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Gap Analysis & ESIA Disclosure Pack

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Volume 2: Technical Annexes to the ESIA

Annex C-2: Herpetofauna (Amphibians and Reptiles)

December 2025

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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 provides the results of the herpetofauna (amphibians and reptiles) field survey.

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 Report Aim and Objectives

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 on amphibians and reptiles was conducted in different time periods ranging from September 2020 to June 2021. Research was conducted on multiple occasions, as follows: 28.9-30.9.2020, 29.10-01.11.2020, 28-31.03.2021, 27-30.04.2021, 24 - 28.05.2021, 01-05.06.2021 and 20-21.06.2022.

Field research was planned and conducted in a manner to provide results covering the period of the biggest activity of diverse species of amphibians and reptiles. The surveys have been carried out in optimal weather conditions with temperatures ranging from 15°C to 27°C. A total of 24 days was spent in the field.

2.2 Survey Methodology

Research on amphibians and reptiles was done at 13 locations on the subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North (Table 1, Figure 4). Sampling points were selected based on the road layout as well as the zone of expected impact (EAAA) on each side of the planned motorway where transects were made.

Table 1: Coordinates and general observations on surveyed localities

No.	Location	Latitude	Longitude	General observations regarding sampling points
1.	Ovcari	43.667564	17.973919	Thermophilic meadows and forests of oak and pine
2.	Polje Bijela	43.633227	17.976897	Residential buildings, meadows and shrubs
3.	Mladeskovici	43.615855	17.964957	Meadows and beech forest
4.	Konjicka Bijela	43.601335	17.950363	Beech forest
5.	Rakov Laz	43.581116	17.937818	Beech forest
6.	Klenova Draga	43.480267	17.877882	Hornbeam bushes
7.	Podgorani	43.469522	17.887710	Garrigue
8.	Dolac	43.459714	17.903786	Garrigue
9.	Zelenika	43.456653	17.908432	Dry meadows
10.	Humilisani	43.445341	17.911096	Maquis, oak forest and dry meadows; very difficult to pass through
11.	Bosnjaci	43.427028	17.910885	Maquis and dry meadows
12.	Kutilivac	43.389805	17.899043	Residential buildings of villages and urban peripheries with

No.	Location	Latitude	Longitude	General observations regarding sampling points
				hedges and maquis
13.	Konjic bypass	43.663025	17.962986	Meadows, hornbeam forest and planted pine trees

During the initial field research, conducted in October 2020, a survey of the complete area has been made in order to identify types of habitats and potential hotspots (waters sources, specific geological characteristic, minimal human impact, and accesibility) for herpetofauna. This analysis has later been used to plan further focus field research in specific areas of interest in 2021 and 2022.

For all the observed individuals coordinates were registered using the Garmin GPSMAP 64sx. Canon EOS 1100D and Nikon Cooplix B600 cameras and Samsung Galaxy A21s mobile phone were used for photo documentation of the registered species and their habitats.

The data on amphibians and reptiles of the area were collected in three ways: active searching of species in favourable habitats using a transect method, search for the road kills and vocal recognition. All caught animals were identified to the species level, and immediately released on the same location they were caught. All the animals were identified using the following standard field guide: Arnold, N. & Ovenden, D. (2002). *A Field Guide to the Reptiles and Amphibians of Britain and Europe*. Glasgow: Harper Collins. All available literature was consulted in order to summarise all the known data on amphibians and reptiles in the area.

The degree of vulnerability and conservation status of recorded species was done according to the following documents:

- Annexes II and IV of the Habitats Directive - Council of the European Union. (2013). Council Directive 2013/17 / EU of 13 May 2013. Official Journal of the European Union L158: 193–229; and
- IUCN Red List of Threatened Species (http://www.iucnredlist.org/);
- *Red List of Wild Species and Subspecies of Plants, Animals and Fungi*[1];
- *Regulation on Mitigation Measures for Strictly Protected Species and Sub-species and Protected Species and Subspecies of Federation of Bosnia and Herzegovina*[2];
- the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).

Prior the start of field investigations, a thorough literature review was undertaken. The following publications were used for reference during field work survey planning and determination of present and likely present species:

[1] Official Gazette of FBiH, No. 7/14

[2] Official Gazette of FBiH, No. 21/20

- Arnold, N. & Ovenden, D. (2002). *A Field Guide to the Reptiles and Amphibians of Britain and Europe*. Glasgow: Harper Collins.
- Annexes II and IV of the Habitats Directive – Council of the European Union. (2013). Council Directive 2013/17/EU of 13 May 2013 adapting certain directives in the field of environment, by reason of the accession of the Republic of Croatia. Official Journal of the European Union L158: 193–229.
- Bolkay, S. (1924). Popis vodozemaca i gmizavaca, koje se nalaze u Bos.-Herc. Zemljskom muzeju u Sarajevu s morfoloskim, bioloskim i zoogeografskim biljeskama [The list of the amphibians and reptiles preserved in the Bosnian-Herzegovinian National museum, with morphological, biological and zoogeographical notes.]. *Spomenar Srpske kraljevske akademije*, *61*(11), 1- 37.
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of Natural Habitats and of Wild Fauna and Flora. Official Journal of the European Communities, No. L 206, European Commission, Environment DG, 1992.
- Cox, N. A. & Temple, H. J. (2009). *European Red List of Reptiles.* Luxembourg: Office for Official Publications of the European Communities.
- Dreskovic, N., Đug, S., Stupar, V., Hamzic, A., Lelo, S., Muratovic, E., Lukic-Bilela, L., Brujic, J., Milanovic, Đ. & Kotrosan, D. (2011). *Natura 2000 – Bosna i Hercegovina.* U.G. Centar za okolisno odrzivirazvoj, Sarajevo, 459 str.
- Lelo, S., Zimic, A., Čengic, M. & Jelic, D. (2015). Biodiverzitet vodozemaca (Chordata: Vertebrata: Amphibia) Bosne i Hercegovine – Biosistematski prijegled podataka sa preliminarnim kartama rasprostranjenja. UZIZAŽ, Ilijas, pp. 58.
- Škrijelj R., Lelo S., Dreskovic N., Sofradzija A., Trozic-Borovac S., Korjenic E., Lukic- Bilela L., Mitrasinovic-Brulic M., Kotrosan D., Šljuka S., Gajevic M. & Karacic J. (2013). *Crvena lista faune Federacije Bosne i Hercegovine.* EU "Greenway", Sarajevo.
- Šunje, E., Zimic, A., Stjepanovic, B., Jusic, B., Čengic, M., Bradaric, M., & Merdan, S. (2014). Biodiversity of batrachofauna and herpetofauna of Prenj and Čvrsnica Mts. (Bosnia and Herzegovina). *Hyla*, *5*(2), 4-19.
- The IUCN Red List of Threatened Species http://www.iucnredlist.org/
- Temple, H. J. & Cox, N. A. (2009). *European Red List of Amphibians*. Luxembourg: Office for Official Publications of the European Communities.

2.3 Assumptions and Limitations

The parts of the planned subsection Ovcari – tunnel Prenj – Mostar North pass the outskirts of the villages Mladeskovici, Bijela and Bosnjaci. It was not possible to fully investigate some parts of the area due to suspected minefields. In addition to this limitation, the owners of fenced private properties in the village of Mladeskovici prohibited entry, therefore the area to be surveyed and transects had to be adjusted accordingly during the planning stage. All three aforementioned areas are areas within the project's buffer zone, but due to strong current and previous anthropogenic influences are considered highly degraded and not environmentally sensitive.

2.4 Project Area of Influence

The 500 m buffer zone at each side of the road route is assessed as sufficient with regard to the impact of the planned works on amphibians and reptiles, as the most natural habitats are already degraded.

Area of influence was generally enough for field surveys, although biodiversity aspects must take biology of species and integrity of ecosystems into consideration. 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" (EIB Guidance Note for Standard 3 on Biodiversity and Ecosystems, 2018) are included. Project's AOI was a basis for baseline surveys which was modified in a way that reflects ecological characteristics of the area and biology of found species. Output of said modification is ecologically appropriate area of analysis (EAAA). The methodology for ecologically EAAA was applied on the basis of field research, confirmed and expected species, artificial ponds and other amphibian breeding sites, 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 herpetofauna 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

A summary of the survey results for amphibians and reptiles is shown below. Table 2 and Table 3 in the next section show the results for the surveys in tabular format and critically assess the species from previous studies and literature as well.

The following standard abbreviations were used:

- IUCN – International Union for Conservation of Nature
- FBiH RL – Federation of Bosnia and Herzegovina Red List
- IUCN and FBiH RL conservation status abbreviations:
  - CR – Critically Endangered
  - EN – Endangered
  - VU – Vulnerable
  - NT – Near Threatened
  - LC – Least Concern
  - DD – Data Deficient
- HD – European Habitats Directive:

- II – Annex II
- IV – Annex IV
- (*) - priority species.

- BC – Berne Convention

3.1.1 Amphibians

Field research on the subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North realised during 2020 and 2021 was done by the transect method, during which data on composition of the amphibians were collected. Four species of amphibians were registered in the study area: marsh frog (*Pelophylax ridibundus*), green toad (*Bufotes viridis*), Greek stream frog (*Rana graeca*) (Figure 1) and fire salamander (*Salamandra salamandra*). According to literature records (Bolkay, 1924; Lelo, 2015; Šunje et al., 2015), in addition to the established representatives of the amphibians, presence of the following species is also stated for the study area: common toad (*Bufo bufo*), yellow-bellied toad (*Bombina variegata*) and agile frog (*Rana dalmatina*). Species Alpine salamander (*Salamandra atra*), Alpine newt (*Ichthyosaura alpestris*) and smooth newt (*Lissotriton vulgaris*) were listed in a previous study published in 2016[3], and we had to include them in the desk study, but they are unlikely to be found because they do not have suitable habitats (Table 2).

*Figure 1: Greek stream frog (*Rana graeca*) found in Mladeskovici*

The presence of permanent aquatic habitats was not recorded in the project area, except the Neretva and Tresanica rivers, which is the reason for the small number of recorded amphibians species. Their presence has been recorded in occasional (seasonal) aquatic habitats. The upper stream of Konjicka Bijela is part of the project area, but due to the fact that it is not a permanent flow, and

[3] Zagrebinspekt "ZGI" d.o.o. Mostar. (2016). Environmental Impact Study. Section: Konjic (loop Ovcari) - Mostar North, L = 36.50 km. Mostar.

aquatic habitats are severely fragmented during different parts of the year, it does not present a favorable habitat for amphibians. Lower course of Konjicka Bijela is a permanent water flow, and will not be influenced by the construction since it is not in proximity to the project area. The most common species is Fire salamander (*Salamandra salamandra*) which has been frequently recorded in temporary watercourses in the area of Ovcari.

Based on the characteristics of the habitat, the findings of the species common frog (*Rana temporaria)* and common tree frog (*Hyla arborea)* are also possible.

Table 2: Overview of recorded species of amphibians on the subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North

Species English name	Scientific name	Conservation status	Suitable habitat in area?	Survey finding – was species found?	Location (where?)	Reference (if literature data)
Marsh Frog	*Pelophylax ridibundus*	HD V	Yes	Yes	Polje Bijela, Bijela, Konjic bypass	EnvironmentalImpact Study, 2016; Amendment to the Environmental Impact Study, 2018
Common Toad	*Bufo bufo*		Yes	No	Tresanica River, Konjic bypass	Bolkay, 1924; Lelo, 2015; Šunje et al, 2014; Amendment to the Environmental Impact Study, 2018
Yellow-bellied Toad	*Bombina variegata*	FBiH NT; HD II, IV; BC II	Yes	No	Tresanica River, Konjic bypass	Bolkay, 1924; Lelo, 2015; Šunje et al, 2014; Amendment to the Environmental Impact Study, 2018
Green Toad	*Bufotes viridis*	HD IV, BC II	Yes	Yes	Podgorani, Humilisani, Zelenika	EnvironmentalImpact Study, 2016; Amendment to the Environmental Impact Study, 2018
Agile Frog	*Rana dalmatina*	HD IV, BC II	Yes	No	Tresanica River	Bolkay, 1924; Lelo, 2015; Šunje et al, 2014; Amendment to the Environmental Impact Study, 2018
Greek Stream	*Rana graeca*	FBiH NT; HD IV	Yes	Yes	Ovcari, Mladeskovici	Amendment to the

Species English name	Scientific name	Conservation status	Suitable habitat in area?	Survey finding – was species found?	Location (where?)	Reference (if literature data)
Frog						Environmental Impact Study, 2018
Fire Salamander	*Salamandra salamandra*	IUCN VU; FBiH LC	Yes	Yes	Konjicka Bijela, Klenova Draga, Ovcari, Podgorani, Konjic bypass	Amendment to the Environmental Impact Study, 2018
Common Frog	*Rana temporaria*	HD V	Yes	No	Expected north of the Prenj Mt.	
Common Tree Frog	*Hyla arborea*	HD IV; BC II	Yes	No	Expected north of the Prenj Mt	Amendment to the Environmental Impact Study, 2018
Alpine Salamander	*Salamandra atra*	FBiH VU; HD IV; BC II	No	No	Not expected	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Alpine Newt	*Ichthyosaura alpestris*		No	No	Not expected	EnvironmentalImpact Study, 2016; Amendment to the Environmental Impact Study, 2018
Smooth Newt	*Lissotriton vulgaris*	FBiH VU	No	No	Not expected	Amendment to the Environmental Impact Study, 2018

3.1.2 Reptiles

During the field research on the subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North 18 species of reptiles were registered: Hermann's tortoise (*Testudo hermanni*), glass lizard (*Pseudopus apodus*), slowworm (*Anguis fragilis*), Dalmatian wall lizard (*Podarcis melisellensis*), common wall lizard (*Podarcis muralis*), sharp-snouted rock lizard (*Dalmatolacerta oxycephala*), sand lizard (*Lacerta agilis*), blue-throated kneeled lizard (*Algyroides nigropunctatus*), eastern green lizard (*Lacerta viridis*), Balkan green lizard (*Lacerta trilineata*), nose-horned viper (*Vipera ammodytes*), Dahl's whip snake (*Platyceps najadum*), dice snake (*Natrix tessellate*), grass snake (*Natrix natrix*), four-lined snake (*Elaphe quatuorlineata*), eastern Montpellier's snake (*Malpolon insignitus*), Aesculapian snake (*Zamenis longissimus*) and Balkan whip snake (*Hierophis gemonensis*).

According to the data from the literature (Bolkay, 1928; Lelo, 2015; Sunje et al., 2015), in addition to the established representatives of the reptiles, presence of the specie *Coronella austriaca* is also stated for the study area (Table 3). Species adder (*Vipera berus*) and Mosor lizard (*Dinarolacerta mosorensis*) were listed in the previous study, and we had to include them in the desk study, but they are unlikely to be found because they do not have suitable habitats.

In the southern part of the route (Figure 2), as well as the northernmost segment near Ovcari and Zlatar, various thermophilus ecosystems are present with garrigue vegetation suitable for the reptiles. The most common species north of the Prenj Tunnel were *Podarcis muralis* and *Lacerta viridis*. South of the Prenj Mt. Tunnel the most common species were *Pseudopus apodus, Podarcis melliselensis* and *Lacerta trilineata.* The rarest species, of which just one individual was found during the research, are *Lacerta agilis* recorded in Ovcari*, Dalmatolacerta oxycephala* and *Zamenis longissimus* recorded in Zelenika and *Elaphe quatuorlineata* recorded in Klenova Draga*.*

Figure 2: Arid habitat at the locality of Humilisani

Although they have not been recorded so far, based on the characteristics of the habitat, the findings of the species *Telescopus fallax and Zamenis situla* are also possible.

Table 3: Overview of recorded species of reptiles on the subsection Konjic (Ovcari) - Tunnel Prenj - Mostar North

Species English name	Scientific name	Conservation status	Suitable habitat in area?	Survey finding – was species found?	Location (where?)	Reference (if literature data)
Hermann's tortoise	*Testudo hermanni*	IUCN NT; FBiH VU; HD II, IV; BC II	Yes	Yes	Klenova Draga, Dolac, Bosnjaci, Humilisani, Kutilivac	Amendment to the Environmental Impact Study, 2018
Glass llizard	*Pseudopus apodus*	HD IV; BC II	Yes	Yes	Klenova Draga, Dolac, Bosnjaci, Zelenika, Humilisani, Podgorani, Kutilivac	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Slowworm	*Anguis fragilis*		Yes	Yes	Mladeskovici, Konjicka Bijela, Polje Bijela, Rakov Laz	Amendment to the Environmental Impact Study, 2018
Dalmatian wall lizard	*Podarcis melisellensis*	HD IV; BC II	Yes	Yes	Ovcari, Polje Bijela, Konjicka Bijela, Gornje polje, Konjic bypass, Along the route south of Prenj Tunnel	Amendment to the Environmental Impact Study, 2018
Common wall lizard	*Podarcis muralis*	HD IV; BC II,	Yes	Yes	Along the route north of Prenj Tunnel	Amendment to the Environmental Impact Study, 2018
Sharp-snouted rock lizard	*Dalmatolacerta oxycephala*	FBiH NT; HD IV	Yes	Yes	Zelenika	
Sand lizard	*Lacerta agilis*	HD IV; BC II	Yes	Yes	Ovcari	Amendment to the

Species English name	Scientific name	Conservation status	Suitable habitat in area?	Survey finding – was species found?	Location (where?)	Reference (if literature data)
						Environmental Impact Study, 2018
Blue-throated kneeled lizard	*Algyroides nigropunctatus*	FBiH NT; HD IV; BC II	Yes	Yes	Humilisani, Bosnjaci, Zelenika, Klenova Draga	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Eastern green lizard	*Lacerta viridis*	HD IV; BC II	Yes	Yes	Polje Bijela, Gornje Polje, Ovcari, Konjicka Bijela, Rakov laz, Klenova Draga, Konjic bypass	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Balkan green lizard	*Lacerta trilineata*	HD IV; BC II	Yes	Yes	Klenova Draga, Dolac, Bosnjaci, Zelenika, Humilisani, Podgorani	
Smooth snake	*Coronella austriaca*	HD IV; BC II	Yes	No	Konjic	Bolkay, 1928; Šunje et al, 2014; Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Nose-horned viper	*Vipera ammodytes*	HD IV; BC II	Yes	Yes	Ravne, Konjicka Bijela	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018

Species English name	Scientific name	Conservation status	Suitable habitat in area?	Survey finding – was species found?	Location (where?)	Reference (if literature data)
Dahl's whip snake	*Platyceps najadum*	HD IV; BC II	Yes	Yes	Humilisani, Dolac, Ravne	Amendment to the Environmental Impact Study, 2018
Dice snake	*Natrix tessellata*	HD IV; BC II	Yes	Yes	Neretva river (Polje Bijela)	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Grass snake	*Natrix natrix*		Yes	Yes	Ovcari, Polje Bijela, Konjic bypass	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Four-lined snake	*Elaphe quatuorlineata*	IUCN NT; FBiH VU; HD II, IV; BC II	Yes	Yes	Klenova Draga	Amendment to the Environmental Impact Study, 2018
Eastern Montpellier snake	*Malpolon insignitus*		Yes	Yes	Dolac, Bosnjaci, Humilisani	Amendment to the Environmental Impact Study, 2018
Aesculapian snake	*Zamenis longissimus*	HD IV; BC II	Yes	Yes	Zelenika	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Balkan whip snake	*Hierophis gemonensis*	BC II	Yes	Yes	Dolac, Bosnjaci, Humilisani	Amendment to the Environmental Impact

Species English name	Scientific name	Conservation status	Suitable habitat in area?	Survey finding – was species found?	Location (where?)	Reference (if literature data)
						Study, 2018
European cat snake	*Telescopus fallax*	HD-IV; BC-II	Yes	No	Expected south of Prenj Mt.	Amendment to the Environmental Impact Study, 2018
European Ratsnake	*Zamenis situla*	FBiH-VU; HD-II, IV; BC-II	Yes	No	Expected south of Prenj Mt.	
Adder	*Vipera berus*		No	No	Not expected	Environmental Impact Study, 2016; Amendment to the Environmental Impact Study, 2018
Mosor lizard	*Dinarolacerta mosorensis*	FBiH-VU; IUCN-VU; HD-II, IV;	No	No	Not expected	Amendment to the Environmental Impact Study, 2018

4 Discussions and Recommendations

4.1 Summary of Main Findings

4.1.1 Sensitive Species of Amphibians and Reptiles

Species of amphibians and reptiles mentioned in the literature and recorded during the field work on the subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North are not on the European IUCN Red List of critically endangered, endangered and vulnerable species for the EU. Four species of amphibians and 15 species of reptiles listed in Annexes II and IV of the Habitats Directive as strictly protected species have been recorded trough field research and analysis of literature data on the subsection Konjic (Ovcari) - Prenj Tunnel - Mostar North (Amphibians: *Bombina variegata, Rana dalmatina, Rana graeca* and *Bufotes viridis*; Reptiles: *Testudo hermanni, Algyroides nigropunctatus, Dalmatolacerta oxycephala, Lacerta agilis, Lacerta viridis, Lacerta trilineata, Podarcis melisellensis, Podarcis muralis, Pseudopus apodus, Platyceps najadum, Coronella austriaca, Zamenis longissimus, Elaphe quatuorlineata, Natrix tesselata* and *Vipera ammodytes*).

According to the IUCN Red List, all the recorded species, except Hermann's tortoise (*Testudo hermanni)* (NT) and Four-lined snake (*Elaphe quatuorlineata)* (NT) (Figure 3), have the status of least concern (LC). According to the Red List FBiH, two species (*Testudo hermanni* and *Elaphe quatuorlineata*) have the status of vulnerable, while all the others are the least concern.

Figure 3: Juvenile four-lined snake (Elaphe quatuorlineata) found in Klenova Draga

Sizes of populations for the total range of these species have not been estimated; however, EAAA estimated by experts do not support a globally significant percentage of the population. All the species of reptiles found during

field research or identified in the previous studies are fast-moving organisms (capable of escaping danger), except for the Hermann's tortoise (*Testudo hermanni*), which is a common species in the wider area south of Prenj Mt.

EAAA assessment is done in Annex D: Criticial Habitat Assessment. However, discovered sensitive habitats that should be given special attention are amphibian breeding sites. Adverse effects can be significantly mitigated by avoiding disturbance of breeding sites (especially for amphibians): two occasional streems in Ovcari area, Podvrabac stream in Mladeskovici village, Klenovik spring in Klenova Draga, artificial pond in Zelenika, and artificial pond in Bosnjaci (Table 4). In areas of two occasional streems in Ovcari, artificial pond in Zelenika and artificial pond in Bosnjaci it is recommended that tunnels with additional protection net fences are placed in at least 50 m away from the locations in order to preserve migratory routes and avoid contact of amphibians and reptiles with cars. Recorded permanent aquatic habitats in the area of Konjic bypass road are the Neretva River, Tresanica River, and an unnamed stream that flows between Repovica and Gredina.

Table 4: Identified amphibian breeding sites

No.	Location	Latitude	Longitude	General observations
1.	Stream No. 1 Ovcari	43.668894	17.975403	Occasional stream
2.	Stream No. 2 Ovcari	43.666222	17.972408	Occasional stream
3.	Podvrabac stream Mladeskovici	43.616256	17.965217	Constant stream
4.	Klenovik spring	43.479700	17.877453	Freshwater spring
5.	Pond Zelenika	43.455236	17.906647	Small artificial pond
6.	Pond Bosnjaci	43.426694	17.911325	Small artificial pond
7.	Stream Repovica – Gredina	43.663848	17.962882	Permanent stream
8.	Klenovik spring	43.479700	17.877453	Fresh water spring

4.2 Impact and Mitigation Measures

Construction has the potential to affect amphibians and reptiles through a number of effects mechanisms such as direct and indirect habitat loss, habitat fragmentation/connectivity, and changes in movement patterns, and increased mortality risk. The proposed mitigation measures described in this section are

designed to reduce or minimise the effects on amphibians and reptiles in the area.

4.2.1 Construction Phase

Avoid habitat destruction and alteration outside of the defined Project footprint to the best extent possible.

In locations Streams no. 1 and 2 in Ovcari, artificial pond in Zelenika and artificial pond in Bosnjaci, due to identification of a large number of amphibians and potential habitat fragmentation, tunnels should be set up to allow the unimpeded passage of animals. To encourage use by amphibians and reptiles, all terrestrial crossings should have a natural substrate on the tunnel floor that consists of soil, sand, branches and other natural materials. The precise design, dimensions, and factors that may affect tunnel placement are listed in the *Guidelines for Amphibian and Reptile Conservation During Road Building and Management Activities in British Columbia* [4]and should be taken into consideration when designing and planning.
Fragmented and small habitats, presented in Table 4, suitable for amphibians found in the area of Ovcari, Mladeskovici, Klenova Draga, Zelenika and Bosnjaci must not be disturbed by heavy machinery during construction.

There must be no loss of amphibians of conservation importance. If found, they must be relocated to the appropriate pristine habitats nearby. Relocation must be supervised by an appropriately qualified ecologist employed by the contractor.

It is necessary to perform daily checks for the presence and removal of individuals of the species fire salamander (*Salamadra salamandra)* and Hermann's tortoise (*Testudo hermanni)* within the motorway subsection under construction, and, if species are found, safely remove them from the area to the habitat of the same type away from machines, local roads and other dangers. If nests with eggs are found during construction it is necessary to ensure they are not disturbed or destroyed and qualified ecologist must be contacted in order to safely remove them from the location.

Amphibians are among the most sensitive species regarding chemical pollution, so it would be recommended to install oil separators along the project zone, that would be frequently monitored and ensure that oil and chemical spills are prevented or controlled in a timely manner.

During construction, the construction site will be managed so as not to provide a suitable habitat for reptiles (shelter and hibernation). Measures would include non-storage of garbage and undertaking work to relocate the rubble, where the presence of reptiles is expected, when temperatures are above 7 ° C. and when reptiles are not in a state of hibernation.

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[4] http://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=15141

4.2.2 Operation Phase

Fences and tunnels should be monitored and maintained in order to prevent amphibian and reptile mortality and site connectivity in the area. Smaller passages such as culverts may become partly or completely blocked with washed sediment, windblown soil, natural debris and discarded trash. Sometimes mammals may dig into soil in a bottomless passage, causing a blockage. Passages require regular checking during the year. Specialist equipment may be needed to reach into them to remove obstructions and this includes items such as plastic bags that get lodged on camera and that may interfere with monitoring. Vegetation usually cannot grow other than at the entrances of smaller passages. Where possible and if the target species will tolerate it in the smaller passages, low depths of soil or no soil can make maintenance easier and less costly. This approach may also discourage predators to establish burrows or dens in passages. Passages may silt up completely in storm events and need substantial effort to clear. A high pressure hose may be needed to do this and is useful to refresh passages every few years or after a suspected road spillage, notably for slotted surface tunnels where oil, salts and other potentially harmful residues may accumulate on the passage floor.

4.3 Monitoring Measures

Important considerations in selecting monitoring procedures include minimising observer influence and ensuring that monitoring activities do not create added disturbance to sensitive wildlife species. In addition, it is important that monitoring efforts are focused on parameters which are directly related to effects mitigation and provide opportunities to improve mitigation performance over time.

4.3.1 Preconstruction Phase

Monitoring of potentially present species of conservational importance should be done before construction begins to include all findings in project planning and destruction of habitats is prevented.

4.3.2 Construction Phase

Early installation and regular maintenance of exclusion fences around specific habitats of amphibians can help to reduce mortality during construction.

Amphibians are among the most sensitive species regarding chemical pollution, so it would be recommended to install oil separators along the project zone, that would be frequently monitored and ensure that oil and chemical spills are controlled in a timely manner.

Habitat monitoring by ecologists during construction, which will include: verifying impact predictions and monitoring the effectiveness of mitigation

measures; Relocation of species found during construction that are not able to quickly avoid danger; Environmental supervision of the contractor: weekly visual inspections during the construction phase to monitor the prescribed mitigation measures.

4.3.3 Operation Phase

Monitoring the effectiveness of mitigation measures by preventing the death of animals in accidents on the highway, e.g. use of underpasses, bridges. These measures are taken by keeping records of the animals killed on each tranche of the highway after construction, through regular patrol checks, e.g. once a week or monthly. Surveillance of parts that allow animals to cross and prevent habitat fragmentation should also be monitored.

5 Annexes

5.1 Maps

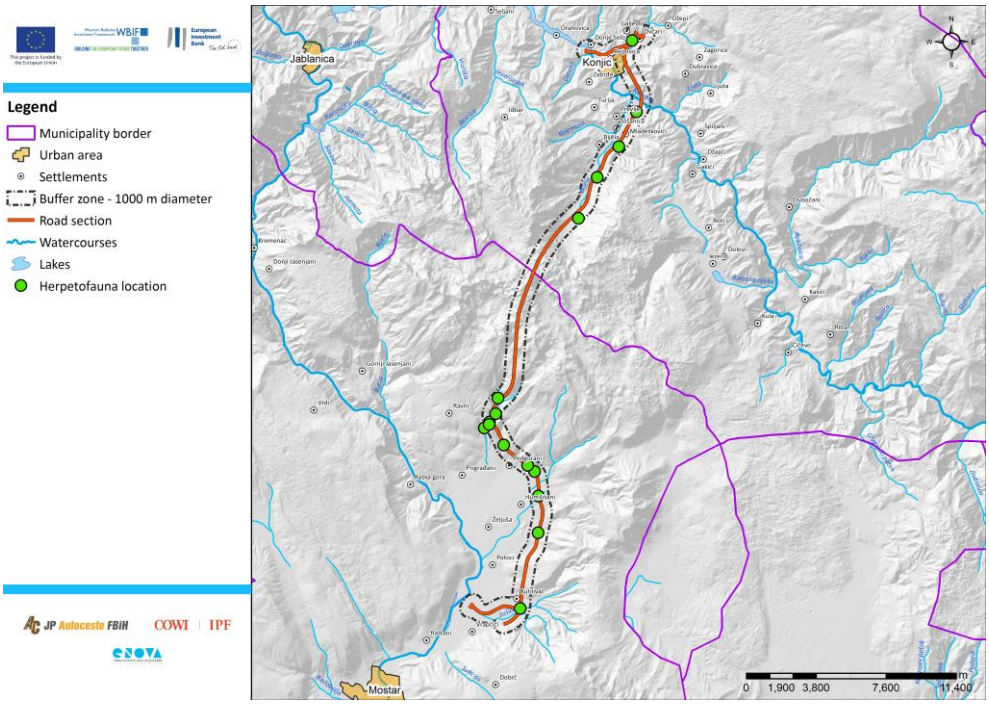

Figure 4: Localities of herpetofauna surveys in relation to the motorway route

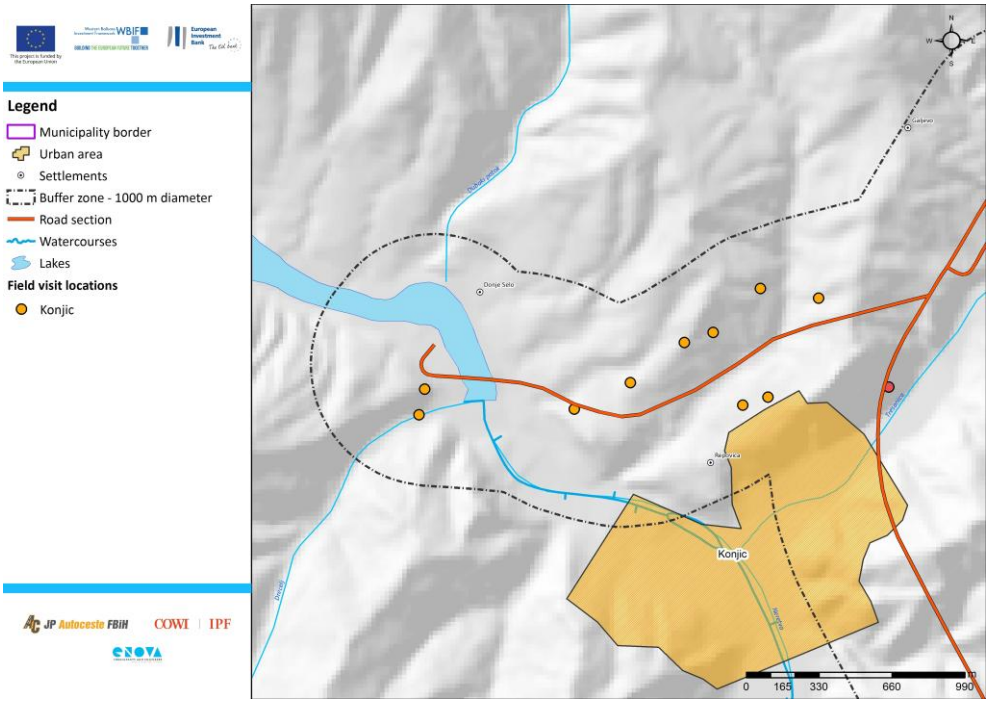

Figure 5: Survey locations along the Konjic bypass

5.2 Photographs of Habitats

Figure 6: Artificial pond in Humilisani

Figure 7: Illegal landfill in Zelenika

Figure 8: Dense vegetation in Klenova Draga

Figure 9: Habitats along Konjic bypass

Figure 10: Unnamed stream flowing from Repovica to Gradina, Konjic bypass

5.3 Photographs of Species

Figure 11: Bufotes viridis

Figure 12: Bombina variegata

Figure 13: Lacerta trilineata

Figure 14: Dahl's whip snake (Platyceps najadum)

Figure 15: Nose-horned viper (Vipera ammodytes)

Figure 16: Dalmatian Algyroides (Algyroides nigropunctatus) in Klenova Draga