Funded by the specific grant agreement number 2018/402-850 from the EU IPA II Multi-Beneficiary Programme for Albania, Bosnia and Herzegovina, Northern Macedonia, Kosovo*, Montenegro and Serbia

Western Balkans Investment Framework Infrastructure Project Facility Technical Assistance 8 (IPF8)

TA2018148R0 IPA

Mediterranean Corridor, Bosnia and Herzegovina - Croatia CVc Road Interconnection, Subsection: Konjic (Ovcari) - Prenj Tunnel - Mostar North

Gap Analysis & ESIA Disclosure Pack

WB20-BiH-TRA-02 Component 1

Volume 2: Technical Annexes to the ESIA

Annex C-3: Ornithofauna

December 2025

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Western Balkans Investment Framework (WBIF)

Infrastructure Project Facility Technical Assistance 8 (IPF8)

Infrastructures: Energy, Environment, Social, Transport and Digital economy

TA2018148 R0 IPA

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PROJECT NO.	DOCUMENT NO.
WB20-BiH-TRA-02	

VERSION	ISSUE DATE	DESCRIPTION	PREPARED BY	VERIFIED BY	APPROVED BY
1	25/09/2021	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić Konstantin Siderovski	Richard Thadani
2	21/11/2022	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić	Richard Thadani
3	03/03/2023	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić	Richard Thadani
4	10/10/2023	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić	Richard Thadani
5	06/01/2025	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić	Richard Thadani
6	01/08/2025	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić	Richard Thadani
7	31/12/2025	Annex C-3: Ornithofauna	Team of experts	Irem Silajdžić	Richard Thadani

CONTENTS

List of Tables

List of figures

1 Introduction

1.1 Project Background

In August 2020, ENOVA was commissioned to conduct an environmental and social impact assessment referring to the Corridor Vc section Konjic (Ovcari) - Prenj Tunnel - Mostar North. The results of the previous biodiversity gap analysis indicated that additional information on biodiversity would be needed for an informed assessment of sensitive habitats and ecological characteristics. Additional information was obtained through field research and analysis of available literature and project documentation. The following field research has been done and is to be included in Annexes to the final Environmental and Social Impact Assessment Report:

- Annex A: Habitats, vegetation and invasive species
- Annex B: Invertebrates
- Annex C: Vertebrates
  - Annex C-1: Ichthyofauna
  - Annex C-2: Herpetofauna (amphibians and reptiles)
  - Annex C-3: Ornithofauna
  - Annex C-4: Mammals (Bats)
  - Annex C-5: Mammals (Large mammals).

This report presents the results of a field study of ornithofauna (birds).

1.2 Site Locations

This subproject includes three subsections between Konjic (Ovcari) and Mostar North along motorway Vc. According to the ToR, the subproject starts with the Konjic Intersection in Ovcari and ends with the Mostar North Interchange and the total length is 35.26 km, has six bridges and nine viaducts.

The motorway subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North (Vrapcici) starts in settlement Ovcari with an interchange which will enable connection of the motorway and the existing main road M17. At the northern entrance to the City of Konjic, after the interchange, the motorway crosses the Sipad industrial zone. Further ahead, the subsection passes through the slopes where steep cuts are envisaged and where the Viaduct 3 over river Tresanica was designed to cross to the opposite side of the M17. Immediately after the end of Viaduct 3, the route enters the slope which passes through tunnels - Tunnel T1 and Tunnel T2.

After exiting the Tunnel T2, the route crosses over the Neretva River and the local road with Viaduct 4. Crossing to the opposite side, the motorway continues along the slopes at the rear of the settlement Bijela up to the settlement Mladeskovici, where the Konjic South interchange is positioned. Further on, the motorway route is laid at the foot of the slope above the settlements of Bijela and Gornja Bijela all the way to the end of the section. The route further runs along the slopes parallel to the Rakov Laz shooting range, continues through the

uninhabited green landscape to the slopes of Prenj Mountain, where the tunnel under Prenj (Tunnel T3) begins and terminates in the territory of the City of Mostar.

After exiting the tunnel through the Prenj mountain, the motorway route traverses mountain curves towards the south and the City of Mostar, through a system of cuts and bridges through uninhabited mountain areas. At the exit from the Prenj mountain range, the road crosses the valley on 300 m long embankment and enter the Klenova Draga Tunnel (Tunnel T3A) on the western cliffs of the gorge.

After the Klenova Draga Tunnel the next viaduct of approx. 800 m begins and turns into approx. 640 m long Tunnel T4. The viaduct over Badnjena Draga near Seliste, which stretches parallel to the settlement begins here.

The route continues northeast of the settlement and extends along the edges of the hill north of Podgorani, where the bridge over Seocka Draga begins and leads the route to Dolac, north of Humlisani. Further, the route continues in a slight semicircle around the settlement of Humilisani along the slopes of Porim. Below Humilisani, the route runs south and under Sljemen, it enters the 2,200-meter-long Tunnel T5, and exits into the Kuti area, the point where the Mostar (north) exit ramp has been envisaged.

The south connection to main road M17 (hereinafter: Konjic Bypass) is also a subject of this ESIA. Konjic bypass will connect the motorway at Ovcari Interchange with the M17 to Jablanica. This bypass will allow for M17 traffic to access the motorway directly without entering the urban area of Konjic. Konjic Bypass begins by turning off the motorway via the Ovcari Interchange. After that, motorway passes the next 100 m in an embankment and reach the first 80-meter-long viaduct. After the viaduct, it enters an 800-meter-long tunnel. After exiting the tunnel, the route goes for approx. 500 m through embankments and another 500 m through a cut with the highest point of approx. 30 m. The next 200 m of the route passes through embankments and cuts and reaches a 350-meter-long bridge that crosses the existing Sarajevo-Capljina railway, the Neretva River, and the main road M17. After 200 m, Konjic Bypass connects to M17.

1.3 Reporting Purpose and Goals

The main purpose of this task is to prepare a written report to serve as basis for Environmental and Social Impact Assessment (ESIA) Disclosure Package and the Biodiversity Management Plan (BMP). For this purpose to be met, this report has been written in accordance with the following objectives:

- Provide field research methodology and results;
- Assess the respective project and impact areas for the potential presence of sensitive species and species of conservation importance;
- Recommend mitigation measures and/or monitoring if necessary.

2 Methodology

2.1 Survey Background

Field research of ornithofauna, on the Konjic (Ovcari) - tunnel Prenj - Mostar North subsection of the future Vc motorway, was carried out in the period from September 2020 to June 2021 and again in June 2022. A total of 7 field trips of 4-5 days each were realised.

Field trips are planned to cover the most important ornithological phenophases: nesting, as well as spring and autumn migration (Table 1). Bird research transects are defined in different parts of the route in order to cover all types of bird habitats, so that their combination provides a representative sample presenting the preliminary data on ornithofauna of a given area, spatial distribution of species, and the number and endangerment of birds along the route.

Table 1: Review of field trips by seasons (phenophases) and months

No.	Ornithological aspect	Date
1.	Autumn migration	29 September – 2 October 2020
2.	Autumn migration	29 October – 1 November 2020
3.	Spring migration and breeding	23 – 27 March 2021
4.	Spring migration and breeding	11 – 14 April 2021
5.	Breeding	13 – 16 May 2021
6.	Breeding	06 – 10 June 2021
7.	Breeding	20 – 21 June 2022

2.2 Survey Methodology

Birds were recorded by the transect method, as well as by counting birds from the surface from the census point[1] along the route of the motorway and in the buffer zone of 500m on each side of the planned motorway. Bird counting was performed with a 20x45 Minox binoculars and a 10x50 Vortex Crossfire binoculars. In order to photo-document the species in the field, a Nikon P900 camera with 83x optical zoom was used. In the habitats of rare and endangered species, the playback method was used, according to which the territorial call of males is broadcast. The 45 watts J.I.Y. q 8 speaker was used for this purpose. Field data entry was performed using the NaturaList application, which enables precise georeferencing of findings. In the breeding season, birds were listed in

[1] Gregory, RD, Gibbons, DW & Donald, PF (2004): Bird census and survey techniques. In: Sutherland WJ, Newton I. et Green RE [eds.] Bird Ecology and Conservation; a Handbook of Techniques. Oxford University Press, Oxford: 17-56.

the early morning or evening hours, which coincides with the period of maximum bird activity, while during the colder period of the year, all-day surveys were conducted. To estimate the size of the breeding population of individual species in Bosnia and Herzegovina and to valorise a given area, the internal assessment of the Ornithological Society "Our Birds", created for the needs of the Red List of Birds of Europe, made for the period 2013-2019 as a result of field research for the development of the European Breeding Bird Atlas 2 (Kotrosan et al., 2019) was used. In addition to the collection of data on the ornitofauna of the given area, mapping and identification of bird habitats were also carried out with the intention of predicting the potential presence of rare and endangered species based on the presence of specific types of habitats, based on which an assessment of the impact on birds was performed.

The degree of endangerment of species recorded during project research as well as species from literature sources in the study area was compared with the categorisation of bird endangerment under the Red List of Fauna of the Federation of Bosnia and Herzegovina and under the European Birds Directive[2], as well as with the endangerment status according to the IUCN Red List of Endangered Species[3].

The standard endangered categories according to the Red List of Fauna of the Federation of Bosnia and Herzegovina and according to the IUCN Red List of Endangered Species are:

- CR – Critically Endangered
- EN – Endangered
- VU – Vulnerable
- NT – Near Threatened
- LC – Least Concern
- DD – Data Deficient
- NE – Not Evaluated

The European Birds Directive includes:

- Annex I: birds for which Special Protection Areas (SPAs) need to be allocated
- Annex II: species that can be hunted
- Annex III: types that can be traded.

For a more precise determination of the spatial distribution of registered species, the area is divided into 14 sections where bird research transects are defined (given in Figure 5 and Figure 6 in 5.1. Maps). In each season, a minimum of 13 of 14 sections (Table 2, Figure 4) were processed. Habitat characteristic of each locality are presented in Table 3.

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[2] Directive 2009/147 / EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds

[3] IUCN, 2021. The IUCN Red List of Threatened Species. Version 2021-1. http://www.iucnredlist.org

Table 2: List of research localities

No.	Locality	Reference point	
		Latitude	Longitude
1.	Ovcari	43°39'55.24"N	17°58'14.56"E
2.	Neretva Konjic	43°38'13.31"N	17°58'46.53"E
3.	Polje Bijela	43°37'48.62"N	17°58'23.76"E
		43°37'29.83"N	17°58'13.56"E
4.	Mladeskovici	43°36'57.45"N	17°57'53.34"E
5.	Konjic Bijela	43°36'36.33"N	17°57'20.24"E
		43°36'4.57"N	17°56'59.94"E
6.	Rakov Laz	43°35'30.82"N	17°56'46.07"E
		43°34'43.15"N	17°56'1.62"E
7.	Klenova Draga	43°28'46.50"N	17°52'38.04"E
8.	Seliste	43°28'26.78"N	17°53'5.79"E
		43°27'59.18"N	17°53'27.44"E
9.	Dolac	43°27'49.44"N	17°53'44.99"E
10.	Zelenika	43°27'25.49"N	17°54'28.11"E
11.	Humi	43°26'43.27"N	17°54'40.61"E
12.	Humilisani	43°26'11.96"N	17°54'49.24"E
13.	Lisani	43°25'37.06"N	17°54'38.78"E
14.	Bosnjaci	43°25'11.23"N	17°54'31.07"E
15.	Konjic bypass	43°66'30.25"N	17°96'29.86"E

Table 3: Habitat review by localities

Locality	Habitat description
Ovcari	Planted pines, oak, neglected orchards and meadows, hawthorn bushes, sour wood, acacia and white hornbeam
Neretva Konjic	The shores overgrown with willow and black alder, while in the wider bank area there are gardens with cultivated plants, grasslands and orchards.
Polje Bijela	Yards with cultivated plants, orchards, small fragments of meadows, beech forests.
Mladeskovici	Yards with cultivated plants, lawns, fragments of meadows, orchards and beech forests
Konjic Bijela	Small fragments of meadows, orchards and young, coniferous beech forest.
Rakov Laz	Young coniferous beech forest with rare white pine and spruce.
Klenova Draga	Rocks, cliffs and hornbeam forest.
Seliste	Rocks and cliffs, woodpecker forest, rocky places with thorns and wild pomegranate.
Dolac	Agricultural land, thorns and wild pomegranate.
Zelenika	Cultivated plants in the destroyed settlement, fragments of meadows, rocky places with thorns and wild pomegranate.
Humi	Secondary habitats formed by succession from meadows to shrubs, thorns, wild pomegranate, dense shrubs of white-hornbeam and ash, fragments of agricultural land

Locality	Habitat description
Humilisani	Secondary habitats formed by succession from meadows to shrubs, thorns, wild pomegranate, dense shrubs of white-hornbeam and ash, fragments of agricultural land
Lisani	Secondary habitats formed by succession from meadows to shrubs, thorns, wild pomegranate, dense shrubs of white-hornbeam and ash, fragments of agricultural land
Bosnjaci	Secondary habitats formed by the succession from meadows to shrubs, thorns, wild pomegranate
Konjic bypass	Young hornbeam forests, meadows, settlements, orchards and planed pine trees.

In order to examine the spatial distribution of registered species as precisely as possible, the investigated area of the Konjic bypass was divided into six smaller polygons, defined according to habitat types (Figure 1). The researched polygons were chosen with the aim of covering all present habitat types, which would result in the most representative sample.

On Polygon 1, from the beginning of the section to 650 m, the habitat types for birds are homesteads, abandoned orchards and small fragments of meadows. In the next polygon (Polygon 2), there are planted pine trees up to the 1152nd meter of the bypass, which transitions into a young hornbeam forest along the stream (Polygon 3). The route continues over narrow fragments of meadows and pastures (Polygon 4), which are in the process of growing into low trees and bushes. Polygon 5 leads through the settlement (Donje Selo), while the last polygon (Polygon 6) stretches across the Neretva River and includes coastal vegetation and the river itself. The first five polygons are habitats of the secondary type, created by anthropogenic activities or the succession of meadows and pastures into bushes and forest, due to the disappearance or reduction of livestock. All these habitat types have a low conservation value, which is why the construction of the bypass will not have a negative impact on bird populations. In this area, there are many species of birds, widely distributed and numerous throughout the territory of Bosnia and Herzegovina.

Figure 1: Surveyed polygons along the entire alignment of Konjic Bypass

Table 4: Polygons along the Konjic Bypass

Polygon	Typical habitat	Bypass chainage*	
1	Yards, orchards, meadows	0	650
2	Planted pine trees	650	1152
3	Young hornbeam forest	1152	1714
4	Meadows and pastures	1714	2213
5	Settlements	2213	2683
6	River flow and coastal vegetation	2683	3103

*based on the currently available Preliminary Solution for the bypass

2.3 Assumptions and Limitations

Bird research during the 2020/2021 season was accompanied by a strong influence of weather conditions, i.e. large temperature fluctuations. The 2020 autumn season was affected by a long period of drought and high temperatures, while heavy rainfall and low temperatures accompanied the 2021 nesting season, which significantly affected the activity of birds. The 2022 surveyes were performed in early summer which is a suboptimal perion but the collected data is satisfactory due to low ornithological value of surveyed area of Konjic.

A significant part of the project area is inaccessible due to dense and impassable woody and bushy vegetation, and there are private fenced areas as well as the landmine infested areas, so transects were defined along existing roads in different habitat types. For inaccessible areas, binoculars were used extensively.

Nevertheless, despite the limiting factors, satisfactory terrain coverage was achieved in different parts of the observed area and different habitat types were included. Data on species composition, population size, distribution and risk factors for nesting bird populations were collected.

2.4 Project Area of Influence

Biodiversity aspects must take biology of species and integrity of ecosystems into consideration and must not rely on arbitrary buffer zone without a valid reasoning. This is done so that "wider distribution of potentially affected

biodiversity features and the ecological patterns, processes and functions that are necessary for maintaining them throughout this distribution"[4] are included. Project's AOI was enlarged in a way that reflects ecological characteristics of the area and biology of found species. Output of said enlargement is ecologically appropriate area of analysis (EAAA). The methodology for ecologically EAAA was applied on the basis of field research, confirmed and expected species, characteristics of surrounding habitats and ecosystems, literature data, expert opinion and, later, IUCN estimated extent of occurrence (EOO) and the area of occupation (AOO) for each individual species. Initial AOI was expanded to include distribution of registered bird species and their habitats in the wider area so that the most adequate baseline for subsequent impact assessment and mitigation measures is ensured. Further evaluation of EAAA was done with regard to EOO based on IUCN data (if available) and expert inputs to facilitate critical habitat assessment (CHA). Critical habitat assessment for this Project is done separately and it is presented in the Annex D of the ESIA Study.

3 Results

3.1 Survey Results

3.1.1 Motorway Alignment

In the period September 2020 - June 2021, bird research was performed at 14 localities along the route of the sub-section of the future motorway, corridor Vc Konjic (Ovcari) - Prenj - Mostar North. In addition to the route and the direct impact zone, the research was conducted in the narrower motorway zone of impact on birds which, depending on habitat conditions, ranges from 200-500 m on both sides of the route. A total of 2285 data entries on the ornithofauna in the referenced area were collected, with 6031 recorded specimens belonging to 98 bird species (Table 5).

There are no published data on birds in the project area, while based on the published data on birds from the local area, nothing can be concluded about ornithofauna in the project area, because parallel between the habitats can't be drawn. Therefore, the bird data collected during the research related to this project are the first and only bird data of the given area.

[4] EIB Guidance Note for Standard 3 on Biodiversity and Ecosystems, 2018

Table 5: Review of registered species by localities with endangerement status

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Wild duck	*Anas platyrhynchos*	LC	IIA,IIIA	LC	Yes	Yes	Ovcari (Tresanica River), River Neretva
Common merganser	*Mergus merganser*	LC	IIB		Registered in dispersion	Yes	River Neretva
Little grebe	*Tachybaptus ruficollis*	LC		NT	Yes	Yes	River Neretva
Common pigeon	*Columba livia*	LC	IIA	LC	Yes	Yes	Polje Bijela, Mladeskovici, Dolac; Expected
Common wood-pigeon	*Columba palumbus*	LC	IIA,IIIA	LC	Yes	Yes	Konjic Bijela, Polje Bijela, Mladeskovici, Rakov Laz, Zelenika, Lisani, Bosnjaci; expected along the route
European turtle-dove	*Streptopelia turtur*	VU	IIB	LC	Yes	Yes	Zelenika, Humi, Himilisani
Eurasian collar-dove	*Streptopelia decaocto*	LC	IIB	LC	Yes	Yes	Dolac
Common cuckoo	*Cuculus canorus*	LC		LC	Yes	Yes	Humilisani, Lisani, Konjic Bijela, Mladeskovici, Neretva Konjic, Polje Bijela, Seliste, Zelenika, Rakov Laz, Bosnjaci
Alpine swift	*Apus melba*	LC		NT	Registered in dispersion	Yes	Neretva Konjic, Klenova Draga
Pallid swift	*Apus pallidus*	LC		EN	Registered in dispersion	Yes	Humi, Klenova Draga

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Common moorhen	*Gallinula chloropus*	LC	IIB	LC	Yes	Yes	Neretva Konjic
Yellow-legged gull	*Larus michahellis*	LC		LC	Registered in dispersion	Yes	Neretva Konjic
Great cormorant	*Phalacrocorax carbo*	LC		VU	Registered in migration	Yes	Neretva Konjic
Grey heron	*Ardea cinerea*	LC		VU	Registered in migration	Yes	Neretva Konjic
Golden eagle	*Aquila chrysaetos*	LC	I	EN	Yes	Yes	Klenova Draga
Western marsh harrier	*Circus aeruginosus*	LC	I	VU	Registered in dispersion	Yes	Seliste
Eurasian sparrowhawk	*Accipiter nisus*	LC		LC	Yes	Yes	Dolac, Lisani, Konjic Bijela, Seliste, Klenova Draga; Expected species along the entire route
Northern goshawk	*Accipiter gentilis*	LC		LC	Yes	Yes	Ovcari, Rakov Laz
Common buzzard	*Buteo buteo*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Mladeskovici, Konjic Bijela, Rakov Laz, Klenova Draga, Lisani, Humi, Bosnjaci; Expected species along the entire route
Eurasian scops-owl	*Otus scops*	LC		NT	Yes	Yes	Zelenika
Tawny owl	*Strix aluco*	LC		LC	Yes	Yes	Rakov Laz
Eurasian hoopoe	*Upupa epops*	LC		NT	Yes	Yes	Seliste, Dolac, Zelenika, Humilisani, Lisani, Bosnjaci

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Common kingfisher	*Alcedo atthis*	LC	I	NT	Registered in migration	Yes	Neretva Konjic
European bee-eater	*Merops apiaster*	LC		NT	Registered in dispersion	Yes	Seliste
Eurasian wryneck	*Jynx torquilla*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Zelenika, Humi, Humilisani
Middle spotted woodpecker	*Dendrocopos medius*	LC	I	LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Zelenika, Humi
White-backed woodpecker	*Dendrocopos leucotos*	LC	I	VU	Yes	Yes	Rakov Laz
Great spotted woodpecker	*Dendrocopos major*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz; Klenova Draga, Zelenika
Syrian woodpecker	*Dendrocopos syriacus*	LC	I	DD	Yes	Yes	Neretva Konjic
Lesser spotted woodpecker	*Dryobates minor*	LC		LC	Yes	Yes	Konjic Bijela, Rakov Laz
Grey-headed woodpecker	*Picus canus*	LC	I	LC	Yes	Yes	Neretva Konjic
Eurasian green woodpecker	*Picus viridis*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Dolac, Zelenika, Humi, Humilisani, Lisani, Bosnjaci
Black woodpecker	*Dryocopus martius*	LC	I	NT	Yes	Yes	Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Lisani, Bosnjaci
Common kestrel	*Falco tinnunculus*	LC		LC	Yes	Yes	Seliste, Klenova Draga

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Eurasian hobby falcon	*Falco subbuteo*	LC		VU	Yes	Yes	Lisani
Eurasian golden oriole	*Oriolus oriolus*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Dolac, Zelenika, Humi, Humilisani
Red-backed shrike	*Lanius collurio*	LC	I	LC	Yes	Yes	Ovcari, Polje Bijela, Konjic Bijela, Rakov Laz, Zelenika, Bosnjaci
Woodchat shrike	*Lanius senator*	LC		DD	Yes	Yes	Bosnjaci
Eurasian jay	*Garrulus glandarius*	LC	IIB	LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Klenova Draga, Seliste, Dolac, Zelenika, Humi, Humilisani, Lisani, Bosnjaci
Common magpie	*Pica pica*	LC	IIB	LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Dolac, Lisani
Yellow billed chough	*Pyrrhocorax graculus*	LC		NT	Registered in dispersion	Yes	Selista
Eurasian jackdaw	*Corvus monedula*	LC	IIB	LC	Yes	Yes	Polje Bijela
Hooded craw	*Corvus cornix*	LC	IIB	LC	Yes	Yes	Ovcari, Neretva Konjic, Rakov Laz, Seliste, Dolac, Humi, Lisani, Bosnjaci
Common raven	*Corvus corax*	LC		LC	Yes	Yes	Ovcari, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Dolac, Zelenika, Lisani
Coal tit	*Periparus ater*	LC		LC	Yes	Yes	Ovcari, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz
Sombre tit	*Poecile lugubris*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Seliste, Zelenika

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Marsh tit	*Poecile palustris*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Humi, Bosnjaci, Klenova Draga
Eurasian blue tit	*Cyanistes caeruleus*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Dolac, Seliste, Zelenika, Humi, Humilisani, Lisani, Bosnjaci, Klenova Draga
Great tit	*Parus major*	LC		LC	Yes	Yes	Species registered along the entire route
Icterine warbler	*Hippolais icterina*	LC		NT	Registered in migration	Yes	Neretva Konjic
Eurasian crag martin	*Ptyonoprogne rupestris*	LC		LC	Registered in dispersion	Yes	Mladeskovici, Rakov Laz, Zelenika
Barn swallow	*Hirundo rustica*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Dolac, Zelenika; Humi, Lisani
Red-rumped swallow	*Cecropis daurica*	LC		VU	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Humi; expected in settlements along the route
Common house martin	*Delichon urbicum*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Seliste, Dolac, Zelenika, Klenova Draga
Willow warbler	*Phylloscopus trochilus*	LC			Registered in migration	Yes	Ovcari, Seliste, Lisani, Humulisani, Bosnjaci
Common chiffchaff	*Phylloscopus collybita*	LC		LC	Yes	Yes	Species registered along the entire route

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Long-tailed tit	*Aegithalos caudatus*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Konjic Bijela, Rakov Laz, Klenova Draga, Dolac, Seliste, Zelenika, Humi, Humilisani, Lisani, Bosnjaci
Eurasian blackcap	*Sylvia atricapilla*	LC		LC	Yes	Yes	Species registered along the entire route
Subalpine warbler	*Sylvia cantillans*	LC			Yes	Yes	Klenova Draga, Seliste, Dolac, Zelenika, Humi, Humilisani, Lisani, Bosnjaci.
Eastern Orphean warbler	*Sylvia crassirostris*	LC		DD	Yes	Yes	Seliste, Humi, Humilisani, Lisani, Bosnjaci, Klenova Draga
Sardinian warbler	*Sylvia melanocephala*	LC			Yes	Yes	Seliste, Dolac
Common whitethroat	*Sylvia communis*	LC		LC	Yes	Yes	Konjic Bijela, Lisani.
Goldcrest	*Regulus regulus*	LC		LC	Registered in migration	Yes	Rakov Laz, Lisani
Common firecrest	*Regulus ignicapilla*	LC		LC	Registered in migration	Yes	Rakov Laz, Zelenika, Humilisani, Lisani
Eurasian nuthatch	*Sitta europaea*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz
Western rock nuthatch	*Sitta neumayer*	LC		DD	Yes	Yes	Klenova Draga
Short-toed treecreeper	*Certhia brachydactyla*	LC		NT	Yes	Yes	Ovcari
Eurasian wren	*Troglodytes troglodytes*	LC		LC	Yes	Yes	Neretva Konjic, Mladeskovici, Konjic Bijela, Rakov Laz

English name	Scientific name	Conservation status		Red List FBiH	Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive				
White-throated dipper	*Cinclus cinclus*	LC		NT	Yes	Yes	Tresanica rijeka, Ovcari
Common starling	*Sturnus vulgaris*	LC	IIB	LC	Yes	Yes	Neretva Konjic, Ovcari
Mistle thrush	*Turdus viscivorus*	LC	IIB	LC	Yes	Yes	Ovcari, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz
Song thrush	*Turdus philomelos*	LC	IIB	LC	Yes	Yes	Ovcari, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Lisani
Common blackbird	*Turdus merula*	LC	IIB	LC	Yes	Yes	Species registered along the entire route
Spotted flycatcher	*Muscicapa striata*	LC		LC	Yes	Yes	Konjic Bijela
European robin	*Erithacus rubecula*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Konjic Bijela, Rakov Laz, Klenova Draga, Seliste, Dolac, Zelenika, Humi, Lisani, Bosnjaci
Common nightingale	*Luscinia megarhynchos*	LC		NT	Yes	Yes	Neretva Konjic, Polje Bijela, Konjic Bijela, Rakov Laz, Klenova Draga, Seliste, Dolac, Zelenika, Humi, Humilisani, Lisani, Bosnjaci.
European pied flycatcher	*Ficedula hypoleuca*	LC			Registered in migration	Yes	Mladeskovici
Common redstart	*Phoenicurus phoenicurus*	LC		LC	Yes	Yes	Polje Bijela, Konjic Bijela
Black redstart	*Phoenicurus ochruros*	LC		LC	Yes	Yes	Ovcari, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Dolac, Zelenika, Bosnjaci
European stonechat	*Saxicola rubicola*	LC		LC	Registered in migration	Yes	Bosnjaci

English name	Scientific name	Conservation status		Red List FBiH	Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive				
House sparrow	*Passer domesticus*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Konjic Bijela, Mladeskovici, Rakov Laz, Dolac, Lisani; registered species in settlements along the entire route
Spanish sparrow	*Passer hispaniolensis*	LC		NT	Yes	Yes	Dolac
Eurasian tree sparrow	*Passer montanus*	LC		LC	Yes	Yes	Polje Bijela, Mladeskovici, Konjic Bijela
Grey wagtail	*Motacilla cinerea*	LC		LC	Yes	Yes	Tresanica River (Ovcari), Neretva Konjic, Mladeskovici, Konjic Bijela,
White wagtail	*Motacilla alba*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Dolac, Humi
Meadow Pipit	*Anthus pratensis*	NT		LC	Registered in migration	Yes	Bosnjaci
Tree pipit	*Anthus trivialis*	LC		LC	Registered in migration	Yes	Konjic Bijela, Zelenika, Humi, Humulisani, Lisani, Bosnjaci
Water pipit	*Anthus spinoletta*	LC			Registered in migration	Yes	Zelenika
Common chaffinch	*Fringilla coelebs*	LC		LC	Yes	Yes	Species registered along the entire route
Hawfinch	*Coccothraustes coccothraustes*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Klenova Draga, Seliste, Zelenika, Humi
Common bullfinch	*Pyrrhula pyrrhula*	LC		LC	Yes	Yes	Konjic Bijela, Rakov Laz

English name	Scientific name	Conservation status			Suitable habitat in the area?	Research finding - has the species been found?	Locality (where?)
		IUCN Global Red list	Bird Directive	Red List FBiH			
Greenfinch	*Carduelis chloris*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Dolac, Zelenika, Humi, Humilisani, Lisani, Bosnjaci
Linnet	*Carduelis cannabina*	LC		LC	Yes	Yes	Dolac, Zelenika, Lisani
Goldfinch	*Carduelis carduelis*	LC		LC	Yes	Yes	Neretva Konjic, Polje Bijela, Zelenika, Lisani, Bosnjaci
Serin	*Serinus serinus*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Humilisani, Zelenika
Eurasian siskin	*Carduelis spinus*	LC		LC	Registered in migration	Yes	Ovcari, Neretva Konjic, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Zelenika, Lisani;
Rock bunting	*Emberiza cia*	LC		LC	Yes	Yes	Polje Bijela, Mladeskovici, Konjic Bijela, Rakov Laz, Seliste, Dolac, Zelenika, Lisani, Humi, Bosnjaci;
Cirl bunting	*Emberiza cirlus*	LC		LC	Yes	Yes	Ovcari, Neretva Konjic, Polje Bijela, Mladeskovici, Konjic Bijela, Klenova Draga, Seliste, Dolac, Zelenika, Humi; Lisani, Bosnjaci; Expected species along the entire route

3.1.2 Konjic Bypass

As previously mentioned, habitat types found along Konjic Bypass have a low conservation value, which is why the construction of the bypass will not have a negative impact on bird populations. In this area, there are many species of birds, widely distributed and numerous throughout the territory of Bosnia and Herzegovina.

A total of 30 species, predominantly species common and widespread in Bosnia and Herzegovina were recorded along the Konjic Bypass (Table 6).

Table 6: Overview of bird species registered along the Konjic Bypass

English name	Scientific name	Conservation status		
		IUCN Global Red list	Bird Directive	Red List FBiH
Wild duck	*Anas platyrhynchos*	LC	IIA,IIIA	LC
Yellow-legged gull	*Larus michahellis*	LC		LC
Grey heron	*Ardea cinerea*	LC		VU
European green woodpecker	*Picus viridis*	LC		LC
Eurasian golden oriole	*Oriolus oriolus*	LC		LC
Red-backed shrike	*Lanius collurio*	LC	I	LC
Woodchat shrike	*Lanius senator*	LC		DD
Eurasian jay	*Garrulus glandarius*	LC	IIB	LC
Common magpie	*Pica pica*	LC	IIB	LC
Hooded craw	*Corvus cornix*	LC	IIB	LC
Coal tit	*Periparus ater*	LC		LC
Crested tit	*Lophophanes cristatus*			
Sombre tit	*Poecile lugubris*	LC		LC
Marsh tit	*Poecile palustris*	LC		LC
Eurasian blue tit	*Cyanistes caeruleus*	LC		LC
Great tit	*Parus major*	LC		LC
Barn swallow	*Hirundo rustica*	LC		LC
Red-rumped swallow	*Cecropis daurica*	LC		VU

English name	Scientific name	Conservation status		
		IUCN Global Red list	Bird Directive	Red List FBiH
Common house martin	*Delichon urbicum*	LC		LC
Common chiffchaff	*Phylloscopus collybita*	LC		LC
Long-tailed tit	*Aegithalos caudatus*	LC		LC
Short-toed treecreeper	*Certhia brachydactyla*	LC		NT
Song thrush	*Turdus philomelos*	LC	IIB	LC
Common blackbird	*Turdus merula*	LC	IIB	LC
Common nightingale	*Luscinia megarhynchos*	LC		NT
House sparrow	*Passer domesticus*	LC		LC
Common chaffinch	*Fringilla coelebs*	LC		LC
Greenfinch	*Carduelis chloris*	LC		LC
Goldfinch	*Carduelis carduelis*	LC		LC
Serin	*Serinus serinus*	LC		LC

4 Discussion and Recommendations

4.1 Summary of Findings for Motorway Alignment

During the bird research from September 2020 to June 2021, a total of 98 bird species were registered on the future Corridor Vc motorway subsection Konjic (Ovcari) - Prenj tunnel - Mostar North. Of this number, 76 species are marked as nesting birds, 18 species are registered in migration, while six species are in dispersion (they nest outside the study area, but feed occasionally in the referenced area). The number of registered species does not form the final composition of the ornithofauna of a given area, instead, it gives a realistic overview of nesting sites, the number of individual species and their distribution by localities. Regular migrating birds who considerably use this area to rest and feed during migration are also included.

Of the total number, 77 species were registered on the part of the planned route north of the Prenj tunnel, while 71 bird species were registered on the south side of the mountain. The larger number of species on the north side can be explained by more favourable climatic factors, greater habitat diversity and the presence of rivers such as the Neretva River, Bijela and Tresanica rivers, while on the south side there are no permanent watercourses, which excludes presence of aquatic habitat types and bird species that favour such habitats. The southern side of the Prenj mountain is strongly influenced by the warm and dry

Mediterranean climate and it is home to species that are adapted to dry, rocky habitats or habitats with xerophilous woody and shrubby vegetation.

From the aspect of localities, on the route north of the Prenj tunnel, less than 40 bird species (i.e. 35 species) were registered only at the Ovcar locality, and the largest number of bird species was registered at the Neretva Konjic locality, 48 species. On the southern side of the Prenj tunnel, the greatest diversity of species was recorded at the localities of Zelenika (40 species) and Lisani (38 species).

Compared to the IUCN list, only the Turtle Dove (*Streptopelia turtur*) has the status of a vulnerable species (VU), while other species fall within a lower endangerment category. According to the Red List of Fauna of Bosnia and Herzegovina, the Golden Eagle (*Aquila chrysaetos*) and the Pallid Swift (*Apus pallidus*) have the status of endangered species (EN), while six species are in the category of vulnerable species: Great Cormorant (*Phalacrocorax carbo*), Gray Heron (*Ardea cinerea*), Marsh Harrier (*Circus aeruginosus*), White-backed Woodpecker (*Dendrocopos leucotos*), Hobby Falcon (*Falco subbuteo*) and Red-rumped Swallow (*Cecropis daurica*). Eight species are listed in Annex I of the Birds Directive: golden eagle (*Aquila chrysaetos*), marsh harrier (*Circus aeruginosus*), common kingfisher (*Alcedo atthis*), middle-spotted woodpecker (*Dendrocopos medius*), white-backed woodpecker (*Dendrocopos leucotos*), Syrian woodpecker (*Dendrocopos syriacus*), gray-headed woodpecker (*Picus canus*), black woodpecker (*Dryocopus martius*) and red-backed shrike (*Lanius collurio*).

4.1.1 Sensitive Species

From the aspect of species and categories of endangerment according to the IUCN Red List, Red List of Endangered Species of Fauna of the Federation of Bosnia and Herzegovina and Annex I of the Birds Directive, 14 bird species were identified as sensitive species. All of them will be discussed in this chapter.

The Great Cormorant (FBiH VU) and Common Kingfisher (BD I), which are registered at the Neretva Konjic site, are present only during migration.

Gray Herons (FBiH VU), Marsh Harriers (FBiH VU, BD I), Syrian Woodpeckers (BD I), and Gray-headed Woodpeckers (BD I) do not nest in the motorway impact zone, but occasionally appear in dispersion, wandering, or flying over.

The Pallid Swift (FBiH EN) nests in urban areas on tall buildings and feeds high in the sky, outside the motorway impact zone. In the area of Klenova Draga, it is present in search of food high in the sky, which is why the construction of the highway does not have a large negative impact on this species.

A pair of Hobby falcons (FBIH VU) was observed in mating ritual on 13 May at the Lisani site, on one of the transmission line poles, about 350 m away from the route. This species feeds in flight, most often catching large insects or birds in the sky. Since there are no suitable tall trees with crow nests along the direct

impact zone, which is often inhabited by the Hobby, the motorway impact on this species can be considered minor.

The Red-rumped swallow (FBiH VU) is associated with settlements where it often nests in buildings. It is a widespread species in Herzegovina. The population size is estimated at 1,000-2,000 pairs with a trend of growth and expansion of the range to the north. In the impact zone, a negligibly small number of pairs nest.

The Middle Spotted Woodpecker (BD I) was registered at 5 localities in the study area, of which nesting was confirmed at the localities of Neretva Konjic, Polje Bijela and Mladeskovici, while in the area of Zelenika and Hum, nesting territories of this species are on the edge of the impact zone. This species is a common and widespread species throughout Bosnia and Herzegovina, with a population size of 3,000-5,000 pairs. In the interior and in the north of the country, it is incomparably more numerous than in the area of Herzegovina. Since the nesting areas of this species are located in the vicinity of future high bridges, a short-term impact is possible during the construction of a referenced section, after which a return to the original condition can be expected.

The Black Woodpecker (BD I) is an indicator species of old and preserved forest habitats. Nesting of this species in the impact zone was confirmed only at the locality of Rakov Laz, while at other localities it was recorded while flying over. The size of the nesting population in Bosnia and Herzegovina is estimated at 1,500-2,500 pairs and it is a common species throughout the country in old and preserved forests with many rotten trees on the ground.

The White-backed Woodpecker (FBiH VU, BD I), with a population of 300-500 pairs, is one of the rarest and most endangered bird species in Bosnia and Herzegovina. It is an indicator of old and preserved beech forests, with a lot of rotten trees on the ground. Due to intensive forestry and sanitary felling, its population trend is declining. One specimen was observed during the nesting season in the direct impact zone of the motorway, while three more territorial males were registered on the slopes of Prenj, outside the impact zone.

The size of the Golden Eagle (FBiH EN, BD I) population in Bosnia and Herzegovina is estimated at 50-80 pairs and according to the Red List of Endangered Species of the Federation of Bosnia and Herzegovina it has the status of EN (endangered species). This is the most valuable species in terms of conservation. In June 2021, an inactive nest was found during survey of the Klenova Draga cliffs, above the future motorway route Tunnel Klenova Draga (Tunnel 3A). The nest was registered again in 2022, when it was slightly expanded but still inactive. There are three possible reasons why the nest is inactive. The Golden Eagle sometimes has several nests in its immediate vicinity that change over the years. Considering the sensitivity of the species, there is also a real possibility that the litter perished in the early stages of nesting or one of the individuals died (not the case with Klenova Draga). Regardless of the cause, a nest found at a given locality is a definite confirmation of the presence

of a nesting pair. One adult individual was observed in flight over Klenova Draga in June 2022.

According to available literature data, each adult pair in the region has, on average, one or more reserve nests in addition to the active one. In Scotland, one pair had eight nests, and in California 12. The eagle rebuilds all nests during the winter period and chooses only one for nesting in the current season. The distance between the nests of one pair can range from a few meters to 8 km. Some pairs can nest in one nest for many years, while others often change nests.[5] Changing nests is thought to depend on human disturbance and the amount of available food. [6] The golden eagle has a habit of greening the active nest during incubation and raising its young. From the abovementioned findings, it can be concluded that the presence of a golden eagle above Klenova Draga confirms that there is an active territory in this area, because this species is extremely territorial and jealously guards its territory from other eagles. The size of the territory in the region is between 100-200 km^2. No traces of greening were observed in the located nest, which means that the brood did not die in the current season, so it can be concluded that it is a reserve nest, which could theoretically become active in the future. The influence of the motorway on the present pair of golden eagles is possible during the construction phase, where a greater negative impact is expected in the variant with a tunnel through Klenova Draga, because the southern portal of the tunnel is located in the vicinity of the nest. The species is extremely sensitive to disturbance, especially during the nesting period, when it is possible it will leave the nest and the offspring to decay. In order to reduce the negative effects on the nesting pair of golden eagles, it is recommended that the construction works start in the period between the second half of July and the beginning of February and take place continuously and rapidly. In that case, if part of the territory is usurped, the eagles have enough time to start nesting in reserve nest in an area where there are no anthropogenic influences. After the construction and commissioning of the motorway, the negative impact will be minimised.

According to the IUCN Red List, the European Turtle Dove (IUCN VU) falls within the highest endangerment category of all registered species. In Bosnia and Herzegovina, it is a relatively common and widespread species up to 1200 m above sea level. It is especially numerous in karst fields and on the edges of forests with clearings in Herzegovina, while avoiding large complexes of dense

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[5] Grubac B. (1998): Golden eagle *Aquila chrysaetos*. Institute for Nature Protection of Serbia, Belgrade.
Watson, J. (2010): The Golden Eagle. Second Edition. Bloomsbury Publishing, London, UK.

[6] Cramp, S. and Simmons, KEL (1980): The Birds of the Western Palearctic. Vol. II, Oxford University Press, Oxford.
Fischer, W (1976): Stein-, Kaffern- und Keilschwanzadler. Die Neue Brehm-Bücherei 500. Ziemsen Verlag, Wittenberg Lutherstadt: 220 pp.
Grubac B. (1998): Golden eagle *Aquila chrysaetos*. Institute for Nature Protection of Serbia, Belgrade.

shrubs. Along the route of the future motorway, one territorial male was registered in the direct impact zone, while other territories of this species were positioned in the border area designated as the impact area.

Based on habitat types, number of species, presence of rare and endangered species, size of their populations, it is concluded that most of the Corridor Vc route Konjic (Ovcari) – Prenj tunnel - Mostar North, from Ovcar to Rakov Laz and from Seliste to Bosnjaci, are characterised by secondary habitats, formed under anthropogenic influence, or due to the succession of open meadows and pastures into dense shrubs and bushes and, as such, these parts of the route have extremely little protective value for bird conservation. There are no large open water areas in these localities where birds could concentrate for migration or nesting, no large nesting colonies have been discovered, as well as no nesting sites of rare and endangered species of European or national importance, no bottlenecks have been recorded through which birds migrate, therefore, it can be assumed with great certainty that the construction of the motorway along this route will not have a great negative impact on birds.

On the other hand, due to the presence of rare and endangered species, the most important are forest habitats on the left side of the route at Rakov Laz where the white-backed woodpecker is registered, rocks and cliffs in Klenova Draga canyon where the Golden Eagle nest was found, as well as fragments of grassland habitats in the locality of Zelenika where the turtledove nests. In order to protect these species, it is necessary to apply special mitigation measures.

4.2 Summary of Findings for Konjic Bypass

During the field survey, carried out in June 2022, a bird census was carried out along the entire Konjic bypass. A total of 30 species of birds were registered. Considering the research period, which includes the late nesting aspect, this number does not reflect the real state of the ornithofauna on the given section, but it gives a good insight into the state of the habitat and the degree of impact of the construction of the bypass on bird populations and their habitats.

According to the IUCN Red List, all species along this section have the lowest level of threat (LC). According to the EU Birds Directive, one species, the red-backed shrike (*Lanius collurio*) is found in Annex I. Two territories of this species were found in fragments of the typical habitat for this species, in the Donje Selo settlement, along the right bank of the Neretva River. The red-backed shrike is a species of open grassy habitats, with scattered bushes. It is a numerous and widely distributed species throughout Bosnia and Herzegovina. Therefore, the construction of the bypass, along which there are individual pairs of the species, will not have a negative impact on the national and European population of this species.

In relation to the Red List of Fauna of the Federation of Bosnia and Herzegovina, the red-rumped swallow (*Cecropis daurica*) and the gray heron (*Ardea cinerea*)

have the status of Vulnerable Species (VU). Both species have a trend of population growth and area expansion at the level of Bosnia and Herzegovina. The gray heron does not nest along the route of the bypass but it is present in the surveyed area in search of food and in flight. On the other hand, the red-rumped swallow nests on buildings in the Donje Selo settlement. The construction of the bypass will not contribute to the disturbance of the national populations of the given species.

No wetland bird colonies or nesting territories of rare and endangered bird species were found along the last polygon (Polygon 6), along the Neretva River. However, the Neretva River is an important transit zone for migrating birds, as well as a corridor along which large numbers of birds move every day in search of food. Side impacts and birds being killed by moving cars will be prevented by a metal guardrail that will be installed on the bridge, so no other mitigation measures are needed.

4.3 Impacts and Mitigation Measures

The construction of the motorway poses a potential danger to bird populations. Negative impacts are manifested directly or indirectly through habitat loss, the impact of noise on reducing the reproductive success of birds (especially songbirds), the death of birds on the route due to collisions with cars and disturbance of birds during all phases of construction. In order to preserve the ornithofauna along the route of the future motorway, it is necessary to apply general mitigation measures, which concern all species, as well as specific measures related to individual rare and endangered species.

4.3.1 Preconstruction Phase

An inactive nest of a Golden Eagle was found in the area of Klenova Draga. Most of Klenova Draga is impassable and inaccessible, which is why this site has not been fully explored. Before but in the year of construction, it is necessary to conduct additional research in order to determine whether there is another location in the immediate environment where this species nests, assess the impact of the motorway and define protective measures.

It is necessary to plan the works on all parts of the Corridor Vc subsection Konjic (Ovcari) - Prenj tunnel - Mostar North, to begin in the period July - March, i.e. outside the bird breeding period.

4.3.2 Construction Phase

In order to preserve the bird population in the referenced area, it is necessary to apply the following mitigation measures during the construction phase:

- It is necessary to install protective panels on the bridges over the Tresanica River in Ovcari, over the Neretva River and in Mladeskovici. At these localities, a high frequency of birds feeding high in the sky is noticeable,

which is why it is possible for them to get hurt due to collisions with moving cars. Protective panels must be placed on both sides of the road at a height of 1.5 m. In order to reduce the collision of birds with protective panels, it is necessary to stick black and white foil over the transparent plexiglass, which increases the visibility of the panels for birds, or silhouettes of birds of prey, which would scare the birds and move them away from the route.

- On the part of the route between 9 + 550 km and the Prenj tunnel in the zone of direct impact, one territory of the white-backed woodpecker and two territories of the black woodpecker have been registered (Figure 2). Both species are indicators of old and preserved forests with a lot of rotten trees on the ground. In order to protect these species, it is necessary to reduce removal of the forest cover to the required minimum.

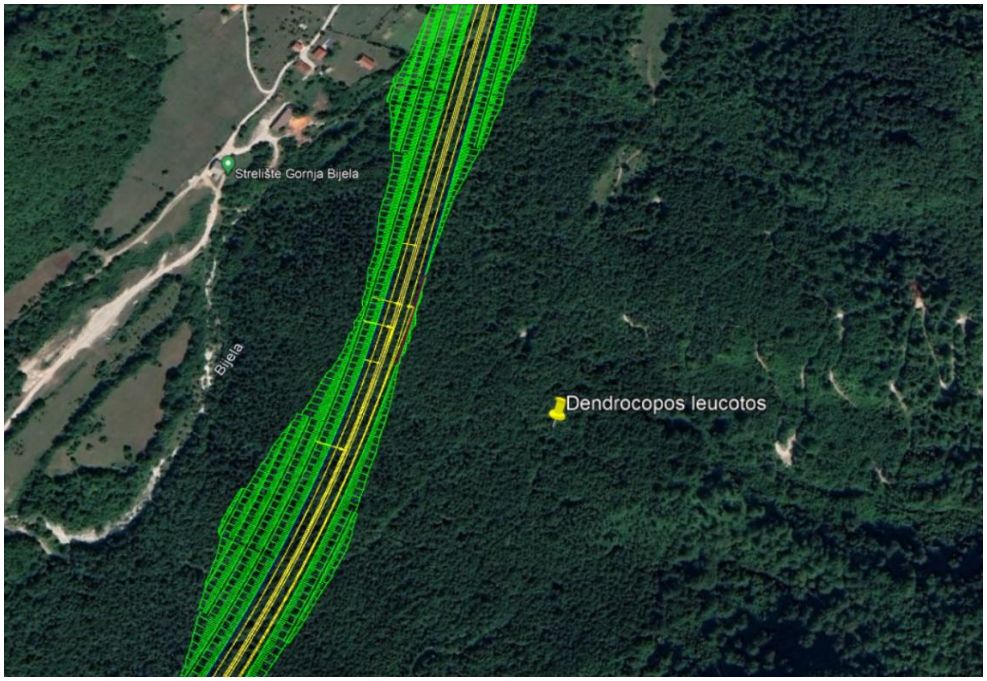

*Figure 2: Territory of white-backed woodpecker (*Dendroocopos leucotos*) in relation to the planned motorway route*

- In the area of Klenova Draga, an abandoned nest of a Golden Eagle has been registered (Figure 3). If it is established that in the following seasons the couple is active at the given locality, it is necessary to apply a number of protective measures:
  - In order to reduce the negative effects on the nesting pair of golden eagles, it is recommended that the construction works start in the period between the second half of July and the beginning of February and take place continuously and rapidly.
  - There are no access roads for the transport of machinery and materials for the construction of the motorway at the given locality. It is necessary to break through the access roads in the off-breeding period from July to February, i.e. to suspend the works from the beginning of incubation to the take-off of the fledglings (beginning of March-end of June).

- Remove trees from access roads only to the width of the road. The existence of a living barrier made of trees will significantly absorb noise, and tree canopies will reduce the visibility of machines, which could reduce the negative impact of disturbance.
- If a pair stays in the nest during the motorway construction phase by putting motorway into operation, there will probably be no major negative impacts on this nesting pair.

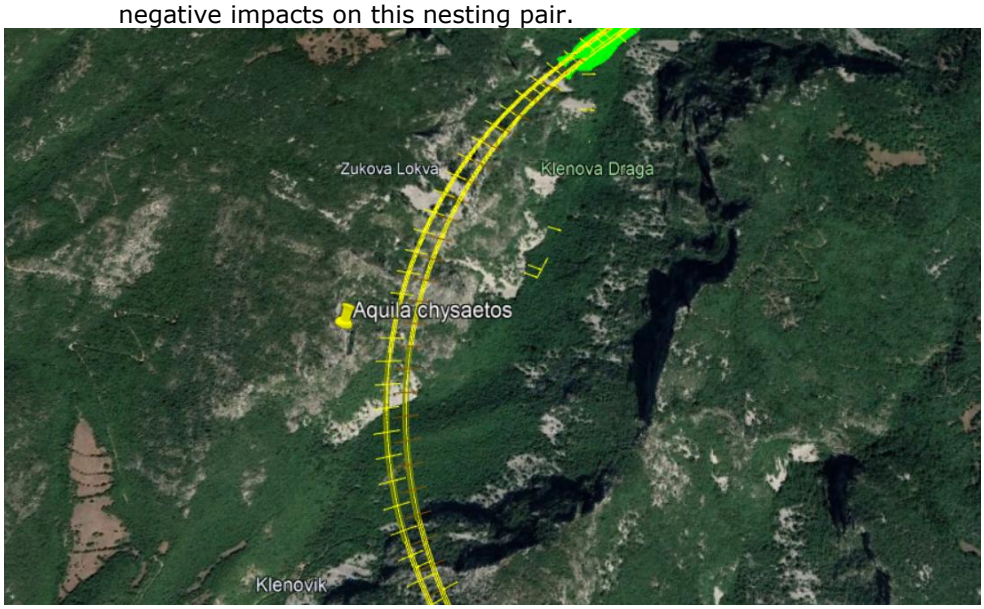

*Figure 3: Location of the inactive nest of golden eagle (*Aquila chrysaetos*) in relation to the planned motorway route*

4.3.3 Operation Phase

If during the monitoring of bird mortality on motorways and during regular maintenance of the motorway, increased bird mortality is noticed on a section, it is necessary to set protective barriers in agreement with the local ornithological society.

4.4 Monitoring Measures

4.4.1 Preconstruction Phase

Perform monitoring of Golden Eagle nest in the year of but prior to start of construction.

4.4.2 Construction Phase

As envisaged in this report, special mitigation measures have been proposed to be applied during the construction phase at the Ovcari, Neretva Konjic, Mladeskovici sites, as well as at the Rakov Laz, Klenova Draga and Zelenika sites. During the construction phase, supervision of the implementation of the proposed measures on the spot by the Supervisory Authority is recommended.

4.4.3 Operational Phase

After the commissioning of the Corridor Vc, continuous monitoring of bird mortality for at least 3 years is recommended. In the event that increased mortality of birds occurs on some sections, it is necessary to prescribe protective measures that would be defined in accordance with the habitat conditions, the species most often killed on the motorway and their behaviour.

5 Annexes

5.1 Maps

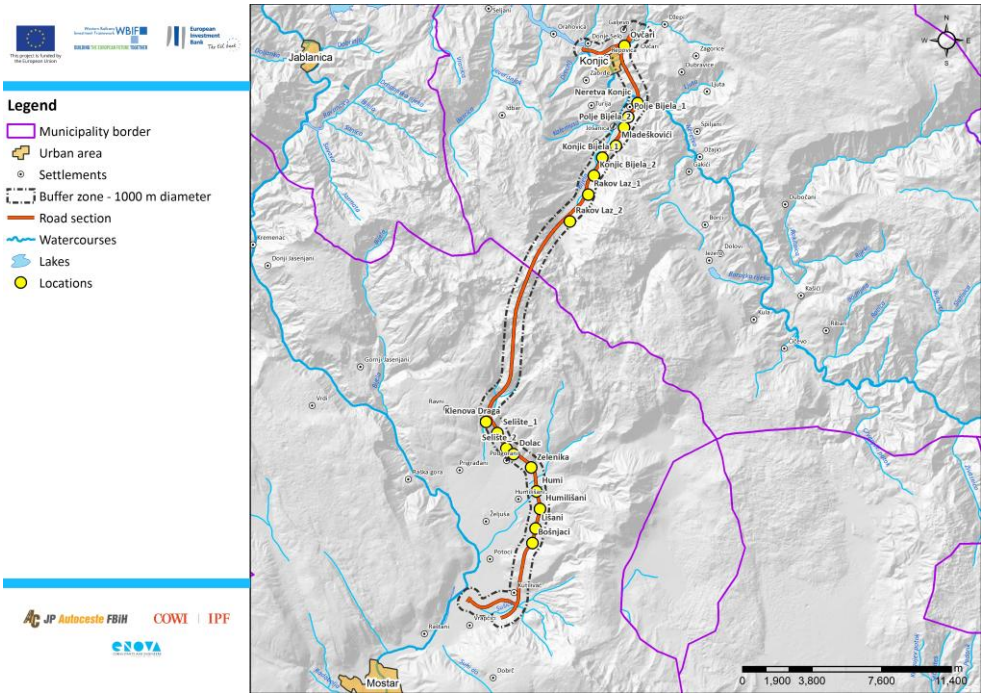

Figure 4: Map of surveyed localities

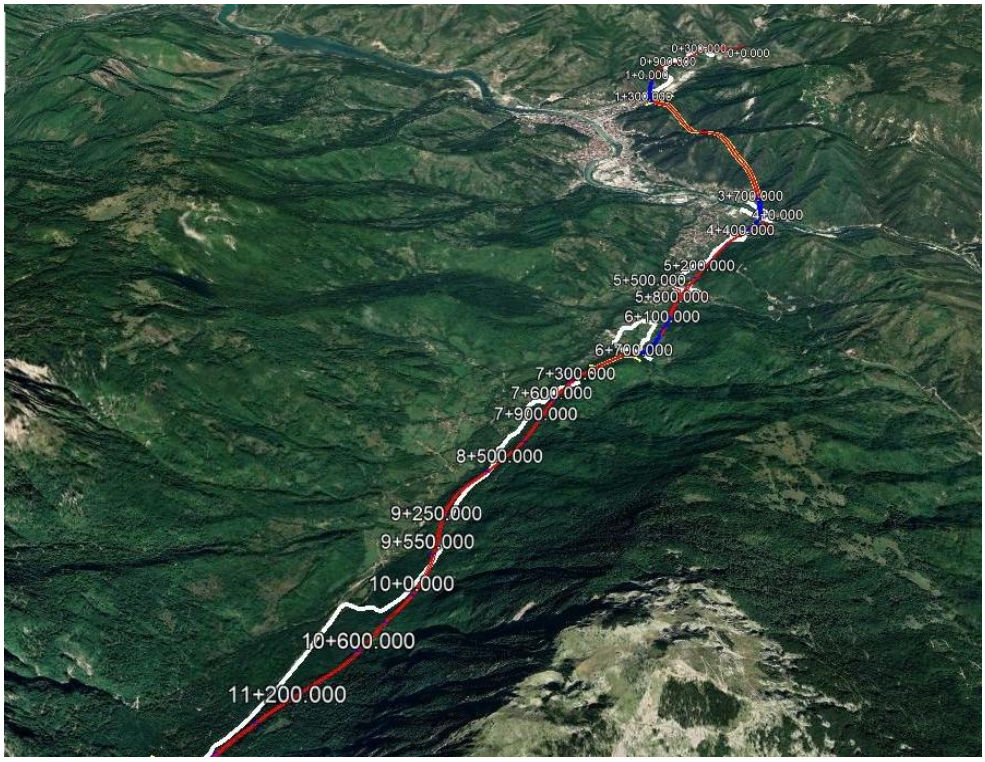

Figure 5: Transects and area of surveying (marked with white line) north of the Prenj tunnel

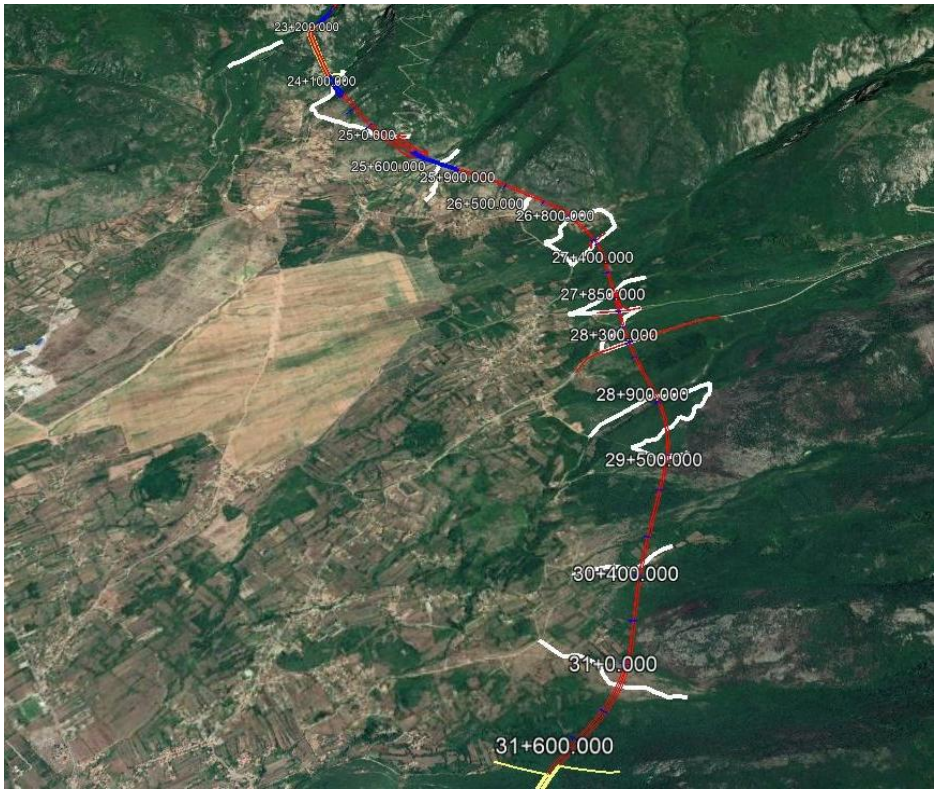

Figure 6: Transects and area of surveying (marked with white line) south of the Prenj tunnel