vulnerable wild species, including preparing of a justification for organizing Ayakagitma reserve (zakaznik), public awareness and strengthening the capacity building of the regional biodiversity rangers to combat poaching.

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Appendix: Records from camera traps

Brandt hedgehog in a cave at the cliffs near the Ayakagitma lake (Ag 02 site)

Red fox near Ayakagitma lake (Ag 01 site)

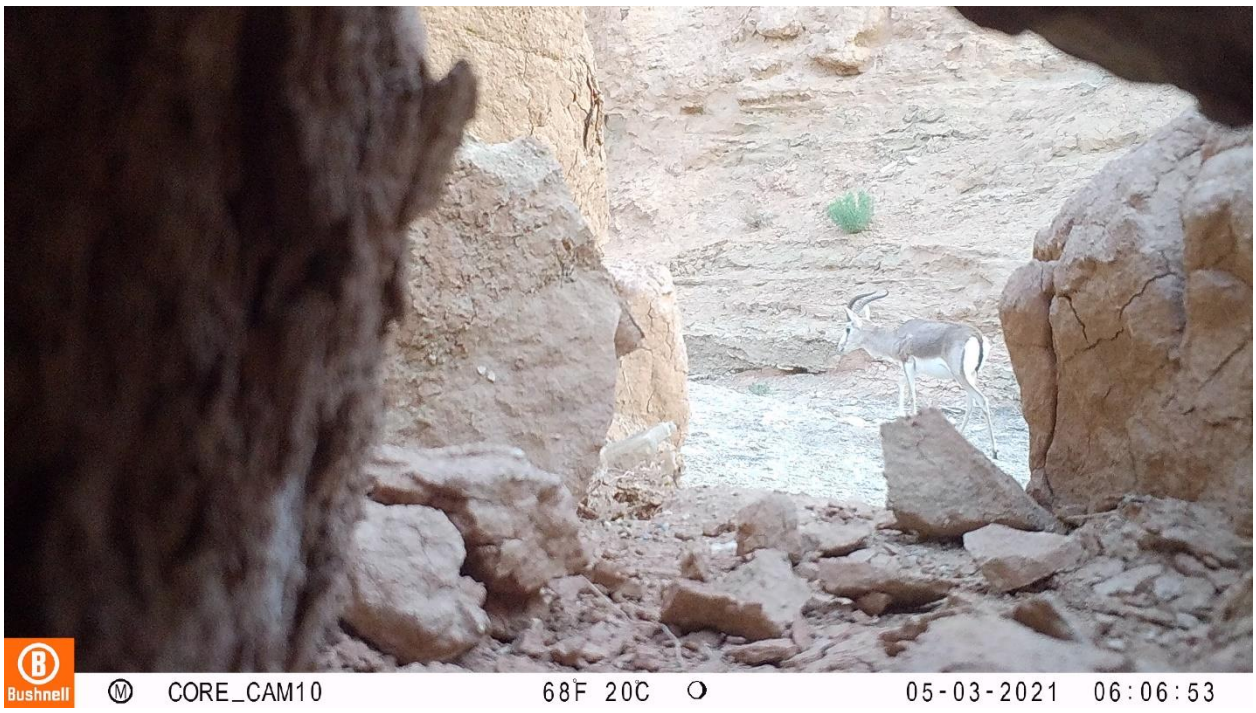
a)

b)

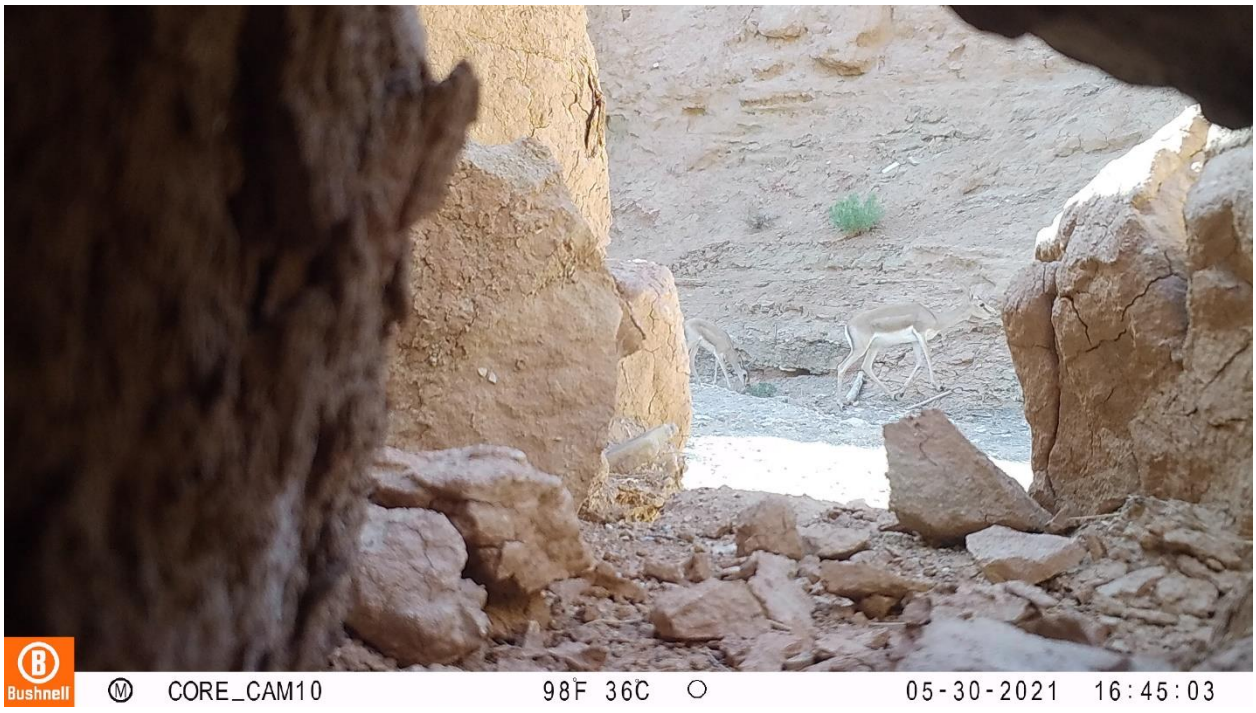
Mark behavior of young foxes: (records a) and b) show how foxes mark and sniff a urinary tag (Ag 01 site)

Two foxes met in stone niche on the shore of Ayakagitma lake (Ag 01 site)

Asiatic wildcat captured by a camera trap in Ayakagitma lake (Ag 01 site)



Goitered gazelle male walks through canyon from the desert plain to the lake (Ag 03)

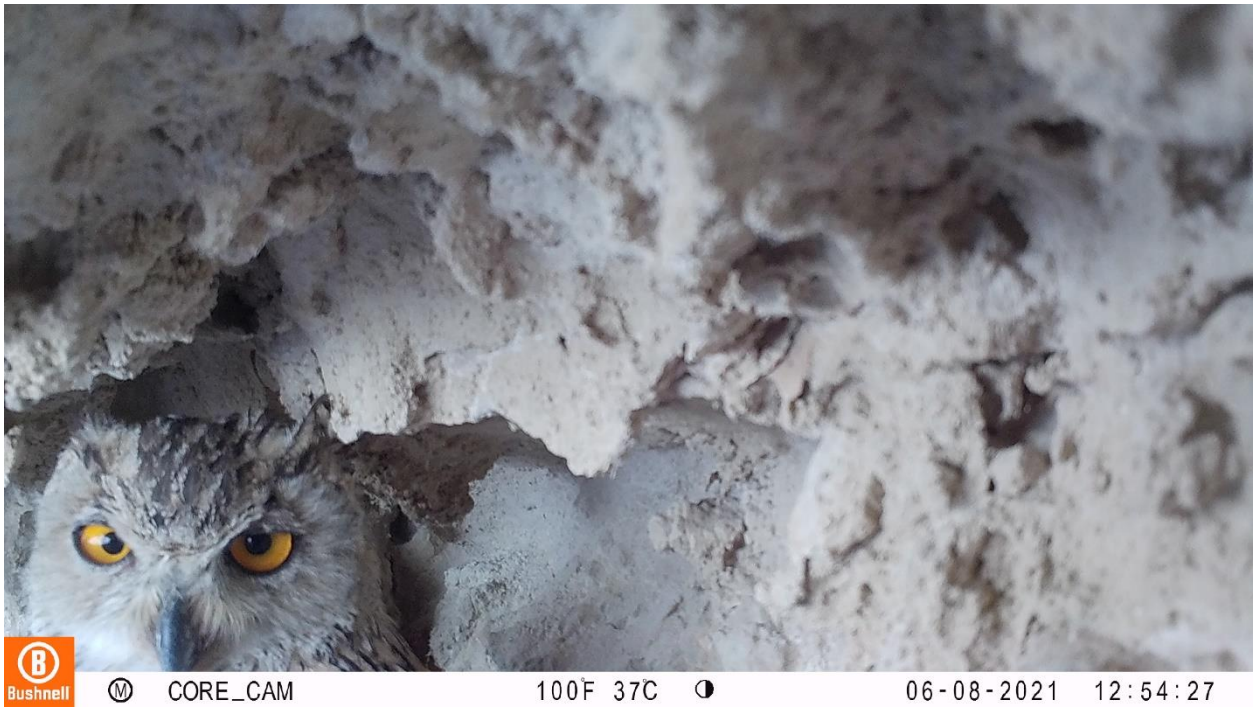


Goitered gazelle female with calf go through canyon from the lake to desert (Ag 03)

Egyptian vulture at the shore of Ayakagitma lake (Ag 01)

Chukars (*Alectoris chukar*) near Ayakagitma lake (Ag 01 site)

Little owl *Athene noctua* eating a steppe agama *Trapelus sanguinolentus* (Ag 03)



Eagle owl *Bubo bubo* during the day rest in a clay cave in Ag 05 site

Domestic horse captured by a camera trap in Ayakagitma plain (Ag 01 site)

Domestic goat captured by camera trap in Ayakagitma plain (Ag 01 site)

Juru Energy

HERPETHOLOGICAL SURVEY REPORT

Report Title	HERPETHOLOGICAL SURVEY
Scope	HERPETOFAUNA
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL / BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

HERPETHOLOGICAL SURVEY

BASH WIND FARM PROJECT

DZHANKELDY WIND FARM PROJECT

CLIENT: 5CAPITALS

Date: July 2021

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Contents

INTRODUCTION

Uzbekistan is located in the central part of Central Asia and has common borders with five countries - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Afghanistan in the south. This geographical location at the junction of a number of biogeographic regions determines the antiquity, diversity, origin and complex genetic relationships of flora and fauna. The gene pool of wild animals inhabiting the territory of the Republic of Uzbekistan is unique. Our country is an important habitat for endemic species and subspecies of animals of Central Asian origin. Most of it is represented by native fauna (Yunusov et al., 2015).

Nowadays, it becomes increasingly clearer that sustainable nature management is the only right way for the further development of humanity.

One of such sustainable approaches is the introduction and use of alternative energy sources.

It should be noted that Resolution No. UP-5544 "On Approval of the Strategy of Innovative Development of the Republic of Uzbekistan for 2019-2021" (President of the Republic of Uzbekistan, 21 September 2018) prescribes an increase in the portion of electric energy production using renewable energy sources to the level of at least 20% by 2025.

In addition, Resolution No. PP-4422 "On accelerated measures to improve the energy efficiency of economic and social sectors, introduce energy-saving technologies and develop renewable energy sources" (President of the Republic of Uzbekistan, 22 August 2019) approves long-term target parameters for the development of renewable energy sources and organisational and practical measures for further development of renewable energy sources.

This resolution prescribes an increase in the portion of electricity production using renewable energy sources to at least 25% by 2030.

To achieve these targets, the government has developed a plan to build almost 10 GW of new renewable energy facilities, including 5 GW of solar (excluding the capacity of individual households), 3 GW of wind and 1.9 GW of hydroelectric power plants.

At the same time, the construction of new renewable energy facilities with a total capacity of more than 10 GW and the modernization of existing hydroelectric power plants will ensure the production of more than 37 billion kWh of electricity by renewable energy facilities (in 2018 – 5.9 billion kWh), as well as expected annual savings of more than 8.1 billion m^3 of natural gas.

This report presents a faunal overview of the territories designed for the construction of wind power plants in the Bukhara region: Dzankeldy (in the western foothills of the Kuldzhuktau residual mountains) and Bash (near the northern chinks of the Ayak-Agitma depression). The report also contains the results of a survey of the projected power transmission lines that will connect Dzankeldy and Bash wind farms and OHTL that will connect Bash wind farm with Karakul substation.

HISTORY OF THE STUDY OF THE REGION

The history of the study of reptiles inhabiting the territory of Uzbekistan, as was the case with other vertebrates in Central Asia, began with the trip of E. A. Eversmann and K. Pander from Orenburg to Bukhara (October 1820 – April 1821). The few and occasional collections of E. A. Eversmann, transferred to the University of Berlin, were processed by Prof. G. Lichtenstein and published in 1823 as an appendix to the work of E. A. Eversmann (Bogdanov, 1960).

A. P. Khoroshkhin left Jizzakh in April 1872 and drove along the foot of the Nuratau Range and past the Aristan-Beltau mountains, and arrived in Tamdy, from where he travelled to the Aktau and Bukantau mountains. However, A. P. Khoroshkhin was not a specialist and did not collect reptiles, and in the book published in 1876 he mentioned only a tortoise, monitor lizard and sand racer.

G. Ye. Grum-Grzhimailo travelled across Uzbekistan with his expedition in 1885 (see Fauna of the Uzbek SSR, vol. II). His collections were processed by A. M. Nikolsky (1915).

The book by A. M. Nikolsky 'Reptiles and amphibians of the Turkestan general-governorship' is a complete literary summary of that time, was published in 1899. The author processed the materials of A. P. Fedchenko and others who collected them in Central Asia. The paper provides information on the distribution of 7 species of amphibians, 3 species of tortoises, 42 species of lizards and 28 species of snakes. Of these, 2 species of amphibians, 1 tortoise species and more than half of the species of lizards and snakes were caught in the territory of Uzbekistan (Sultanov, Persianova, 1982).

In 1933, 1934 and 1935 A. M. Andrushko collected in the central part of Kyzylkum more than 700 individuals of reptiles. Her article published in 1953 lists 23 species and specifies their distribution across biotopes. 7 species of reptiles (Transcaspian bent-toed gecko, Turkestan thin-toed gecko, Reticulated toad-headed agama, Striped racerunner, Tatary sand boa, Spotted whip snake, Diadem snake) were for the first time discovered in this part of the desert.

O. P. Bogdanov in his work "Fauna of the Uzbek SSR. Amphibians and reptiles" (1960) provides data that he collected in Central Kyzylkum in 1949, 1950, 1954 and 1955.

N. N. Shcherbak (1974) studied racerunners (genus *Eremias*) throughout their habitat, including the central part of Kyzylkum, in particular, in the area near the towns of Zaravshan and Uchkuduk.

The publication of D. A. Bondarenko and E. A. Peregontseva (2017) describes the spatial distribution of the Russian tortoise *Testudo horsfieldii* in Uzbekistan, mostly in the central part of the Kyzylkum desert.

Also, this report presents the author's personal data collected during field studies of the area in 2012, 2014, 2015, 2018 and 2019.

The list of reptiles is given according to the latest updated reptile database

(http://www.reptile-database.org/data/Reptile_checklist_2019_07.xlsx.)

PHYSIOGRAPHICAL DESCRIPTION OF THE RESEARCH AREA

The Kyzylkum physiographical region (Fig. 1) is located almost in the very center of the flat part of Central Asia, which is associated with truly desert landscape. It includes the western part (belonging to Uzbekistan) of the Kyzylkum Desert (its northern and eastern parts are on the territory of Kazakhstan). In the north lies the border of the region with Kazakhstan, in the south-west – with Turkmenistan, in the east is the Mirzachul area, in the south-east – the Zarafshan area and in the west – the lower Amudarya area (Gulomov et al., 2013).

The surface of the area slopes slightly down from south-east to north-west. The average altitude above sea level is 200-300 m, in the south-east the heights reach 350-400 m, in the north-west – only 100 m. The lowest point is the Mingbulak depression 12 m below sea level. The highest point is Aktau peak (922 m) in the Tamdytau Mountains (Gulomov et al., 2013).

The Kyzylkum Desert in the north-west is bordered by the Aral Sea, in the north-east by the Syr Darya, in the east by the spurs of the Tien Shan and Pamir Alai, in the south-west by the Amu Darya. The area of the desert is about 300 thousand square kilometers (Yugai, 1964).

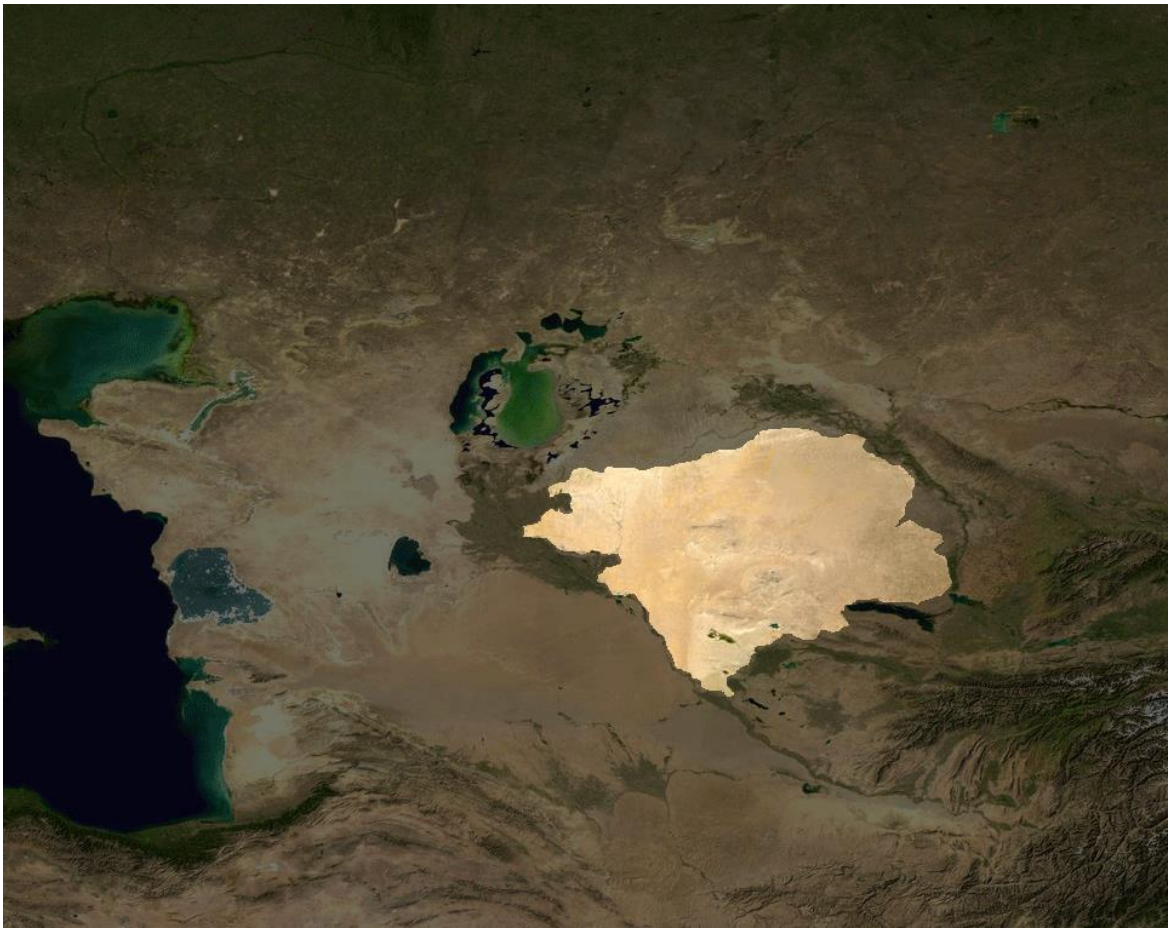

Figure 1 Satellite image with the territory of the Kyzylkum desert highlighted (Wikipedia, source file: Whole world – land and oceans.jpg)

The Kyzylkum Desert is a plain generally sloping to the north-west (altitudes above sea level range from 300 meters in the south-east to 53 meters in the northwest); it has a

number of closed depressions and highly dissected isolated residual (island) mountains – Bukantau (764 m), Kuldzhuktau (up to 785 m), Tamdytau (922 m) and others, composed of strongly dislocated and metamorphosed Paleozoic shales, hornstones, limestones, granites. (Yugai, 1964). The mountains are barren and mostly have levelled peaks and rocky, heavily cut slopes. Between these mountains are the Mingbulak, Karakata, Mullali and Ayakagitma depressions. The lower parts of these depressions are occupied by *solonchaks*, *takyrs* and sands (Gulomov et al., 2013).

Most of the desert is occupied by extensive sandy areas composed of semi-fixed sands. The most widespread are meridionally-oriented sandy ridges. The relative height of the ridges is from 3 to 30 m, with a maximum of up to 75 m. The flat portions are composed of Cenozoic clays and sandstones, in the north and north-west – loamy and mixed sandy and loamy river sediments. A characteristic feature of the Kyzylkum desert is the existence in its central and south-western parts of isolated low mountains – residual (island) mountains. These are Bukantau, Dzhetymtau, Tamdytau, Kuldzhuktau, as well as Sultanuizdag in the west. All of them are remnants of Paleozoic (Hercynian) folded chains located on the continuation of the structures of the northern chains of the Pamir-Alai (Turkestan and Nuratau Ranges) and formed by the latest tectonic processes. The elevations are composed of highly dislocated and metamorphosed Paleozoic slates, limestones and granites. The tops and crests of many of the residual (island) mountains have levelled surfaces used for unirrigated farming. The slopes of the residual (island) mountains are strongly dissected; at the feet there are aprons composed of pebbly and sandy accumulations, which often contain fresh groundwater and in some places feed the springs that supply mining villages with water. The area of the residual (island) mountains also features flat hilly elevations and plateaus of the cuesta type, composed of slightly disturbed Cretaceous and Paleogene sedimentary rocks (marls, sands, clays). Another characteristic feature is the existence of extensive closed basins (the Karakat and Ayakagytma basins) in the central and south-western parts of the desert (Gulomov et al., 2013).

Loose sand dunes are found near human settlements and around wells. In most cases, the exposure of the sands is the result of excessive grazing and trampling of vegetation by livestock near watering holes, as well as the use of shrubs and saxaul for fuel (Gulomov et al., 2013).

Sheep and goats, as well as camels and horses and, to a lesser extent, cattle graze in the Kyzylkum desert. The organization of pasture use and the creation of new wells made it possible to significantly increase the livestock population (Gulomov et al., 2013).

Large artesian basins were discovered in the central and south-western parts of the desert. Agriculture is beginning to develop near artesian wells in depressions, where melons and pumpkins are cultivated and experimental stations are established to provide livestock with additional feed (Gulomov et al., 2013).

CLIMATE, WATER, SOIL AND VEGETATION

The climate of the Kyzylkum physiographical region is arid and sharply continental. It is characterized by high summer temperatures, a very low level of annual precipitation and a strong fluctuation of daily and annual temperatures (Gulomov et al., 2013).

Winter in Kyzylkum is cold. The reason for this is the frequent invasions of dry and cold Arctic air masses and the Siberian anticyclone from the north. On such days, the air temperature drops sharply to –31–35 ° C. Western air masses bring precipitation and a slight increase in temperature. The average temperature in January in the north of Kyzylkum is –5–10 ° C, in the middle part –2–4 ° C, in the south –1–2 ° C (Gulomov et al., 2013).

With the coming of spring, the temperature gradually rises and rainfalls become quite frequent. Nature awakens and the earth becomes covered with ephemeral plants. The precipitation season is already over in April. In the long summer period (lasts more than 150 days), the air temperature is the same almost throughout. This is due to the large amount of solar radiation (total annual radiation is 120 kcal per 1 cm^3) and the penetration of hot tropical air masses from the south. The average temperature in the southern and central parts is + 30 °, in the north + 26 + 28 ° C; on some days the temperature reaches + 48 ° C. At this time, the sands warm up to +75 + 80 ° C.

Autumn in Kyzylkum is usually dry. There is little precipitation (up to 75–100 mm annually), and it is unevenly distributed over the seasons. The largest portion of the annual amount of precipitation falls in spring (up to 48%) and winter (up to 30%), but the evaporation rate reaches 1,000–1,500 mm (Gulomov et al., 2013).

The region has a significant stock of groundwater. The dynamic amount of groundwater is 58–60 m^3/sec. The groundwater is salty. Fresh artesian waters are available in the strata of the Mesozoic and Paleogene sediments. Also, mineral thermal waters were found in the Paleozoic deposits (Gulomov et al., 2013).

In Kyzylkum, sandy and mixed sandy and loamy soils are widespread in the plains, foothills and on the slopes of the elevations – grey-brown soils, and in the basins – solonchak and marshy solonchak soils (Gulomov et al., 2013).

More than 600 plant species grow in the Kyzylkum area. They are dominated by ephemerals and ephemeroids with a short spring growing season: bulbous bluegrass, sedge, Bromus danthoniae, tulips, snowdrops, Ixiolirion, Cousinia microcarpa. When the hot season sets in, they wither. Plants adapted to droughts and solonchaks continue to grow in summer (Gulomov et al., 2013).

Calligonum, white saxaul, Stipagrostis, sand acacia inhabit fixed sands. Sagebrush and weed widely occur on grey-brown soils (Gulomov et al., 2013).

Black saxaul, tamarisk, Climaooptera crassa, Halocnemum grow on solonchak and solonchak-marshy soils, Gamanthos – on takyr (Gulomov et al., 2013).

METHODS OF CONDUCTING HERPETOLOGICAL FIELD SURVEY

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 cold weather did not allow for a full survey in this area, while single records of reptiles do not give a complete understanding of the composition of the biodiversity in the area. Therefore, 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 (1978), V. M. Makeev, A. T. Bozhansky (1988) and N. N. Shcherbak (1989), D. A. Bondarenko, Chelintsev, (1996). 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:

- species composition in the study area;

- distribution across habitats;

- daily and seasonal changes in activity;

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.

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 one-kilometer transect was chosen because heaviest errors arise when long transects are used for species that, like the Russian 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 Russian tortoise population density (***D***) was calculated using the following formula (Bondarenko, Chelintsev, 1996):

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

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 Russian tortoise caused by a decrease in their detectability in remote parts of the survey strip, regardless of the degree of its limitation (Bondarenko and Chelintsev, 1996).

The survey method for the Southern Even-fingered Gecko (*Alsophylax laevis*) is different from the method of accounting for other reptile species. This is mainly due to the small size, secretiveness and other aspects of the biology of this species such as nocturnalism.

Southern Even-fingered Gecko (Alsophylax laevis) is distinguished by the acoustic interaction between individuals, but louder signals are noted in males. Acoustic signals of females are practically not audible in the field. The signals of males, under ideal weather conditions, can be heard within a radius of 100 meters or more.

Before starting accounting of Southern Even-fingered Gecko, it is necessary to identify the optimal biotope for this species. Since the Southern Even-fingered Gecko is a stenobiont species, the survey should be carried out only on a suitable biotope.

The method of accounting for the Southern Even-fingered Gecko (*Alsophylax laevis*) is carried out after sunset; the surveyor takes a position on the optimal biotope, preferably on a hill so that the acoustic signals reach the surveyor better. After taking the position, the surveyor must observe absolute silence and not turn on the lighting devices. The acoustic signals produced by the Southern Even-fingered Gecko in the accounting radius, which on average covers 1 ha, are recorded in a notebook with information about the direction of the acoustic signals and the distance to the gecko.

Since only males can be heard, the resulting density should be multiplied by a factor of 0.3 when extrapolating. This coefficient is derived from the males: females ratio in a gecko population (2 males per one female in average).

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

RESULTS

This section provides historical data and data collected during the field trips carried out in Spring and Summer of 2021. Also, in this section, the primary abundance of reptiles found at the accounting points (transects) and the average density derived by analyzing the primary data at each of the accounting points are shown. These data will help to create a map of the abundance and distribution of reptiles in the project area in the future, as well as help to create an action plan to reduce the burden on the populations.

The basis for compiling the list of herpetofauna of the studied territory was the modern list of amphibian fauna of Uzbekistan, consisting of 3 species from two families and the list of reptile species of Uzbekistan, consisting of 62 species from 13 families.

Herpetological survey in the Dzhankeldy WF project area (Kuldzhuktau residual mountains)

Herpetological survey in this area is of particular interest because there are various biocenoses and, consequently, the species diversity of reptiles is very rich. The most concerning species is critically endangered Southern Even-fingered Gecko (*Alsophylax laevis*), which was first found in this area last century. However, it should be noted that Southern Even-fingered Gecko inhabiting this territory is more likely to be a separate new species (Figure 2). And most likely it is an even rarer and endemic species that inhabits only this territory. Currently, the active study of this species is being conducted. Due to the fact that this species is the only representative of vertebrates on the project territory that is included in the Red List of the International Union for Conservation of Nature (IUCN Red List) with the status CR - critically endangered, survey on this particular species was given priority.

Figure 2 Southern Even-fingered Gecko at Dj 8 point in April 2021 (adult male)

The first field visit was made in April 2021. April is the period of the highest activity of the Russian tortoise (*Testudo horsfieldii*), which is also listed in the Red List of the International Union for Conservation of Nature (IUCN Red List) as VU - vulnerable. However, April appeared to be not optimal for the gecko survey this year, since night temperatures were still quite low, and the weather in the desert is not stable at this time of the year. During this period, the very first individuals appear on the surface, while most are waiting for warmer weather. In connection with the above, the accounting of this species in April is not indicative. More information that is accurate was collected during the summer survey, when an absolute number of individuals were active. As for the Caspian monitor (*Varanus griseus caspius*), the situation is almost the same as with the gecko, in April only some individuals were active. The Desert sand boa (*Eryx miliaris*) is active in both spring and summer, but this species can be observed in the daytime only in spring (Figure 3).

Figure 3 Young Desert sand boa (*Eryx miliaris*) at Dj 20 point in April 2021

The second field visit was carried out in June 2021. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

All 4 species are listed also in the Red Book of the Republic of Uzbekistan and were found in the project area around the Kuldzhuktau residual mountains.

Table 1 List of reptile species inhabiting the Dzankeldy WF project area

№	Species	Species presence acc. to literary sources	Author's earlier personal data	April 2021 field expedition data	June 2021 field expedition data	Endemism	Conservation status		
							UzRDB	IUCN	CITES
Family *Bufonidae* (toads)									
1	Turan Toad *Bufotes turanensis*	+	+	+		UZ, TJ, TM			
2	Marsh frog *Pelophylax ridibundus*	+	+	+				LC	
Family *Testudinidae* (tortoises)									
1	Russian tortoise *Testudo horsfieldii*	+	+	+			2 (VU)	VU	II
Family *Gekkonidae* (geckoes)									
2	Southern Even-fingered Gecko *Alsophylax laevis*	+		+	+	UZ, TM	VU:D	CR	
3	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+	+	+			LC	
4	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+	+	+	+	UZ, TJ, TM, KZ			
Family *Agamidae* (agamas)									
5	Steppe agama *Trapelus sanguinolentus*	+	+	+	+				
6	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+	+	+				
7	Reticulated toad-headed agama *Phrynocephalus reticulatus*	+	+	+	+	UZ, TM		LC	
Family *Lacertidae* (true lizards)									
8	Rapid Lizard *Eremias velox*	+	+	+	+				
9	Aralo-Caspian racerunner *Eremias intermedia*	+		+					
Family *Varanidae* (monitor lizards)									

10	Caspian Monitor *Varanus griseus caspius*	+	+				2 (VU:D)		I
Family *Boidae* (Boas)									
11	Desert sand boa *Eryx miliaris*	+		+			3 (NT)		II
Family *Colubridae* (colubrid snakes)									
12	Sand racer *Psammophis lineolatus*	+	+	+					
13	Spotted whip snake *Hemorrhois ravergieri*	+		+	+				
14	Spotted desert racer *Platyceps karelinii*	+	+						
15	Dice Snake *Natrix tessellata*	+	+						

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); 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, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and two field survey results, currently, the Dzankeldy wind farm project area is inhabited by 2 amphibian species and 15 reptile species belonging to 7 families (Table 1). The total number of amphibian species comprises 66,6% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 24,2%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (26,7% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (13,3% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (20% of the total number of species inhabiting the project area).

Spring survey (April 2021)

The first field trip to the survey points in the area of the Kuldzhuktau residual mountains was carried out from April 17 to 20, 2021. During the spring survey of the project area, 22 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 4).

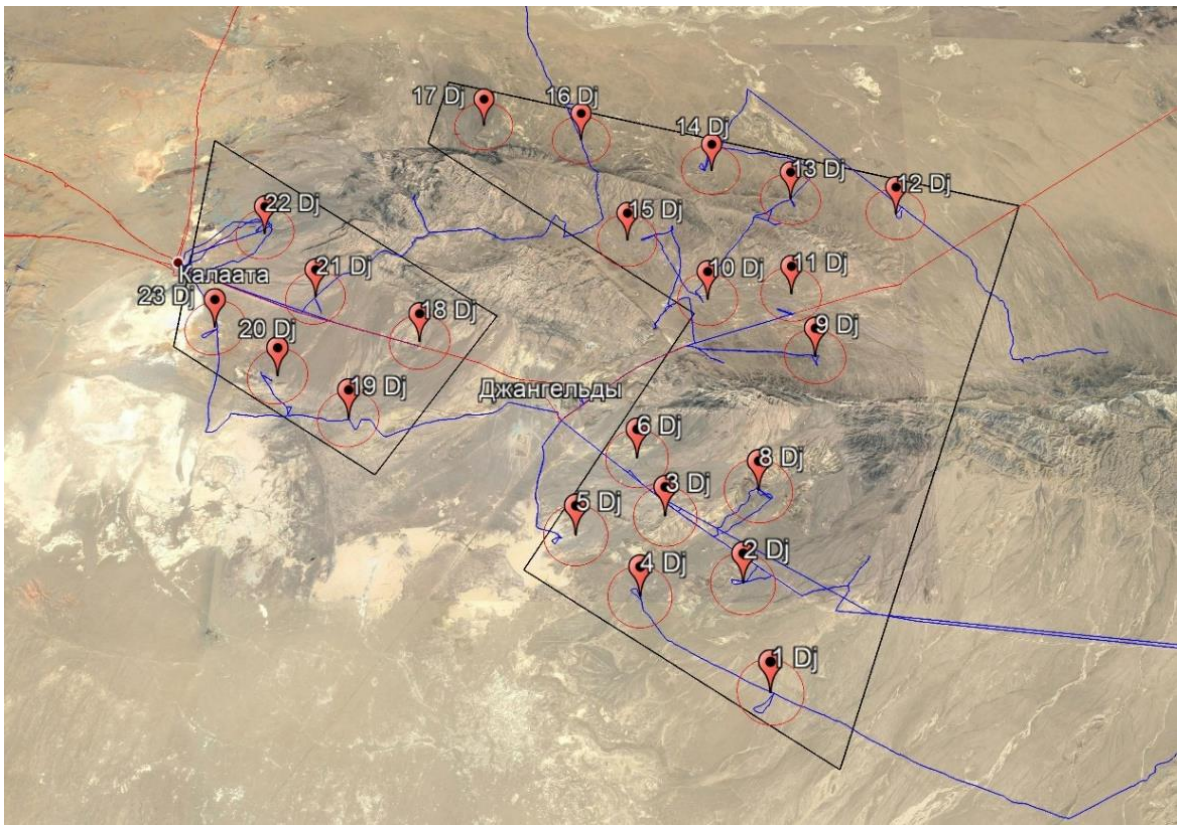

Figure 4 Observation points and transects on the Dzankeldy project territory in spring 2021

Reptile survey was carried out both during the day (Figure 5) and at night. Moreover, in some points that were identified as potential habitats of the Southern Even-fingered Gecko during the day, both day and night surveys were carried out, in places that were identified as not suitable biotope for the Southern Even-fingered Gecko, night records were not carried out.

Figure 5 Photographing a Desert sand boa at the Dj 20 point in April 2021

The average night air temperature in April was 18 °C, the soil temperature was 17 °C, the air humidity was 35%. These values are not high enough for the reptile nocturnal survey.

During the survey of the territory, we recorded 11 reptiles species (17.7% of the total number of reptiles species), of which 3 species (27.3% of the number of species encountered) - Russian tortoise, Desert sand boa and Southern Even-fingered Gecko are included in the Red Book of the Republic of Uzbekistan, and two (18.2% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

The highest density of the Russian tortoise on the project territory during the Spring survey was recorded at Dj 13 point and amounted to 3.99 ind/ha. However, similar number of 2 tortoises per transect was observed at several other points: Dj 9, Dj 10, Dj 12 and Dj 14. The Russian tortoise was found at 8 points, which is 38% of the total number of observation points (21 points), most of which are located in the northern foothill part of the Kuldzhuktau mountains (Figure 6). It is worth noting that the Russian tortoise is not a numerous species throughout the project area.

Figure 6 Russian tortoise at Dj 10 point in April 2021

The highest density of Southern Even-fingered Gecko on the project territory, during the first field trip, was recorded at 3 points: Dj 3, Dj 6, Dj 18 and amounted to 3 ind/ha on each of them. However, as mentioned above, the spring abundance and density indicators for this species can not be considered indicative, due to low night temperatures and small percentage of individuals coming to the surface (Figure 7).

Figure 7 Southern Even-fingered Gecko at Dj 6 point in April 2021

In general, the reptiles' species composition is typical for this geographical area.

Table 2 Primary data and the density of reptiles at the accounting points in the area of the Kuldzhuktau outlier in the spring of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
Dj 1				Rubbly-clayey plain with depressions, Artemisia association	1 km	20.04.21	C24,9°	C30,9°	29%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	3	1,5						
3	*Eremias intermedia* Aralo-Caspian racerunner	4	2						
Dj 2				Rubbly-clayey plain with cliffs and elevations, Artemisia-Ferula association	1 km	19.04.21	C29,8°	C38,4°	17%
1	*Trapelus sanguinolentus* Steppe agama	1	1						

Dj 3				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C18,2°	C17,2°	22%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	3						
Dj 4				Rubbly-clayey plain with depressions, Artemisia association	1 km	20.04.21	C23,3°	C27,2°	30%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
3	*Eremias intermedia* Aralo-Caspian racerunner	2	1						
Dj 5				Rubbly-clayey plain, sparse wormwood and saxaul bushes	1 km	19.04.21	C24,3°	C32,7°	17%
1	*Phrynocephalus helioscopus* Sunwatcher toad-headed agama	1	0,5						
Dj 6				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C18,0°	C18,6°	28%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	3						
Dj 8				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C20,3°	C19,1°	22%
1	*Alsophylax laevis* Southern Even-fingered Gecko	1	1,3						
Dj 9				Hilly sandy foothills, sarzagan association	1 km	19.04.21	C29,0°	C37,4°	18%
1	*Testudo horsfieldii* Russian tortoise	2	0,89						
2	*Tenuidactylus fedtschenkoi* Turkestan thin-toed gecko	1	0,2						
3	*Trapelus sanguinolentus* Steppe agama	1	1						
4	*Eremias velox* Rapid Lizard	1	0,5						
Dj 10				Rubbly-clayey plain with depressions,	1 km	18.04.21	C29,0°	C44,8°	30%

				Artemisia association					
1	*Testudo horsfieldii* Russian tortoise	2	2,78						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
Dj 11				Hilly sub-sandy foothill plain, in some places the sections are rubbly-sandy, Artemisia-saxaul formation, in in some places along sai (small water flow) Tamarix	1 km	19.04.21	C27,5°	C27,7°	18%
1	*Tenuidactylus fedtschenkoi* Turkestan thin-toed gecko	1	0,2						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
3	*Eremias velox* Rapid Lizard	2	1						
Dj 12				Rubbly-sandy desert, sai (water flow) from the Kuldjuktau Mountains, Artemisia-Ferula association, Tamarix and Peganum harmala along sai	1 km	18.04.21	C23,5°	C24,3°	18%
1	*Testudo horsfieldii* Russian tortoise	2	0,85						
2	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	0,2						
Dj 13				Hilly loamy plain, Artemisia-ferula association	1 km	18.04.21	C27,5°	C30,0°	17%
1	*Testudo horsfieldii* Russian tortoise	2	3,99						
2	*Eremias intermedia* Aralo-Caspian racerunner	2	1						
Dj 14				Clay foothills, Artemisia-ferrula association	1 km	18.04.21	C28,1°	C29,2°	18%
1	*Testudo horsfieldii* Russian tortoise	2	0,3						
2	*Trapelus sanguinolentus* Steppe agama	2	2						
Dj 15				Rubbly-sandy hummocky foothill desert, Artemisia - ferula association	1 km	18.04.21	C29,7°	C42,3°	18%

1	*Testudo horsfieldii* Russian tortoise	3 trace	–						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
Dj 16				Rubbly-sandy foothills, Artemisia-ferula association	1 km	17.04.21	C25,4°	C27,9°	23%
1	*Testudo horsfieldii* Russian tortoise	3	1,4						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
Dj 18				Rubbly plain with clay cliffs, Artemisia association	1 km	17.04.21	C17,6°	C16,4°	38%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	3						
Dj 19				Rubbly-sandy hummocky foothill desert, Artemisia - ferula association	1 km	18.04.21	C27,7°	C36,2°	21%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	0,4						
2	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
3	*Trapelus sanguinolentus* Steppe agama	6	6						
4	*Eremias intermedia* Aralo-Caspian racerunner	2	1						
Dj 20				Rubbly plain, Artemisia-ferula association	1 km	18.04.21	C32,2°	C36,8°	24%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
2	*Trapelus sanguinolentus* Steppe agama	2	2						
3	*Eremias intermedia* Aralo-Caspian racerunner	1	0,5						
4	*Eremias lineolata* Striped Racerunner	1	0,2						
5	*Eryx miliaris* Desert sand boa	1	-						
Dj 21				Rubbly-sandy foothills, Artemisia-ferula association	1 km	17.04.21	C23,8°	C25,8°	26%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						

Dj 22				Rubbly-sandy plains Artemisia-ferula association	1 km	18.04.21	C21,1°	C20,2°	40%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	3	1,5						
Dj 23				Rubbly plain with depressions and chakalaks (large hillocks up to 1-3 m in height) Artemisia-Ferula association	1 km	18.04.21	C24,7°	C25,0°	32%
1	*Testudo horsfieldii* Russian tortoise	1	1,3						
2	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
3	*Trapelus sanguinolentus* Steppe agama	1	1						
4	*Eremias intermedia* Aralo-Caspian racerunner	1	0,5						

It is worth noting that almost the entire southern foothill part of Kuldzhuktau is a potential habitat for the Southern Even-fingered Gecko (see points DJ 1, 2, 3, 4, 5, 6, 8, 11, 18, 19, 20, 21, 22, 23). On the contrary, most of the northern sub-mountain plain of Kuldzhuktau, as well as the outlier itself, is unsuitable habitat for this species. However, such rare and listed in the Red Book of the Republic of Uzbekistan species as: Russian tortoise, Caspian monitor, and Desert sand boa inhabit the entire area of the construction of the Dzankeldy wind farm.

Summer survey (June 2021)

The second field trip to the survey points in the area of the Kuldzhuktau residual mountains was carried out from June 19 to 22, 2021. The priority of this field visit was to conduct the quantitative assessment of Southern Even-fingered Gecko population at the points identified in spring as the most suitable. During the summer survey of the project area, 6 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 8).

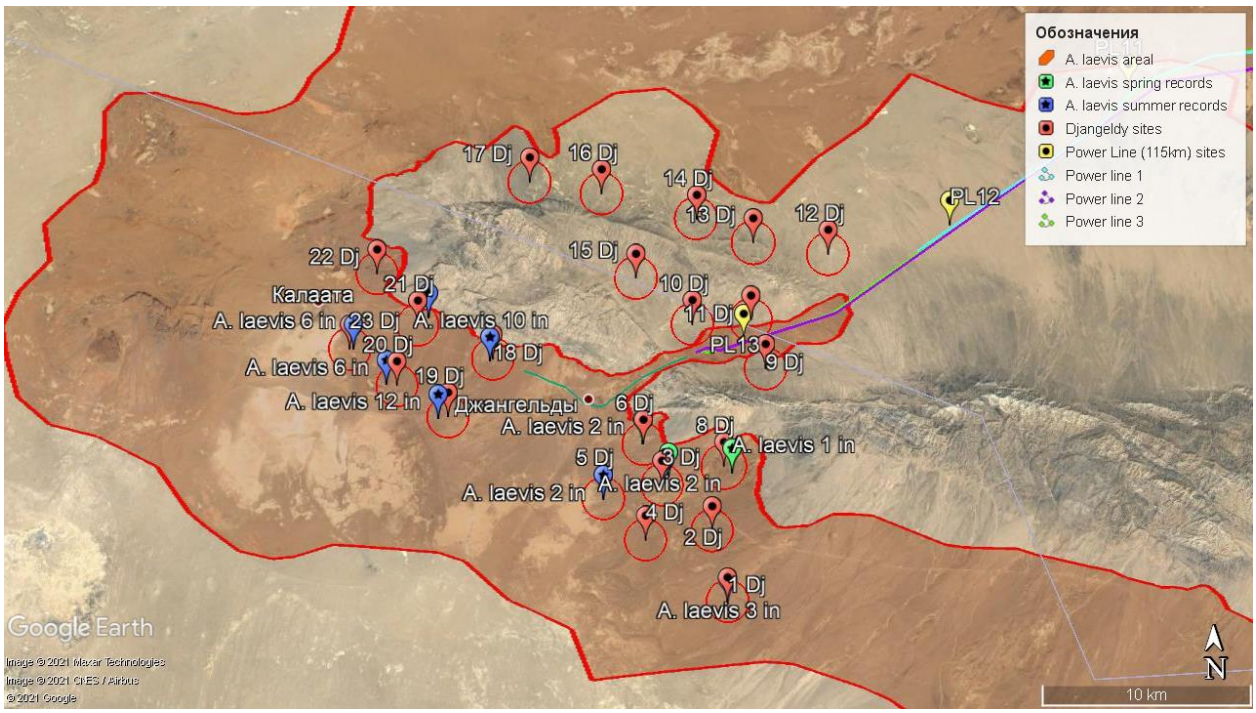

Figure 8 Survey points on the Dzankeldy WF project territory, as well as locations where the Southern Even-fingered Gecko was observed in summer and the areal range for the Southern Even-fingered Gecko population in the vicinity of the settlements of Dzhankeldy and Kalaata

Reptile survey was carried out mainly at night – after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases (Figure 9). However, at some points, the survey was also conducted during the daytime.

Figure 9 Nocturnal survey with a headlamp

The average night air temperature in June was 26-27°C, the soil temperature was 27-28°C, the air humidity was 20-25%. These values are ideal for the nocturnal reptile survey, including the Southern Even-fingered Gecko.

During the survey of the territory, we recorded 8 reptiles species (12,9% of the total number of reptiles species), of which 1 species (12,5% of the number of species encountered) - Southern Even-fingered Gecko is included in the Red Book of the Republic of Uzbekistan, and 1 species - Southern Even-fingered Gecko (12,5% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List). The variety of species for the second field visit turned out to be less than for the first, due to the narrow focus and specifics of the summer survey.

Table 3 Primary data and the density of reptiles at the accounting points in the area of the Kuldzhuktau outlier in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
Dj 1				Rubbly-clayey plain with depressions, Artemisia association	1 км	22.06.21	C24,1°	C25,3°	29%
1	*Alsophylax laevis* Southern Even-fingered Gecko	3	4						
Dj 2				Rubbly-clayey plain with cliffs and elevations, Artemisia-ferula association	1 км	22.06.21	C29,8°	C23,4°	17%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	-						
2	*Phrynocephalus helioscopus* Sunwatcher toad-headed agama	2	2,7						
Dj 3				Multicolour uplands, rubbly-clay depressions Artemisia association	1 км	19.06.21	C26,2°	C25,6°	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	4	5,3						
Dj 4				Rubbly-clayey plain with depressions, Artemisia association	1 км	22.06.21	C23,3°	C23,0°	30%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	2	2,4						
Dj 5				Rubbly-clayey plain, sparse sagebrush and saxaul bushes	1 км	22.06.21	C24,3°	C23,6°	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	2,7						
Dj 6				Multicolour uplands, rubbly-clay depressions Artemisia association	1 км	19.06.21	C25,9°	C24,6°	18%

1	*Trapelus sanguinolentus* Steppe agama	1	-						
Dj 8				Multicolour uplands, rubbly-clay depressions Artemisia association	1 км	19.06.21	C24,3º	C22,7º	18%
1	*Tenuidactylus fedtschenkoi* Turkestan thin-toed gecko	3	4,5						
Dj 18				Rubbly-clayey plain with cliffs and elevations, Artemisia association	1 км	21.06.21	C27,0º	C29,3º	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	10	13,3						
Dj 19				Rubbly-sandy hillock desert, Artemisia-saxaul association	1 км	22.06.21	C28,0º	C27,2º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	12	16						
2	*Trapelus sanguinolentus* Steppe agama	2	-						
3	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	3	4,7						
Dj 20				Rubbly plain, Artemisia-saxaul association	1 км	22.06.21	C25,5º	C25,3º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	6	8,1						
2	*Hemorrhois ravergieri* Spotted whip snake	1	-						
Dj 21				Rubbly-sandy foothills, Artemisia-ferula association	1 км	21.06.21	C25,6º	C24,1º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	4	5,3						
Dj 22				Rubbly plain with clay cliffs, Artemisia-saxaul association	1 км	22.06.21	C28,6º	C32,3º	17%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	4	2,5						
2	*Eremias velox* Rapid Lizard	1	-						
Dj 23				Rubbly plain with depressions and chakalaks (large hillocks up to 1-3 m	1 км	21.06.21	C25,5º	C24,1º	18%

				in height) Artemisia-Ferula association					
1	*Alsophylax laevis* Southern Even-fingered Gecko	6	8,1						

The highest density of Southern Even-fingered Gecko on the project territory, during the summer field trip, was recorded at Dj 19 point and amounted to 16 ind/ha (Figure 10).

As a result, Southern Even-fingered Gecko was found at 8 survey points during the summer field trip, which is 38% of all the survey points on the project territory. However, it must be noted that we did not find Southern Even-fingered Gecko at several points on potentially suitable biotope due to bad weather conditions during the survey period, namely due to strong wind: the wind speed sometimes reached 15-18 m/s. The following points (on which we did not observe the gecko during the summer survey) are still potential for Southern Even-fingered Gecko: Dj 2, 4, 6, 8, 22, 10 and 11.

Figure 10 Southern Even-fingered Gecko on Dj 19 point in June 2021 (adult male)

In general, the reptiles' species composition is typical for this geographical area.

Herpetological survey in the Bash WF project area (Ayak-agitma lake)

The first field visit was conducted in April 2021. April is the period of the highest activity of the Russian tortoise (*Testudo horsfieldii*), which is also listed in the Red List of the International Union for Conservation of Nature (IUCN Red List) as VU - vulnerable. However, April appeared to be not optimal for the gecko survey this year, since night temperatures were still quite low, and the weather in the desert is not stable at this time of the year. During this period, the very first individuals appear on the surface, while most are waiting for warmer weather. In connection with the above, the accounting of this species in April is not indicative. More information that is accurate was collected during

the summer survey, when an absolute number of individuals were active. As for the Caspian monitor (*Varanus griseus caspius*), the situation is almost the same as with the gecko, in April only some individuals were active. The Desert sand boa (*Eryx miliaris*) is active in both spring and summer, but this species can be observed in the daytime only in spring.

The second field visit was conducted in June 2021. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

All 4 species are listed also in the Red Book of the Republic of Uzbekistan and were found in the project area near Ayak-agitma lake.

Table 4 List of reptile species inhabiting the Bash WF project area

№	Species	Species presence acc. to literary sources	Author's earlier personal data	April 2021 field expedition data.	June 2021 field expedition data	Endemism	Nature conservation status		
							UzRDB	IUCN	CITES
Family *Bufonidae* (toads)									
1	Turan Toad *Bufotes turanensis*	+	+	+		UZ, TJ, TM			
Family *Testudinidae* (tortoises)									
1	Russian tortoise *Testudo horsfieldii*	+	+	+			2 (VU)	VU	II
Family *Gekkonidae* (geckoes)									
2	Southern Even-fingered Gecko *Alsophylax laevis*	+			+	UZ, TM	VU:D	CR	
3	Comb-toed Gecko *Crossobamon eversmanni*	+				UZ, TJ, TM, KZ, IR, AF			
4	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+	+	+			LC	
5	Turkestan thin-toed gecko*Tenuidactylus fedtschenkoi*	+	+	+	+	UZ, TJ, TM, KZ			
6	Common Wonder Gecko *Teratoscincus scincus*	+	+	+		UZ, TJ, TM, KG, IR,CN			
Family *Agamidae* (agamas)									
7	Steppe agama *Trapelus sanguinolentus*	+	+	+	+				
8	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+	+	+				

9	Lichtenstein's Toadhead Agama *Phrynocephalus interscapularis*	+	+	+		UZ, TM, KZ			
Family *Lacertidae* (true lizards)									
10	Rapid Lizard *Eremias velox*	+	+	+	+				
11	Aralo-Caspian racerunner *Eremias intermedia*	+		+					
12	Sand Racerunner *Eremias scripta*	+		+					
Family *Varanidae* (monitor lizards)									
13	Caspian Monitor *Varanus griseus caspius*	+	+	+			2 (VU:D)		I
Family *Boidae* (Boas)									
14	Desert sand boa *Eryx miliaris*	+		+			3 (NT)		II
Family *Colubridae* (colubrid snakes)									
15	Sand racer *Psammophis lineolatus*	+	+	+					
16	Spotted whip snake *Hemorrhois ravergieri*	+		+	+				
17	Spotted desert racer *Platyceps karelinii*	+	+	+					
18	Dice Snake *Natrix tessellata*	+	+						

Notes : UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); 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, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and two field survey results, currently, the Bash wind farm project area is inhabited by 1 amphibian species and 18 reptile species belonging to 7 families (Table 4). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 29,03%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (22,2% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (11,1% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (16,7% of the total number of species inhabiting the project area).

Spring survey (April 2021)

The first field trip to the survey points in the area of the Ayak-agitma lake was carried out from April 20 to 22, 2021. During the spring survey of the project area, 14 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 10).

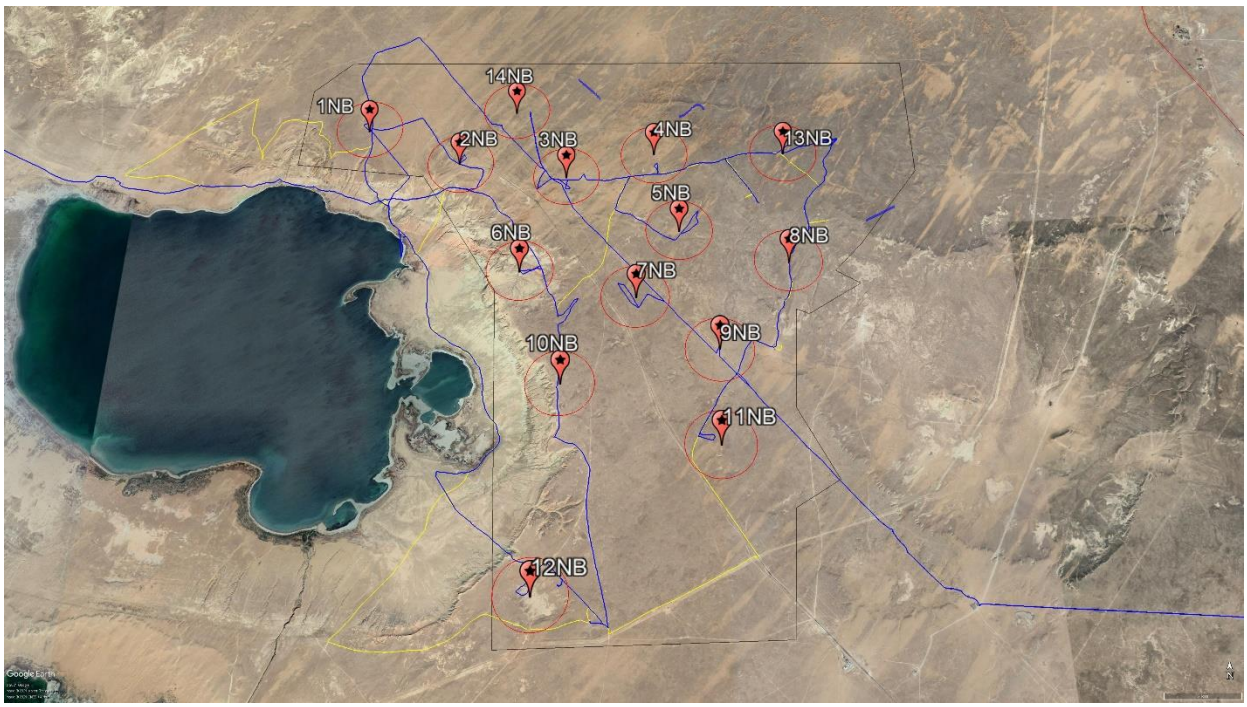

Figure 11 Observation points and transects on the Bash project territory in spring 2021

Reptile survey was carried out during the daytime, since the night temperature was too low for reptile activity. The situation was worsened by a strong gusty wind. Wind speed reached 16-18 m/s. However, during the daytime surveys, points on suitable for Southern Even-fingered Gecko biotope were examined for the possibility of conducting surveys in the summer.

The average night air temperature in April was 14 °C, the soil temperature was 11-12 °C, the air humidity was 38%. These values are not high enough for the reptile nocturnal survey.

During the survey of the territory, we recorded 7 reptiles species (11,3% of the total number of reptiles species), of which 3 species (42,8% of the number of species encountered) - Russian tortoise, Desert sand boa and Caspian monitor are included in the Red Book of the Republic of Uzbekistan, and one (14,3% of the number of species encountered) of them is included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

Table 5 Primary data and the density of reptiles at the observation points in the area of Lake Ayak-Agitma in the spring of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
NB 1				Loamy plain, Artemisia-Calligonum association,	1 km	20.04.21	C30,3°	C32,3°	21%

				Peganum harmala and Ferula					
1	*Testudo horsfieldii* Russian tortoise	2	0,8						
2	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 2				Loamy plain, Artemisia-Calligonum association, Peganum harmala and Ferula	1 km	20.04.21	C33,4°	C35,6°	19%
1	*Testudo horsfieldii* Russian tortoise	2	1,6						
2	*Eremias velox* Rapid Lizard	6	8,7						
NB 3				Small-hill sands, Artemisia-Calligonum- Ferula association	1 km	21.04.21	C19,3°	C29,0°	37%
1	*Testudo horsfieldii* Russian tortoise	2	3,1						
2	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 4				Fixed hilly sands, Artemisia--Calligonum- Ferula association	1 km	21.04.21	C18,7°	C23,2°	22%
1	*Testudo horsfieldii* Russian tortoise	4	3,03						
2	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 5				Fixed hilly sands, Artemisia--Calligonum- Ferula association	1 km	21.04.21	C19,3°	C23,7°	23%
1	*Trapelus sanguinolentus* Steppe agama	2	1,8						
NB 6				Clay hilly plain crossed by ravines Artemisia association	1 km	20.04.21	C28,2°	C33,8°	20%
1	*Testudo horsfieldii* Russian tortoise	2	0,22						
2	*Trapelus sanguinolentus* Steppe agama	2	2,3						
3	*Eremias velox* Rapid Lizard	1	-						
4	*Eryx miliaris* Desert sand boa	1	-						

NB 7				Clay plain, Artemisia association	1 km	20.04.21	C28,7°	C34,7°	20%
1	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 8				Fixed hilly sands, Artemisia-association	1 km	21.04.21	C23,5°	C31,5°	20%
1	*Testudo horsfieldii* Russian tortoise	13	3,6						
2	*Eremias velox* Rapid Lizard	2	3,1						
3	*Varanus griseus* Caspian Monitor	1	0,06						
NB 9				Clay plain, Artemisia association	1 km	21.04.21	C21,7°	C35,1°	31%
1	*Testudo horsfieldii* Russian tortoise	2	0,5						
2	*Eremias velox* Rapid Lizard	3	4,7						
NB 10				Clay hilly plain crossed by ravines, wormwood association	1 km	20.04.21	C27,1°	C28,0°	22%
0									
NB 11				Clay plain, Artemisia-Saxaul association	1 km	21.04.21	C23,1°	C33,6°	19%
1	*Testudo horsfieldii* Russian tortoise	2	1,6						
2	*Phrynocephalus helioscopus* Sunwatcher toad-headed agama	2	2,7						
NB 12				Clay hilly plain, Artemisia association	1 km	20.04.21	C22,7°	C19,4°	24%
0									
NB 13				Fixed hilly sands, Artemisia-Saxaul association	1 km	21.04.21	C19,1°	C29,3°	22%
1	*Testudo horsfieldii* Russian tortoise	6	2,6						
NB 14				Clay plain, Artemisia-Ferula association	1 km	21.04.21	C16,5°	C26,0°	41%
1	*Eremias velox* Rapid Lizard	2	3,1						
2	*Psammophis lineolatus* Sand racer	1	-						

The highest density of the Russian tortoise on the project territory during the Spring survey was recorded at NB 8 point and amounted to 3.6 ind/ha. However, similar number of 2 tortoises per transect was observed at several other points: NB 3, NB 4 and NB 13. The Russian tortoise was found at 9 points, which is 64,3% of the total number of observation points (14 points). It is worth noting that the Russian tortoise is not a numerous species throughout the project area.

The points located along the chinks of the Ayak-Agitma depression were identified as the most promising points for the summer Southern Even-fingered Gecko survey.

In general, the reptiles' species composition is typical for this geographical area.

Summer survey (June 2021)

The second field trip to the survey points in the area of the Ayak-Agitma lake was carried out from June 22 to 24, 2021. The priority of this field visit was to conduct the quantitative assessment of Southern Even-fingered Gecko population at the points identified in spring as the most suitable. During the summer survey of the project area, 13 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 8).

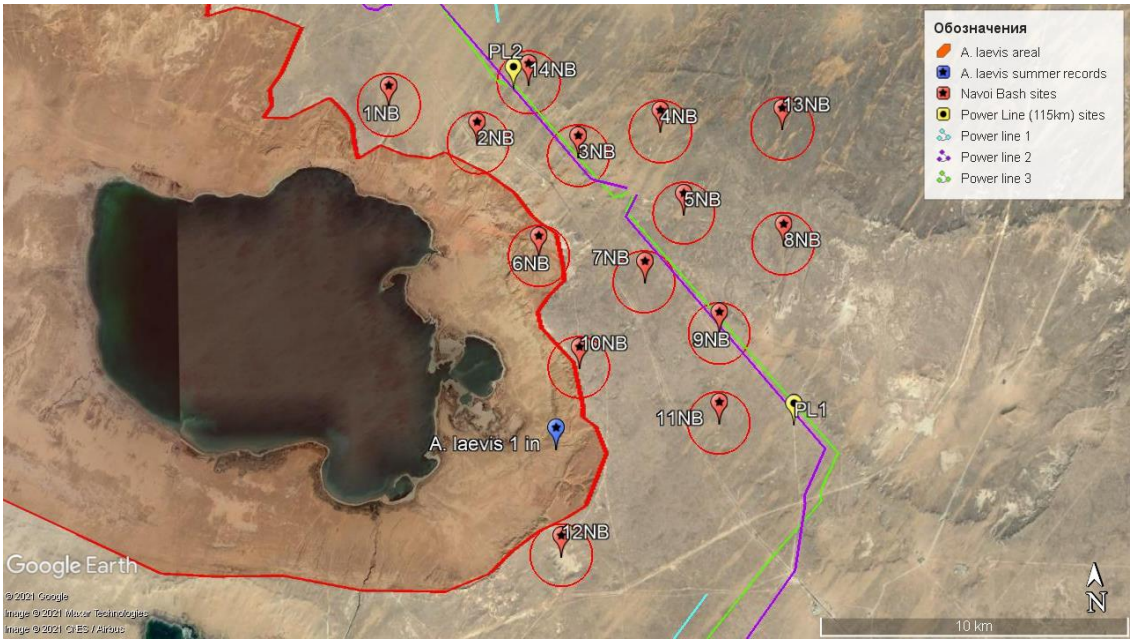

Figure 12 Survey points on the Bash WF project territory, as well as location where the Southern Even-fingered Gecko was observed in summer and the areal range for the Southern Even-fingered Gecko population in the vicinity of the Ayak-Agitma lake

Reptile survey was carried out mainly at night – after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases.

The average night air temperature in June was 27°C, the soil temperature was 28°C, the air humidity was 20%. These values are ideal for the nocturnal reptile survey, including the Southern Even-fingered Gecko.

However, the windy weather did not allow us to find many Southern Even-fingered Gecko. The wind speed reached 10-12 m/s.

Table 6 Primary data and the density of reptiles at the accounting points in the area of Lake Ayakagitma in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
NB 1				Loamy plain, Artemisia--Calligonum- Ferula association	1 km	22.06.21	C30,3°	C32,3°	21%
0									
NB 2				Loamy plain, Artemisia-Calligonum association, Peganum harmala and Ferula	1 km	22.06.21	C33,4°	C35,6°	19%
0									
NB 6				Clay hilly plain crossed by ravines, Artemisia association	1 km	24.06.21	C28,2°	C33,8°	20%
0									
NB 10				Clay hilly plain crossed by ravines, Artemisia association	1 km	24.06.21	C27,1°	C28,0°	22%
0									
NB 12				Clay hilly plain crossed by ravines, Artemisia association	1 km	23.06.21	C22,7°	C19,4°	24%
0									
NB 15 levis				Clay hilly plain crossed by ravines, Artemisia association	1 km	23.06.21	C22,7°	C24,8°	19%
1	*Alsophylax laevis* Southern Even-fingered Gecko	1	1,3						

During the survey of the territory, we recorded 1 reptiles species - Southern Even-fingered Gecko - (1,6% of the total number of reptiles species), which is included in the Red Book of the Republic of Uzbekistan (100% of the number of species encountered), and included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (100% of the number of species encountered). The variety of species for the second field visit turned out to be less than for the first, due to the narrow focus and specifics of the summer survey.

Herpetological survey along planned Dzhankeldy-Bash OHTL

During the construction of new power lines, there are great risks that some populations of rare and endemic species may be destroyed, in this regard, it is necessary to conduct detailed field studies for such populations.

The field trip to the survey points in the area along planned Dzhankeldy-Bash OHTL was carried out from June 19 to 25, 2021. During the summer survey of the project area, 13 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 13).

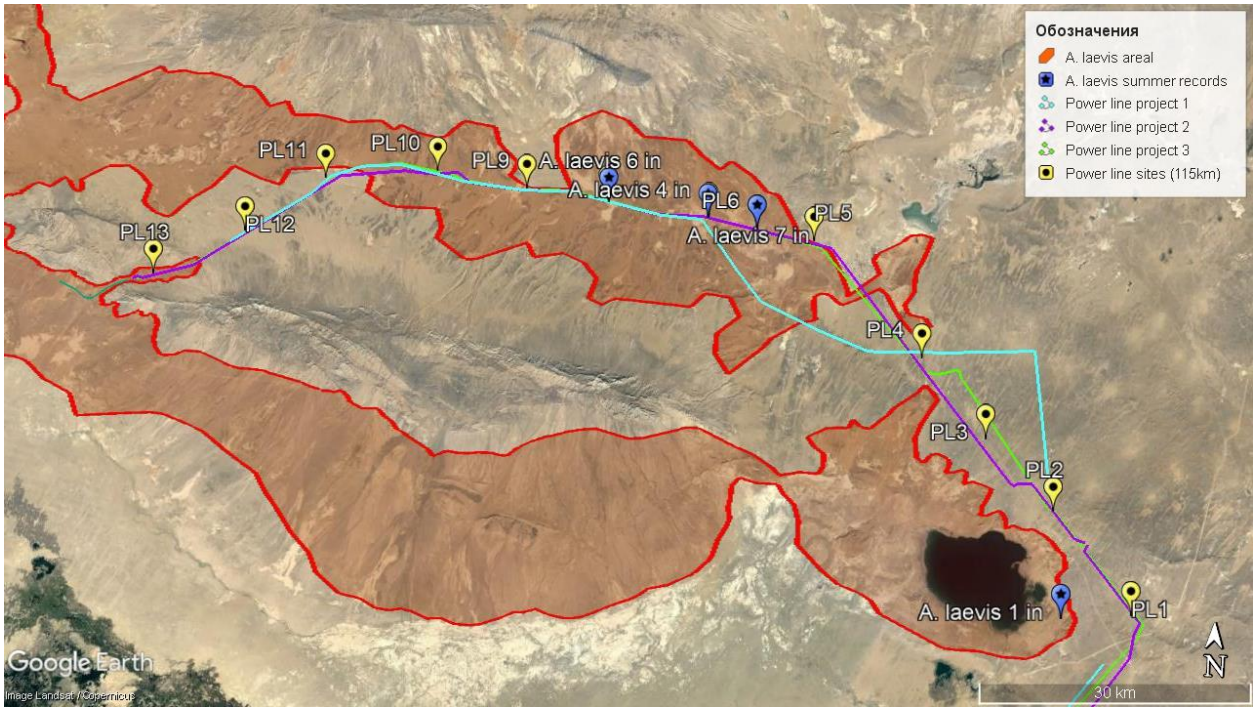

Figure 13 Survey points along planned Dzhankeldy-Bash OHTL, as well as locations where the Southern Even-fingered Gecko was observed in summer and the areal range for the Southern Even-fingered Gecko population

The main purpose of this field trip was to identify the areal of Southern Even-fingered Gecko population on the project territory. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. However, we found many burrows of this species at many survey points. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

Table 7 List of reptile species inhabiting the project area along planned Dzhankeldy-Bash OHTL

№	Name of species	The presence acc. to literary sources	Author's earlier personal data	June 2021 field expedition data	Endemism	Endemism		
						UzRDB	IUCN	CITES
Family Bufeniode (toads)								
1	Turan Toad *Bufotes turanensis*	+	+		UZ, TJ, TM			
Family *Testudinidae* (tortoises)								
1	Russian tortoise *Testudo horsfieldii*	+	+	+		2 (VU)	VU	II
Family *Gekkonidae* (geckoes)								
2	Southern Even-fingered Gecko *Alsophylax laevis*	+		+	UZ, TM	VU:D	CR	
3	Comb-toed Gecko *Crossobamon eversmanni*	+			UZ, TJ, TM, KZ, IR, AF			
4	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+	+			LC	
5	Turkestan thin-toed gecko*Tenuidactylus fedtschenkoi*	+	+		UZ, TJ, TM, KZ			
6	Common Wonder Gecko *Teratoscincus scincus*	+	+	+	UZ, TJ, TM, KG, IR,CN			
Family *Agamidae* (agamas)								
7	Steppe agama *Trapelus sanguinolentus*	+	+	+				
8	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+					
9	Lichtenstein's Toadhead Agama *Phrynocephalus interscapularis*	+	+		UZ, TM, KZ			
Family *Varanidae* (monitor lizards)								
10	Rapid Lizard *Eremias velox*	+	+	+				
12	Sand Racerunner *Eremias scripta*	+						
Family *Varanidae* (monitor lizards)								
13	Caspian Monitor *Varanus griseus caspius*	+	+	+		2 (VU:D)		I
Family *Boidae* (Boas)								
14	Desert sand boa *Eryx miliaris*	+				3 (NT)		II
Family *Colubridae* (colubrid snakes)								
15	Sand racer *Psammophis lineolatus*	+	+					

16	Spotted whip snake *Hemorrhois ravergieri*	+						
17	Spotted desert racer *Platyceps karelinii*	+	+					

Notes : UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); 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, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and the field survey results, currently, the project area along planned Dzankeld-Bash OHTL is inhabited by 1 amphibian species and 17 reptile species belonging to 7 families (Table 7). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 27,4%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (23,5% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (11,7% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (17,6% of the total number of species inhabiting the project area).

Reptile survey was carried out both during the day and at night. Moreover, in some points that were identified as potential habitats of the Southern Even-fingered Gecko during the day, both day and night surveys were carried out, in places that were identified as not suitable biotope for the Southern Even-fingered Gecko, night records were not carried out. Nocturnal survey was carried out after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases.

The average night air temperature was 22 ^{o}C, the soil temperature was 20 ^{o}C, the air humidity was 17%. These values are not high enough for the reptile nocturnal survey.

Since most of the project area runs along the highway, it was decided that in addition to the transect survey along planned OHTL, we would record the roadkill on the highway No. 4P61. So for 79.5 km of this highway, we found 2 young Caspian monitors (Figure 14), 2 Common Wonder Geckos and 4 Steppe agamas.

Figure 14 A young individual of Caspian monitor killed on highway No. 4P61 in Summer 2021

Table 8 Primary data and the density of reptiles at the survey points along planned Dzankeld-Bash OHTL in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
PL 1				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.06.21	C34,1°	C53,6°	16%
1	*Testudo horsfieldii* Russian tortoise	4 holes	-						
2	*Trapelus sanguinolentus* Steppe agama	6	8,9						

PL 2				Clay plain, Artemisia-Ferula association	1 km	25.06.21	C34,4°	C52,4°	16%
1	*Eremias velox* Rapid Lizard	4	5,7						
PL 3				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.06.21	C34,8°	C48,1°	16%
0									
PL 4				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.04.21	C33,7°	C47,2°	16%
2	*Trapelus sanguinolentus* Steppe agama	1	-						
PL 5				Semi-fixed hilly sands, Artemisia saxaul -ferula association	1 km	19.06.21	C40,0°	C55,3°	16%
1	*Testudo horsfieldii* Russian tortoise	1 hole	-						
2	*Trapelus sanguinolentus* Steppe agama	2	2,8						
3	*Varanus griseus caspius* Caspian Monitor	1	0,06						
PL 6				Sub-sandy hilly plain crossed by ravines and clay-rubbly uplands, Artemisia association	1 km	25.06.21	C24,7°	C22,5°	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	7	9,3						
2	Common Wonder Gecko *Teratoscincus scincus*	20	16,3						
PL 7				Clay hilly plain crossed by ravines, Artemisia-Saxaul-Sazkazgan association	1 km	25.06.21	C21,5°	C19,7°	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	4	5,2						
2	*Testudo horsfieldii* Russian tortoise	14 holes and 2 shells	-						
3	*Trapelus sanguinolentus* Steppe agama	3	4,3						
PL 8				Clay hilly plain, Artemisia-Tamarix association	1 km	25.06.21	C20,8°	C19,3°	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	6	8,1						

2	*Trapelus sanguinolentus* Steppe agama	3	4,3						
PL 9				Clay plain, Artemisia association	1 km	19.06.21	C36,7º	C42,8º	16%
1	*Trapelus sanguinolentus* Steppe agama	1	-						
2	*Eremias velox* Rapid Lizard	1	-						
PL 10				Small-hill sands, Artemisia-Calligonum- Ferula association	1 km	19.06.21	C35,4º	C39,5º	17%
1	*Testudo horsfieldii* Russian tortoise	Ruined egg clutch							
2	*Trapelus sanguinolentus* Steppe agama	2	2,7						
3	Common Wonder Gecko *Teratoscincus scincus*	trails	-						
PL 11				Fixed hilly sands, Artemisia-ferula association	1 km	20.06.21	C31,2º	C48,2º	16%
1	*Trapelus sanguinolentus* Steppe agama	1	-						
PL 12				Small-hill sands, Artemisia-Calligonum- Ferula association	1 km	20.06.21	C31,4º	C46,0º	16%
1	*Varanus griseus caspius* Caspian Monitor	1	0,01						
PL 13				Small-hill sands, with depressions Artemisia-Calligonum- Ferula association	1 km	20.06.21	C31,5º	C43,6º	16%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	-						
2	*Trapelus sanguinolentus* Steppe agama	3	4,1						
3	*Varanus griseus caspius* Caspian Monitor	1	0,025						

During the survey of the territory, we recorded 7 reptiles species (11,3% of the total number of reptiles species), of which 3 species (42,8% of the number of species encountered) - Russian tortoise, Caspian Monitor and Southern Even-fingered Gecko are included in the Red Book of the Republic of Uzbekistan, and two (28,6% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

The highest density of Southern Even-fingered Gecko on the project territory was recorded at PL 6 point and amounted to 9.3 ind/ha (Figure 15).

Figure 15 Southern Even-fingered Gecko on the PL 6 point in Summer 2021 (adult male)

Since Russian tortoise is in a state of aestivation in the summer months, the presence of the latter on the project territory was determined by the remains and traces of the species vital activity (burrows, etc.) (Figure 16).

Figure 16. The burrow of the Russian tortoise at the PL 6 point in Summer 2021

In general, the reptiles' species composition is typical for this geographical area.

Herpetological survey along planned Bash-Karakul OHTL

The field trip to the survey points in the area along planned Bash-Karakul OHTL was carried out from May 5 to 7, 2021. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 17).

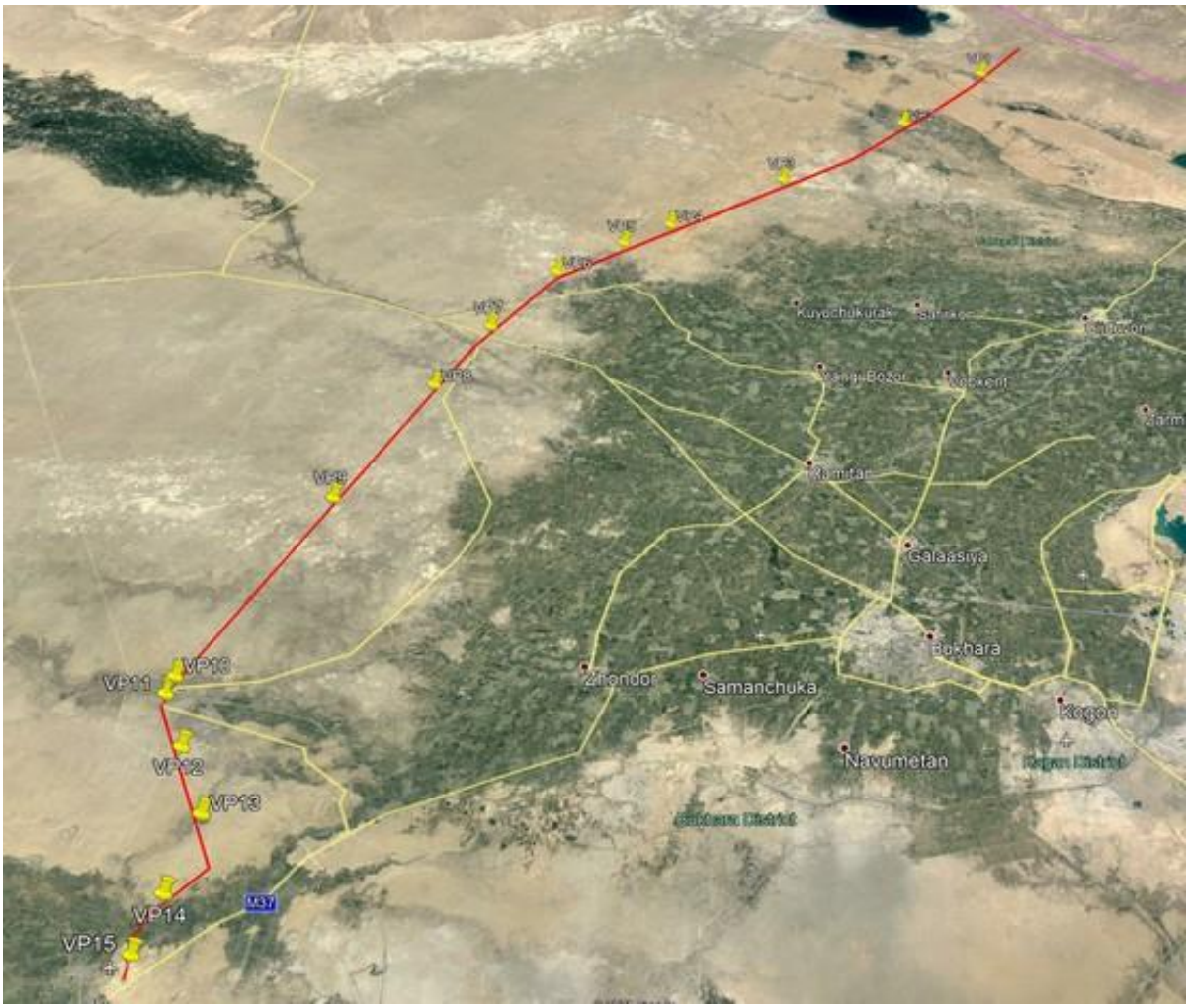

Figure 17 Survey points along planned Bash-Karakul OHTL

As a result of the field trip, 8 species of reptiles were recorded on the project territory, of which 2 species – the Russian tortoise and Caspian Monitor, are rare and threatened species listed in the Red Book of the Republic of Uzbekistan (2019). The most of the encountered reptiles are typical psamobionts. It is worth noting that the main part of the project area passes through agricultural lands, and no potential habitats for the Southern Even-fingered Gecko were identified throughout the project area.

Table 9 List of reptile species inhabiting the project area along planned Bash-Karakul OHTL

№	Species	Species presence acc. to literary sources	Author's earlier personal data	May 2021 field expedition data	Endemism	Nature conservation status		
						UzRDB	UzRDB	UzRDB

Family Bufonidae (toads)								
1	Turan Toad *Bufotes turanensis*	+	+		UZ, TJ, TM			
Family *Testudinidae* (tortoises)								
1	Russian tortoise *Testudo horsfieldii*	+	+	+		2 (VU)	VU	II
Family *Gekkonidae* (geckoes)								
2	Comb-toed Gecko *Crossobamon eversmanni*	+			UZ, TJ, TM, KZ, IR, AF			
3	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+				LC	
4	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+	+		UZ, TJ, TM, KZ			
5	Common Wonder Gecko *Teratoscincus scincus*	+	+	+	UZ, TJ, TM, KG, IR,CN			
Family *Agamidae* (agamas)								
6	Steppe agama *Trapelus sanguinolentus*	+	+	+				
7	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+						
8	Lichtenstein's Toadhead Agama *Phrynocephalus interscapularis*	+		+	UZ, TM, KZ			
9	Secret Toadhead Agama *Phrynocephalus mystaceus*	+						
Family *Lacertidae* (true lizards)								
10	Rapid Lizard *Eremias velox*	+	+	+				
11	Sand Racerunner *Eremias scripta*	+	+	+				
12	Reticulate Racerunner *Eremias grammica*			+				
Family *Varanidae* (monitor lizards)								
13	Caspian Monitor Varanus *griseus caspius*	+	+	+		2 (VU:D)		I
Family *Boidae* (Boas)								
14	Desert sand boa *Eryx miliaris*	+				3 (NT)		II
Family *Colubridae* (colubrid snakes)								
15	Sand racer *Psammophis lineolatus*	+	+					
16	Spotted whip snake *Hemorrhois ravergieri*	+	+					
17	Spotted desert racer *Platyceps karelinii*	+	+					
18	Diadem Snake *Spalerosophis diadema*	+	+					
Family *Viperidae*								
19	Saw-scaled Viper, Phoorsa *Echis multisquamatus*	+	+					

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation

of Nature (VU - vulnerable; NT – near-threatened); 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, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and the field survey results, currently, the project area along planned Bash-Karakul OHTL is inhabited by 1 amphibian species and 19 reptile species belonging to 8 families (Table 9). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 30,6%. Among them, 3 species are included in the Red Book of the Republic of Uzbekistan (2019) (15,8% of the total number of species inhabiting the project area), 1 species is included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (5,2% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (15,8% of the total number of species inhabiting the project area).

Table 10 Primary data and the density of reptiles at the survey points along planned Bash-Karakul OHTL in the spring of 2021

№	Species	Number	Density in/ ha	Biotope	Route length	Date and time	Air temperature	Soil temperature	Humidity %
VP 1				Sandy desert/ Waterbody	1 km	05.05.21	C34,1°	C42,6°	25%
1	*Eremias grammica* Reticulate Racerunner	1	1						
VP 2				Saline land Alhagi, Harmala, Capparis, Salsola association	1 km	05.05.21	C34,4°	C42,4°	21%
1	*Trapelus sanguinolentus* Steppe agama	1	1						
2	*Eremias grammica* Reticulate Racerunner	2	4,9						
3	*Varanus griseus caspius* Desert Monitor	1	0,1						
VP 3				Fixed sands. Sheep cot.	1 km	05.05.21	C34,8°	C38,3°	19%
1	*Trapelus sanguinolentus* Steppe agama	4	4,6						
2	*Eremias grammica* Reticulate Racerunner	2	3,3						

3	*Eremias scripta* Sand Racerunner	2	6,2						
4	*Eremias velox* Rapid Racerunner	1	1						
5	*Varanus griseus caspius* Desert Monitor	1	0,7						
VP 4				Sandy desert. Sheep cot. Vegetation is sparse.	1 km	05.05.21	C33,7°	C37,8°	19%
1	*Testudo horsfieldii* Central Asian tortoise	2 traces	-						
2	*Teratoscincus scincus* Common Wonder Gecko	12	12						
3	*Phrynocephalus interscapularis* Lichtenstein's Toadhead Agama	10	20						
4	*Eremias velox* Rapid Racerunner	2	3,3						
5	*Varanus griseus caspius* Desert Monitor	1	0,1						
VP 5				Old quarry with water	1 km	06.05.21	C32,0°	C35,6°	26%
1	*Eremias velox* Rapid Racerunner	2	3,3						
VP 6				Agricultural zone	1 km	06.05.21	C28,7°	C36,5°	24%
1	*Eremias grammica* Reticulate Racerunner	2	3,3						
VP 7				Developed zone	1 km	06.05.21	C28,5°	C36,7°	23%
1	*Eremias velox* Rapid Racerunner	2	3,3						
VP 8				Sandy desert	1 km	06.05.21	C27,8°	C35,3°	22%
0									
VP 9				Sandy desert	1 km	06.05.21	C33,7°	C43,8°	21%
1	*Testudo horsfieldii* Central Asian tortoise	3 traces	-						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
3	*Phrynocephalus interscapularis* Lichtenstein's Toadhead Agama	3	7,2						
4	*Eremias scripta* Sand Racerunner	1	1						

5	*Eremias velox* Rapid Racerunner	1	1						
VP 10				Sandy desert/ Waterbody	1 km	06.05.21	C33,4°	C38,5°	28%
0									
VP 11				Sandy desert. Saxaul association	1 km	07.05.21	C31,2°	C45,4°	19%
1	*Trapelus sanguinolentus* Steppe agama	2	3,3						
2	*Eremias grammica* Reticulate Racerunner	1	1						
3	*Eremias scripta* Sand Racerunner	2	4,9						
4	*Varanus griseus caspius* Desert Monitor	1	0,1						
VP 12				Sandy desert. Artemisia association.	1 km	07.05.21	C31,4°	C43,0°	22%
1	*Testudo horsfieldii* Central Asian tortoise	1	0,01						
2	*Trapelus sanguinolentus* Steppe agama	3	2,3						
3	*Teratoscincus scincus* Common Wonder Gecko	1 egg	-						
4	*Eremias scripta* Sand Racerunner	1	3,1						
VP 13				Sandy desert Saxsaul. Alhagi, Salsola association	1 km	07.05.21	C31,5°	C45,7°	22%
1	*Trapelus sanguinolentus* Steppe agama	1	1						
2	*Eremias scripta* Sand Racerunner	2	3,3						
VP 14				Agricultural zone. In the fields of alfalfa and wheat Tamarix association	1 km	07.05.21	C23,7°	C29,1°	26%
1	*Trapelus sanguinolentus* Steppe agama	1	1						
2	*Eremias velox* Rapid Racerunner	1	1						
VP 15				Developed zone	1 km	07.05.21	C22,5°	C28,7°	24%
0									

RARE SPECIES OF REPTILES INHABITING THE PROJECT TERRITORIES

Family *TESTUDINIDAE*

Russian tortoise
Testudo horsfieldii (Gray, 1844)

Figure 18 Russian tortoise. Photo by T. V. Abduraupov.

The Russian tortoise is a vulnerable species endemic to Central Asia, whose numbers are decreasing. It is included in the IUCN Red List [VU] and the Red Book of the Republic of Uzbekistan 2(VU) (2019) and listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

This species is endemic to Central Asia, where it inhabits lowlands and foothills (except drifting sands). In addition to Southern Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan and Tajikistan, it is distributed in Northern and Eastern Iran, Afghanistan, North-western China and Northern Pakistan (Ananyeva et al., 1998; Bogdanov, 1960, 1965).

Carapace length is up to 286.4 mm. The carapace is flat, slightly serrated at the rear edge. The indentation on its front edge is not deep. Each of the front paws has four claws. The forearm is covered with six to seven transverse rows of tile-like mails. On the back of the thigh there are several horny tubercles concentrated in one group. The horny mails of the carapace are usually monochromatic, yellowish or brownish-olive, sometimes with wide black spots, more pronounced on the plastron.

It inhabits both sandy and clayey deserts, plains, mountain slopes, depressions and valleys, gorges and mountain steppe up to 1,150 m above sea level (Dal, 1936, 1937). Rarely lives on agricultural lands – on the edges of irrigated and unirrigated fields, in

vegetable gardens and orchards. Avoids places with dense grass cover, as well as areas grazed intensively by livestock.

This is a strictly diurnal species. In hot weather, it can be observed only in the morning and before sunset. In the middle of the day, animals hide from the heat in temporary shelters under shrubs, where they half burrow into the soil, into the holes of rodents or those dug by themselves. During the day, tortoises are capable of covering from 120 m to 2 km. At night they burrow into shallow pits, sometimes remaining on the surface of the ground.

After the winter diapause, tortoises appear on the surface in March—early April, in warm winters and in the south of the range – in February. Mating begins a few days after their emergence. The breeding season is extended from late March to late May. Newly emerged tortoises with a shell 30—50 mm long remain under the ground during the winter and usually appear on the surface next spring.

They grow slowly. Tortoises become mature at the age of 10—13 years, when their carapaces reach 11 cm in length. In natural environment, they can live for at least 30 years.

In June, when ephemeral vegetation dries, the Russian tortoise enters a period of estivation (summer dormancy), for which it digs holes up to 1 m long. In deserts tortoises disappear by the end of May, but in the mountains or on irrigated lands, single individuals may be recorded in June and even July. Much more often, estivation flows into hibernation (winter dormancy).

In certain areas in the southern piedmont plains of Tamdytau and the eastern piedmont plains of Dzhetymtau (Navoi region), the population density averaged 11.7 individuals/ha, with a maximum of up to 15.6 inds./ha; in the pebbly-gravelly-loamy piedmont plain – 12.31 inds./ha (avg. 7.63 ± 5.92 inds./ha); in the rest of the area it was rare. In the rugged rocky areas of low mountains (Aitymtau Mountains) the tortoise occurs mainly along valleys. The highest population density of the species is 4.14 individuals/ha, which was recorded in a gently sloping valley with eroded loamy slopes (Bondarenko, 1994).

In the steppe between Tamdy and Ayakuduk – 29.2 inds./ha were recorded – 26.4♂: 50.5♀: 23.1 juv (Vashetko, Nuridjanov et al., 2010).

The number of tortoises is subject to significant fluctuations (Bogdanov, 1965), which depend on winter and spring meteorological conditions, as well as the abundance of food in biotopes where the animals live. The cultivation of virgin lands, livestock grazing and the use of natural habitats by humans significantly impact the population.

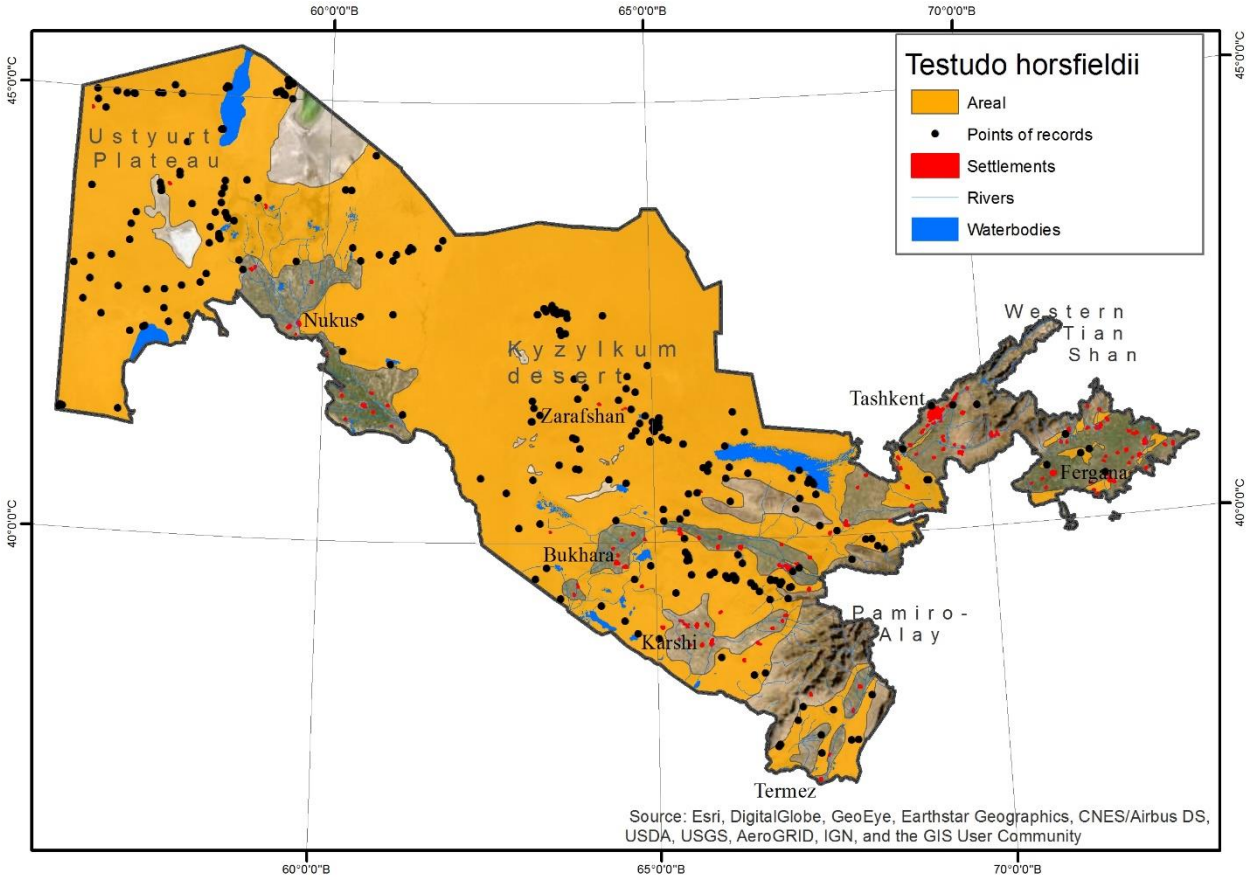

Figure 19 Map of the areal and known locations of the Russian tortoise in various regions of the Republic of Uzbekistan

Family *GEKKONIDAE*

Southern Even-fingered Gecko
Alsophylax laevis Nikolsky, 1907

Figure 20 Southern Even-fingered Gecko. Photo by T. V. Abduraupov.

This is a vulnerable, declining, sporadically distributed endemic species. Listed in the IUCN Red List [CR] and in the Red Book of the Republic of Uzbekistan 2 (VU: D) (2019). Endemic to Uzbekistan and Turkmenistan.

Length of the body with the head: male – up to 31 mm, female – up to 33 mm (Figure 14). The head and body are slightly flattened from top to bottom. There are 16—20 scales across the forehead between the centers of the eyes. The upper side of the body is yellowish with a grey tint, with four indistinct, dark transverse, sometimes interrupting stripes on the back; similar stripes can be seen on the upper surface of the limbs and tail; in immature individuals the stripes are more contrasting. A wide dark longitudinal stripe extends from the tip of the muzzle across the eyes as far as the nape. There is a transverse stripe on the back of the head.

The Southern Even-fingered Gecko occurs on takyr with sparse vegetation, where completely barren and flat areas alternate with areas where short saltwort, clusters of wormwood and camel thorn and weak meadow grass plants grow.

In the 1970s, there were from 0.3 (Ayakagytma depression) to 1,600 individuals (Kuldzhuktau sky island) recorded on 1 hectare in local populations; by now it has disappeared from many known habitats, while in others the number has sharply decreased (Bogdanov, 1992).

Southern Even-fingered Gecko is active from March to October at night, while during the day it hides in cracks in the ground, in its burrow or the hole of an insect or some other lizard. Mating takes place in March—April. In one season (from May to August) females produce 1–2 clutches each consisting of 1–2 eggs. The first young under 1 year of age

are observed from mid-July; they become mature after wintering. It feeds on small insects and arachnids.

O. P. Bogdanov (1992) recorded Southern Even-fingered Gecko in the central part of Kyzylkum, near the Kuldzhuktau residual mountains and along the escarpments of the Ayakagytma depression. We recorded this species in small numbers at the foot of the Lau-Lau elevation: during a 3-hour night transect we encountered only 2 individuals. We also found one individual near a railway, at the Moilisay station not far from Uchkuduk.

Quite numerous mosaic populations were observed by us near the settlements of Dzhankeldy and Kalaata in the southern foothill part of the Kuldzhuktau outlier. In this part of the range, the number of Southern Even-fingered Gecko reaches up to 12-16 ind/ha. Also, almost the same populations exist north-east of the Kuldzhuktau outlier, near the Karakata depression – 9-10 ind/ha. According to our data, the number of Southern Even-fingered Geckos on the slopes of the Ayak-Agitma depression is quite low – 1.3 ind/ha.

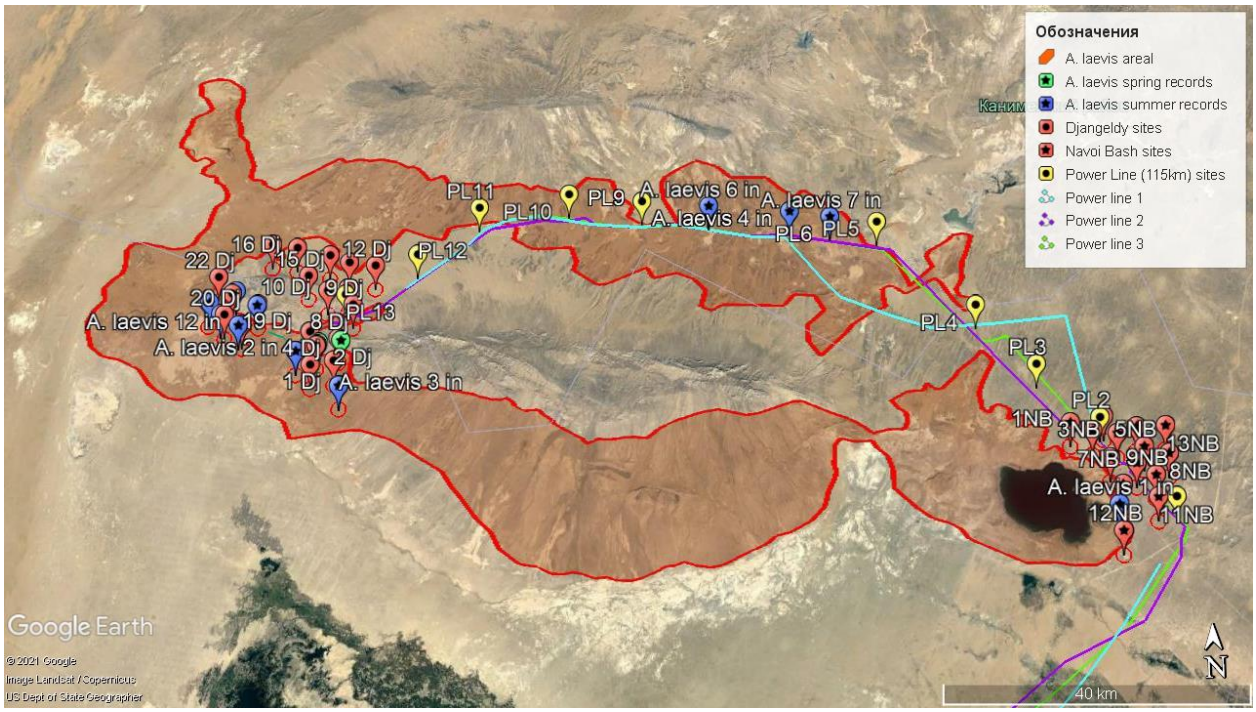

Figure 21 Map of the areal and known locations of the Southern Even-fingered Gecko on the project territories

Family *VARANIDAE*

Caspian Monitor
Varanus griseus caspius (Eichwald, 1831)

Figure 22 Caspian Monitor. Photo by T. V. Abduraupov.

Rare species. UzRDB (2019): 2 (VU:D).

The largest lizard in Uzbekistan and neighboring countries. The length of the body with the head is up to 520 mm. The upper side of the body is greyish-brown, yellowish-brown or reddish-brown, with numerous dark dots and specks. On the upper side of the neck there are two or three longitudinal brown stripes, and on the back and tail there are several transverse stripes of the same colour. In youngsters, the stripes are very pronounced, they are black or almost black.

After hibernation, the first individuals appear relatively late – in early to mid-April. Active all day throughout April. In May, they are active in the morning and evening hours. They go into hibernation in September-October. Often the Caspian Monitor has an estivation in summer, which gradually turns into winter hibernation. They begin estivating in late June—early July.

It inhabits mainly fixed and semi-fixed sands, clay and stony-gravelly soils, visits solonchaks. Sometimes it is found in the foothills of sky islands up to 1,000 m above sea level. M. Andrushko (1953) recorded the species in the central part of Kyzylkum. T. Z. Zakhidov (1938) reports that the Caspian Monitor often occurs in the northern part of the Kenimeh desert.

According to an oral report of the surveyor of the Houbara Bustard Breeding Center in the Bukhara region, Dr. John Burnside, Caspian Monitor is quite often found around the remnants of Kuldzhuktau, especially in the vicinity of the villages of Dzhankeldy and

Kalaata. We have also repeatedly observed it in the area of the Kuldzhuktau, Bukantau and Auminzatau residual mountains, as well as in the vicinity of Ayak-Agitma Lake in 2012, 2014 and 2019.

Family *BOIDAE*

Desert sand boa
Eryx miliaris (Pallas, 1773)

Figure 23 Desert sand boa. Photo by T. V. Abduraupov.

Desert sand boa is a near-threatened, sporadically distributed subspecies, included in the Red Data Book of the Republic of Uzbekistan (2019) with the status 3(NT); also included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A medium-size snake. Females reach 720 mm in length, males are somewhat smaller – 550-580 mm. Tail length – 50-70 mm. The tail is short and blunt.

It lives mainly in sand deserts, where it prefers drifting and semi-fixed dunes, as well as more or less loose soils in deserts and semi-deserts with wormwood-saltwort communities and saltwort populations. It is less common on takyrs with patches of vegetation near sands and on relatively hard loess and clay soils, near ruins, on the slopes of gullies and at the borders of irrigated lands. Often occurs near colonies of Gerbils, whose burrows it uses to shelter. It is able to plunge into the sand quickly, head first, and "swim" under its surface, leaving a characteristic trail in the form of a serpentine bulge. The upward-looking eyes allow the Desert sand boa to examine the surface without raising its head above the sand.

Active from April to October. In the hot season, it leads a nocturnal and crepuscular lifestyle. It uses the holes of rodents as a refuge, therefore it often settles in colonies of Gerbils. The breeding season is in late March. In June-July, the female gives birth to 4—10 babies up to 12—14 cm long. It feeds on lizards, rodents and small birds.

M. N. Bogdanov (1882) encountered this species in the sands of the Kyzylkum desert. A. M. Andrushko (1953) recorded it in the central part of the desert, and T. Z. Zakhidov

(1938) – in the Kenimeh desert. Kh. S. Salikhbayev caught this snake in the Shafrikan forestry enterprise (leskhoz) near Barat-Kuduk (Bogdanov 1960).

In the 1950s, up to 20 individuals from the local population were recorded on a three-hour transect in Bukhara region (Shafrikan leskhoz).

In 2014 and 2016 our team recorded the Desert sand boa in the central part of the Kyzylkum desert, in the Yamankum sands, where it inhabits semi-fixed dunes. The average density of this species during the period of the highest activity in the Yamankum sands is 0.3–0.4 ind/ha. The average density of the Desert sand boa during the period of the highest activity in this area is 0.2-0.3 ind/ha. We have repeatedly observed it near the Ayak-Agitma depression and near the settlements of Kalaata and Dzhankeldy.

Currently, the population is rapidly decreasing due to increased poaching (the species is used in traditional medicine), high export and cultivation of lands.

SUMMARY TABLES

Table 11 List of reptile species found on the Dzankeldy WF project area

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED	
	LATIN	ENGLISH		SPRING	SUMMER
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	17	-
2	*Alsophylax laevis*	Southern Even-fingered Gecko	CR/2(VU:D)	7	47
3	*Tenuidactylus caspius*	Caspian thin-toed gecko	LC/-	2	6
4	*Tenuidactylus fedtschenkoi*	Turkestan thin-toed gecko	LC/-	2	3
5	*Trapelus sanguinolentus*	Steppe Agama	-/-	18	3
6	*Phrynocephalus helioscopus*	Sunwatcher toad-headed agama	-/-	1	2
7	*Phrynocephalus reticulatus*	Reticulated toad-headed agama	LC/-	11	4
8	*Eremias intermedia*	Aralo-Caspian racerunner	LC/-	12	-
9	*Eremias lineolata*	Striped racerunner	LC/-	1	-
10	*Eremias velox*	Rapid racerunner	-/-	3	1
11	*Eryx miliaris*	Desert sand boa	-/3(NT)	1	
12	*Hemorrhois ravergieri*	Spotted whip snake	-/-	-	1

Table 12 List of reptile species found on the Bash WF project area

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED	
	LATIN	ENGLISH		SPRING	SUMMER
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	35	-
2	*Alsophylax laevis*	Southern Even-fingered Gecko	CR/2(VU:D)	-	1
3	*Trapelus sanguinolentus*	Steppe Agama	-/-	8	-
4	*Phrynocephalus helioscopus*	Sunwatcher toad-headed agama	-/-	2	-
5	*Eremias velox*	Rapid racerunner	-/-	14	-
6	*Varanus griseus*	Caspian Monitor	-/2(VU:D)	1	-
7	*Eryx miliaris*	Desert sand boa	-/3(NT)	1	-
8	*Psammophis lineolatus*	Sand racer	-/-	1	-

Table 13 List of reptile species found on the project area along planned Dzhankeldy-Bash OHTL

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	19 holes
2	*Alsophylax laevis*	Southern Even-fingered Gecko	CR/2(VU:D)	17
3	*Tenuidactylus caspius*	Caspian thin-toed gecko	LC/-	1
4	*Teratoscincus scincus*	Common Wonder Gecko	-/-	20
5	*Trapelus sanguinolentus*	Steppe Agama	-/-	22
6	*Eremias velox*	Rapid racerunner	-/-	5
7	*Varanus griseus*	Caspian Monitor	-/2(VU:D)	3

Table 14 List of reptile species found on the project area along planned Bash-Karakul OHTL

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	5 traces, 1 in.
2	*Teratoscincus scincus*	Common Wonder Gecko	-/-	12
3	*Trapelus sanguinolentus*	Steppe Agama	-/-	13
4	*Phrynocephalus interscapularis*	Lichtenstein's Toadhead Agama	-/-	13
5	*Eremias grammica*	Reticulate racerunner	LC/-	8
6	*Eremias scripta*	Sand racerunner	LC/-	6
7	*Eremias velox*	Rapid racerunner	-/-	9
8	*Varanus griseus*	Caspian Monitor	-/2(VU:D)	4

CONSTRUCTION-RELATED THREATS

1. The development of natural habitats for many species of reptiles (including rare ones) may cause the population loss, especially populations of narrow-area endemics, such as Southern Even-fingered Gecko;
2. Animals (insects, amphibians, reptiles, birds, mammals) can get into the pit and trenches dug for the construction purposes, which can lead to their injury and death. These trenches are especially dangerous for the Russian tortoise;
3. Changing the existing relief will lead to partial loss of the habitats for animals inhabiting the project area;
4. If the construction work is begun in the winter season, part of the population of reptiles (including rare ones) being in hibernation in the ground may die;
5. Linear structures connected to the construction site will also pose threat to the life of most reptiles, especially Russian tortoise and Caspian Monitor.

RECOMMENDATIONS

Safety and environmental protection must be priorities in any activity, for which it is necessary, after assessing potential threats, in this case to biodiversity, to make efforts to carry out activities aimed at minimizing potential damage. In this regard, we recommend the following actions:

1. Seasonality of work. The construction work must take into consideration the reptiles' activity features. That is, it is advisable that all construction work should be carried out at a time when all reptiles came out of hibernation (winter dormancy). In this period, reptiles do not have permanent burrows and can leave the construction site in advance. If the works begins in the hibernation period, underground wintering chambers can be damaged and then the reptile is doomed to death.
2. Construction works must be carried out strictly within the territory designated for the purpose.
3. All trenches must be levelled (filled with earth) after the termination of the construction; trenches should not be used as barriers to protect the territory, so that animals should not be captured there.
4. When the construction stage is over, it is necessary to monitor regularly populations of terrestrial animals in the existing research sites within the project territory.
5. The so-called 'closed zones' (protected with a fence) must be organized in the territory of the objects, where no activity should be allowed. This territory should be representative from the point of view of the biotope and the presence of a protected species. It would serve both a buffer zone of the object and, at the same time, a kind of protected area where animals can live undisturbed.
6. Creation/support of a reptile's nursery, with the function of rehabilitation and breeding of rare species, such as Southern Even-fingered Gecko and Russian tortoise. After the construction work, it is possible to resettle these animals back to

the reclaimed areas from the nursery. This nursery could help in preserving rare narrow-area endemic reptile species.

7. It is necessary to conduct large-scale work to study the current state of populations and the boundaries of the areal of the Southern Even-fingered Gecko throughout Uzbekistan.
8. The Russian tortoises must be removed from the construction site to nearby areas with similar biotopes. Moreover, after the removal, the construction site must be enclosed in a solid corrugated metal fence to prevent the tortoises' possible returning to the construction site.

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Juru Energy

Entomological Survey report

Report Title	Entomological Survey report
Scope	INVERTEBRATES
Areas Covered	BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021
Notes	

Juru Energy

Entomological survey

BASH WIND FARM PROJECT:

CLIENT: 5 CAPITALS

Date: June 2021

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Contents

Introduction

Studies of the regional entomofauna were launched in the second half of the 19th century by researchers and travellers A. P. Fedchenko and O. A. Fedchenko, who made large collections of plants and insects in the Kyzylkum desert. Descriptions of a number of new species and information on the distribution of representatives of the Kyzylkum entomofauna can be found in A. P. Fedchenko's Trip to Turkestan series (1871—1873).

The studied area of Bash WF is located in the south-west of the Kyzylkum desert, Bukhara Province.

In 1923-1931, the entomofauna of Bukhara Province was studied by V. V. Yakhontov.

In 1934-1937, entomologists V. N. Nevsky and A. A. Bekuzin from the Central Asian State University organised a zoological expedition to the Kanimeh steppe (south-eastern part of Kyzylkum). The data they collected was used by V. P. Nevsky to write his work Entomofauna of the Kanimeh Desert («Энтомофауна Кенимехской пустыни») (1953). The author described 250 insect species and their associations with specific biotopes and plants.

M. P. Sosnina (1958) and B. V. Korniyenko (1962, 1963, 1967, 1971) provided information on the insects of the Karnabchul clayey desert adjoining South-Western Kyzylkum. The deepest research was made by Yu. V. Sinadsky (1959, 1963, 1964, 1968), who studied insects damaging Central Asian desert forests, including those in Kyzylkum. His works summaries data on insects' species composition, ecology and biology.

In 1962-1963, a team of researchers from the Severtsov Institute of the Evolutionary Morphology and Ecology of Animals, Academy of Sciences of the USSR, headed by Academician M. S. Gilyarov, studied the zoology of soils in the Ayakguzhumdy area. The findings were published in articles by B. M. Mamayev (1966), F. N. Pravdin (1965), M. S. Gilyarov and B. M. Mamayev (1964, 1967).

In 1965-1966, a team of entomologists from the Institute of Zoology, Academy of Sciences of the USSR, worked in the Kyzylkum desert and gathered large amounts of data on various groups of insects. Since 1966, M. I. Falkovich was studying the ecology and economic significance of lepidopterans in the territory of the Kyzylkum desert station. He identified over 600 insect species, studied trophic links in about 250 and described a number of new species in the families Coleophondae. Scytridae and Geometridae (1969, 1970, 1972). I. L. Sukhareva (1972) published materials on the owlet moths of Kyzylkum.

The most comprehensive work covering the insect fauna of the region is «Entomofauna of South-Western Kyzylkum» (A. G. Davletshina et al. 1979). In 1962—1964 the authors made research into the part of the desert between the Shafirkan village and Dzhankeldy in the west, the Mingbulak depression in the north and Tamdybulak in the east. The route ran along the sky islands of Kuljuktau, Auminzatau, the southern portion of Bukantau, Tamdytau, and the Mingbulak, Karakata and Ayakagitma depressions.

In 1974—1975, in the north and north-east of the western portion of the Kyzylkum desert the survey covered the villages of Ayakagytma and Dzhankeldy, Karakata depression, the towns of Zeravshan and Tamdybulak, in the south – Alat District of Bukhara Province and the Karakul Reserve, which is the southernmost point of the South-Western Kyzylkum.

According to the authors, this territory was inhabited by 1,100 species from 16 genera and 108 families, 3 of which are included in the Red Data Book of Uzbekistan: *Hypermnestra helios* Nickerl, 1846 (NT), *Satanas gigas* Eversmann,1855 (VU: R), *Reduvius fedtschenkianus* Oshanin, 1871 (VU: R).

The collection of papers Insects as Components of the Saxaul Forest Biocoenosis (Mamayev et al., 1975) on insects' species composition, ecology and their biocoenotic relations with plants was a great contribution to the study of the entomofauna of desert forest biocoenoses. The work reveals insects' evolution and distribution patterns in man-planted saxaul woods.

G. M. Dlussky made big research into the ants of the desert in 1960—1970, which resulted in the monograph Ants of the Desert (Dlussky 1981).

The entomofauna of specific desert plants was studied in subsequent years – saxaul (Nurmuratov, 1971), Calligonum (Yelyubayev, 1974), sagebrush (Moiseyeva, 1965, Korniyenko, 1967), sand acacia (Soitova, 1974) and other.

In April 2014, May 2015 and September 2017, 3 joint Russian-Uzbek expeditions were organised as part of an international cooperation agreement between the Karshi and Nizhny Novgorod State Universities to inventory the entomofauna of certain regions of Uzbekistan. The results of the first expedition, including the itinerary with the coordinates of locations where the material was collected, were published in a special issue of the 'Эверсманния' (Eversmannia) magazine (Anufriyev, Rahimov, 2015 and other). The same issue contains an article describing 24 ant species (Mokrousov, Zryanin, 2015).

In 2017, A. G. Blummer described a new species in the Kyzylkum desert – *Uranembia rivkusi* Blyummer.

However, in general, desert entomocoenoses are not studied properly. There are no comprehensive, generalising works on or full lists of Central Asian desert insects.

Based on the desktop study 11 insect species listed in the Red Data Book of Uzbekistan were identified as possible on the studied territory and adjacent areas.

Order – Heteroptera

1. *Reduvius fedchenkianus* Oshanin, 1871 (VU:R)

Order – Hymenoptera

Family – Sphecidae

2. *Fedtschenkia indigotea* Radoszkowski, 1886 (EN)
3. *Chlorion regae* F.Smith, 1873 (VU:R)
4. *Prionyx macula lugens* Kohl, 1890 (VU:R)

5. *Prionyx nigropenctinatus* (Taschenberg, 1869) (VU:R)
6. *Eremochares mirabilis* (Gussakovskij, 1928) (VU:R)

Family – Crabronidae

7. *Larra transcaspica* F.morawitz, 1894 (VU:R)
8. *Laphyragogus kohlii* (Bingham, 1896) (VU:R)

Order – Lepidoptera

Family – Noctuidae

9. *Catocala remissa* Staudinger, 1891(VU:D)

Family – Papilionidae

10. *Hypermnestra helios* Nickerl, 1846 (NT)

Order – Diptera

Family – Asilidae

11. *Satanas gigas* Eversmann,1855 (VU:R)

Survey methodology

Transect and area surveys were used in this study. Transects were employed for noticeable and easily identifiable large-size species, such as mantis, various beetles, butterflies and dragonflies, as well as their nests (wasps, ants). Transects were 1 km long and 2 m wide. One of the varieties of transect – current recording method – was used in complex topographies. In this case, the 1-kilometre-long line was divided into two 500-metre or five 200-metre sections, depending on the terrain. As they moved along a transect, researchers recorded in their notebooks every insect that could be identified right on the spot. In addition, insects along the transects were caught using a net. All transects were recorded with the help of GPSs.

Since often it is impossible to identify reliably the species of an insect without examining it with a microscope or magnifying glass, the insects were caught with the help of special traps for identification.

After the expedition, the material that could not be identified in the field was identified at the entomology laboratory at the Institute of Zoology, Academy of Sciences of Uzbekistan, with the help of a binocular digital microscope.

Physiographical characteristics of the survey areas

The studied area is located in the south-west of the Kyzylkum desert. The desert is a unique physiographical region spreading over the interfluvial area between the Amudarya and Syrdarya in Uzbekistan. In the north-west it is bordered by the Aralkum desert and Aral Sea, in the north-east by the Syrdarya river, in the east by the spurs of the Tien Shan and Pamir-Alai and in the south-west by the Amudarya.

The study area encompasses the low sky islands of Kuljuktau in the west and south and Ayakagytma depression as far as to the Bashagytma spring in the east. The territory is a flatland with fixed and semi-fixed sands and piedmont plains covered with gypsum deserts. Sand ridges and hillocks are fixed with vegetation. Depressions between the ridges are occupied by takyrs.

Accumulative temperatures in the growing season are quite high in the area, while relative humidity in the daytime in July is never above 20%, usually ranging within 15-16%. About 45% of annual precipitation falls in spring.

Because of low precipitation, very dry air and high temperatures in summer, the soil dries up somewhat earlier than in more humid regions of Uzbekistan. Nevertheless, due to a lower wilting point, the drought on sandy and sandy-loamy soils affects vegetation less than in loamy and clayey areas.

Vegetation

The vegetation in the studied area is highly diverse. One of the typical plants is the semi-shrub sagebrush *Artemisia*. Sagebrush associations occupy large areas of the gypsum desert on the piedmont plains of the Kuljuktau area. The sand cover is favourable for the distribution of bindweed, *Astragalus* and saltwort (*Salsola arbuscula, Salsola orientalis*) associations. Sandy areas feature *Aristida*, *Calligonum*, *Ammodendron, Haloxylon persicum, Carex physodes, Astragalus*, *Ephedra* and similar plants. *Tamarix, Haloxylon persicum* and *Salsola* associations develop on the bottoms of depressions near bodies of water (wells).

Intense overgrazing in the desert leads to strong changes in the numbers and composition of natural biocoenoses. *Peganum harmala* develops actively on heavily overgrazed areas.

Results

The entomological survey was conducted from 19 to 21 April on the project territory of Bash WF and from 3 to 6 May 2021 along OHTL from Bash WF to Karakul substation, by A. G. Akhmedov, a researcher from the Entomology laboratory at the Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan.

All the recorded insect species have the status of 'not listed'.

12 locations were surveyed on the project territory of Bash WF (Figure 1). The results of the survey are presented in the Table 1.

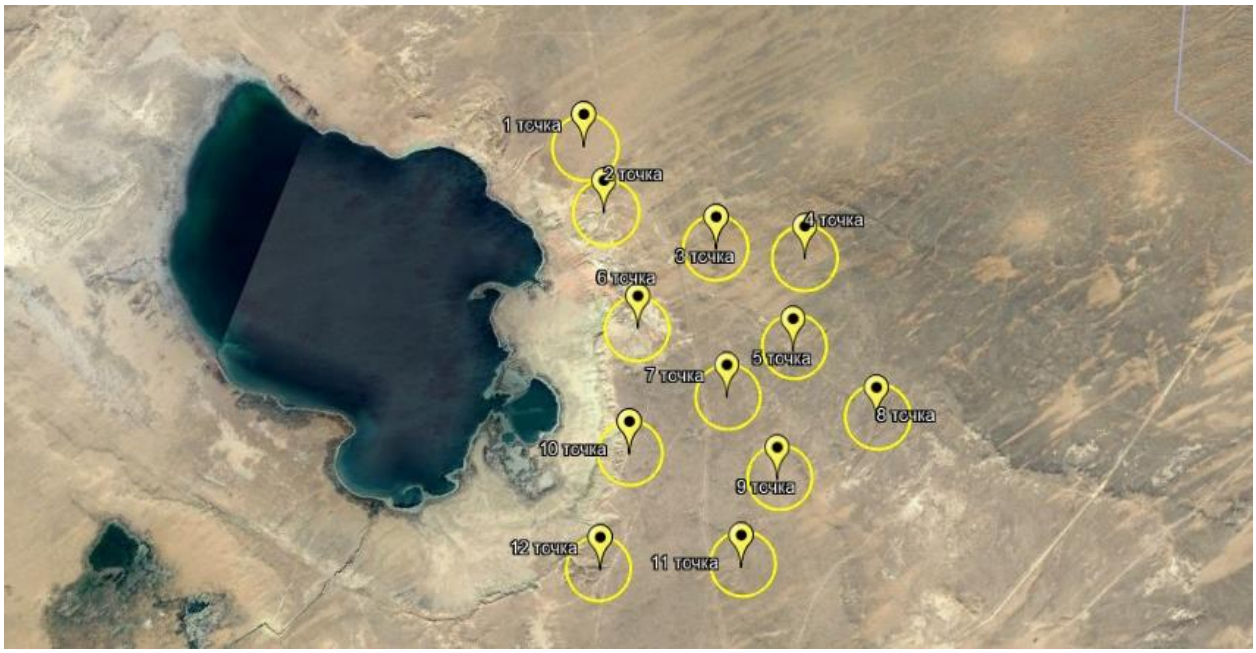

Figure 1 Studied locations on the project territory of Bash WF

Table 1 Results of the entomological survey on the project territory of Bash WF

No. of monitoring location	Coordinates	Biotope	Recorded species
Location 1	40°40'46.94"N 64°35'28.37"E	Gravelly-clayey plain	Cataglyphis cinnamomea
Location 2	40°39'52.89" 64°36'25.49"	Gravelly-clayey plain	Zero records because of very strong wind
Location 3	40°40'0.81" 64°39'1.24"	Sand hillocks	Cataglyphis pallidula Trichomyrmex sp. Lixus hirticollis
Location 4	40°40'24.95" 64°40'54.84"	Sand hillocks	Cataglyphis pallidula Cataglyphis oxiana
Location 5	40°38'54.63" 64°41'25.58"	Clayey plain	Cataglyphis cinnamomea
Location 6	40°38'18.19" 64°38'3.73"	Gravelly-clayey plain	Tetramorium schneideri Anacanthotermes turkestanicus
Location 7	40°37'47.22"	Gravelly-clayey plain	Theone costipennis

	64°40'26.84"		Messor variabilis Anacanthotermes turkestanicus
Location 8	40°38'21.74" 64°43'41.36"	Gravelly-clayey plain	Cataglyphis cinnamomea Pieris rapae
Location 9	40°36'49.20" 64°42'8.87"	Gravelly-clayey plain	Cataglyphis cinnamomea Sarathropus depressus Vespa orientalis Chrysoperla carnea
Location 10	40°36'18.39" 64°38'54.80"	Gravelly-clayey plain	Zero records because of a very strong wind
Location 11	40°35'14.23" 64°42'7.55"	Gravelly-clayey plain	Cataglyphis cinnamomea Sarathropus depressus Menecleonus sp.
Location 12	40°34'19.89" 64°39'15.64"	Gravelly-clayey plain	Plagiolepis pallescens Messor variabilis Polistes watii

15 locations were surveyed along planned OHTL from Bash WF to Karakul substation (Figure 2). Due to the sparse vegetation in the area and the prevalence of windy weather throughout the survey, the recorded entomofauna was very poor. The results of the survey are presented in the Table 2.

Figure 2 Studied locations along planned OHTL from Bash WF to Karakul substation

Table 2 Results of the entomological survey along the projected power line from Bash to Karakul substation

No. of monitoring location	Coordinates	Biotope	Recorded species, including from the Red Data Book
Location 1	40°32'17.34" 64°41'47.15"	Clayey plain	Lopezus fedtschenkoi Bombylius sp. Cataglyphis pallidula
Location 2	40°27'25.46" 64°36'42.26"	Clayey plain	Cataglyphis setipes Monomorium kusnezovi Tapinoma erraticum
Location 3	40°17'23.87" 64°22'29.33"	Fixed sands	Menecleonus sp. Hyalomma asiaticum
Location 4	40°14'13.01" 64°17'37.85"	Sand hillocks and dunes	Nighttime records Reduvius sp. Lopezus fedtschenkoi Aeschna sp. Mesobuthus eupeus Lycosa sp. Pimelia sp. Adesmia sp. Cataglyphis oxiana Tetramorium schneideri
Location 5	40°11'40.99" 64°11'52.91	Fixed sands adjoining fields	Cataglyphis oxiana Adesmia sp. Musca domestica
Location 6	40°09'17.39" 64°07'43.95"	Anthropogenic fields	Клопы miridae Eurydema ornata Chironomus sp. Vespa orientalis Polistes watii Messor laboriosus Cataglyphis aenescens Camponotus turkestanicus Monomorium kusnezovi Tapinoma erraticum Apis mellifera Hyalomma asiaticum Numerous small unidentifiable dipterans. Locust larvae unidentifiable at early developmental stages.
Location 7	40°00'41.23"	Anthropogenic	-

	64°01'05.15"	landscape near road	
Location 8	40°00'41.23" 64°01'05.15"	Sand hillocks	Nighttime records Reduvius sp. Lopezus fedtschenkoi Lioponera desertorum (rare species endemic to Uzbekistan and Turkmenistan) Cataglyphis pallidula Camponotus xerxes Hyalomma asiaticum Lycosa sp.
Location 9	39°53'23.02" 63°56'36.24"	Sand hillocks	Julodis variolaris Adesmia sp. Cataglyphis pallidula
Location 10	39°32'04.77" 63°51'58.45"	Fixed sands adjoining canal	Chironomus sp. Polistes watii
Location 11	39°42'54.32" 63°50'29"	Fixed sands adjoining canal	Messor laborisus Crematogaster subdentata Vespa orientalis
Location 12	39°40'27.34" 63°51'53.11"	Fixed sands	Anacanthotermes turkestanicus Hyalomma asiaticum Cataglyphis palludila
Location 13	39°37'31.75" 63°53'32.01"	Fixed sands	Anacanthotermes turkestanicus Hyalomma asiaticum Julodis variolaris Camponotus xerxes Cataglyphis aenescens Vespa orientalis Polistes watii Pimelia sp. Sympetrum
Location 14	39°34'21.37" 63°52'41.51"	Sandy area adjoining fields	Vespa orientalis Pieris brassicae Messor laboriosus Cataglyphis aenescens Cataglyphis setipes Musca domestica Apis mellifera
Location 15	39°32'04.77" 63°51'58.45"	Anthropogenic landscape	Vespa orientalis Cataglyphis aenescens

Conclusions and recommendations

The recorded entomofauna was typical for this area. The most common species in all biotopes were darkling beetles and ants, as well as *Anacanthotermes turkestanicus*. The highest insect diversity was recorded on flowering plants (Ferula, Astragalus, Ammodendron). There were numerous records of various small dipterans and hymenopterans, which were impossible to identify in the field. Other common arthropods included tarantula and *Scolopendra cingulata*. In April, when nighttime temperatures were low and winds were quite strong, the insect species diversity was low. In early May the species diversity was somewhat higher. The only endemic species was *Lioponera desertorum*: we recorded males of this endemic of Uzbekistan and Turkmenistan. No species listed in the Red Book of Uzbekistan or IUCN Red List were found.

In general, we do not see any potential threat to the entomofauna on the construction site, but, nevertheless, we recommend that the construction work have as little impact on the site as possible.

Table 3 Summary table for Bash WF

	INVERTEBRATES	
	TAXONOMIC ORDER	NO. OF SPECIES
1	Hymenoptera	11
2	Coleoptera	5
3	Diptera	2
4	Lepidoptera	1
5	Hemiptera	2
6	Araeae	1
7	Scorpiones	1
8	Scolopendromorpha	1
9	Bllatodae	1

Table 4 Summary table for Bash-Karakul OHTL

	INVERTEBRATES	
	TAXONOMIC ORDER	NO. OF SPECIES
1	Hymenoptera	13
2	Coleoptera	13
3	Diptera	4
4	Bllatodea	1
5	Hemiptera	5
6	Araeae	1
7	Scorpiones	1
8	Scolopendromorpha	1
9	Lepidoptera	3

Appendix 1

Baby scorpion

Reduvius sp.

Reduvius sp.

Location 5, 40°11'40.99" 64°11'52.91

Collecting insects

Camponotus xerxes

Bombyliidae

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