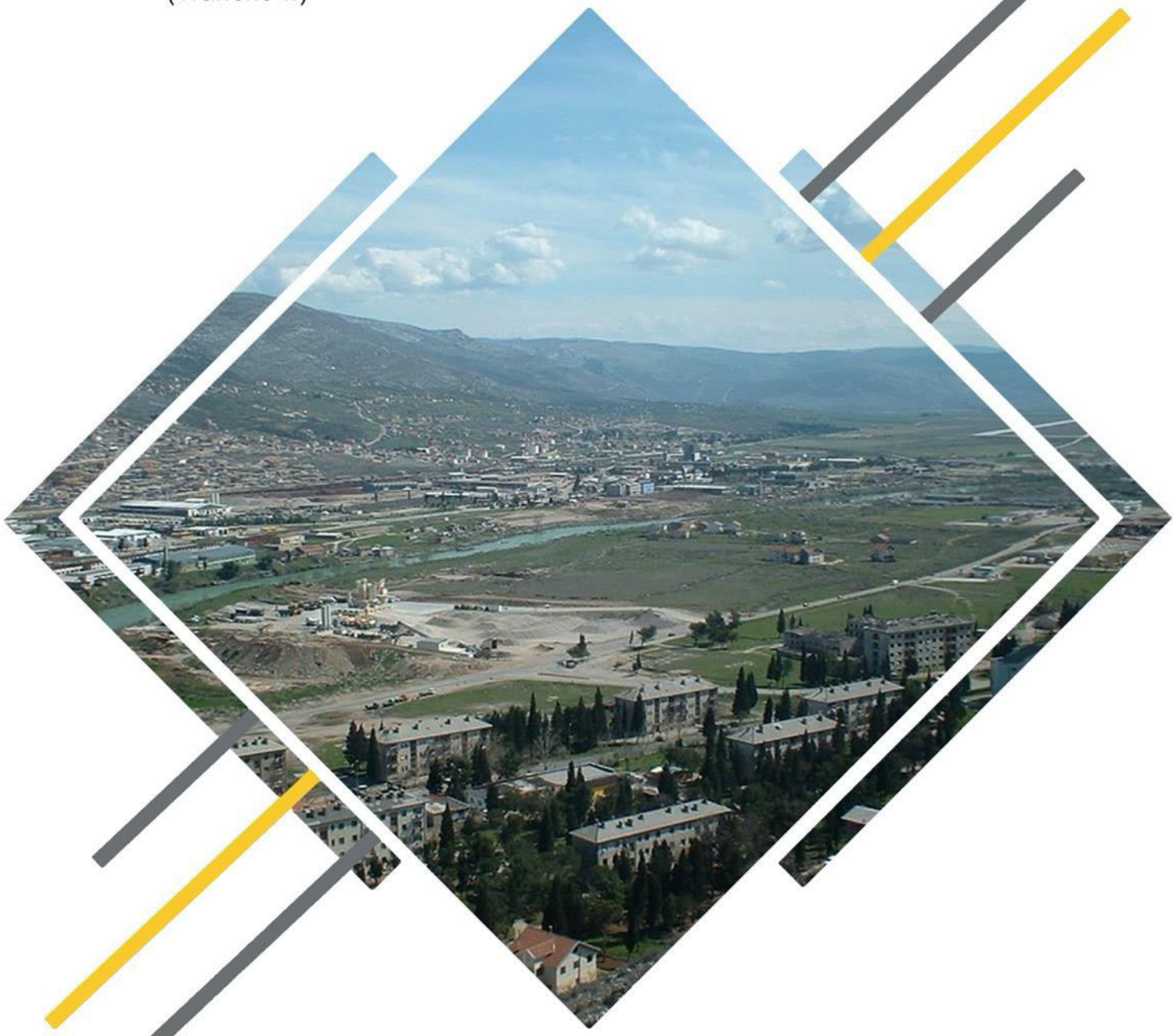
CATEGORY A PROJECT
Bosnia and Herzegovina Corridor Vc in FBiH – part 3
(Tranche II)



VOLUME 1:

Environmental and Social Impact Assessment for Sub-Section Mostar South Interchange to Tunnel Kvanj

July 2020

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Abbreviations

BHANSA	Bosnia and Herzegovina Air Navigation Services Agency
BHDCA	Bosnia and Herzegovina Civil Aviation Directorate
BiH	Bosnia and Herzegovina
BMP	Biodiversity Management Plan
CEPF	Critical Ecosystem Partnership Fund
CESMP	Construction Environmental and Social Management Plan
CKS	Center for Karst and Speleology
CSOP	Construction Site Organisation Plan
DCWMP	Detailed Construction Waste Management Plan
EBRD	European Bank for Reconstruction and Development
EBRD ESP	EBRD's Environmental and Social Policy
EIA	Environmental Impact Assessment
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FBiH	Federation of Bosnia and Herzegovina
FBiH CR	Federation of Bosnia and Herzegovina Critically Endangered Species
FBiH LC	Least-concerned Species
FBiH RL	Red List
FBiH VU	Vulnerable Species
FMET	Federal Ministry of Environment and Tourism
GHG	Greenhouse gas
GIIP	Good International Industry Practice
HD	Habitat Directive
IUCN	International Union for Conservation of Nature
IUCN DD	Data Deficient
IUCN EN	International Union for Conservation of Nature Endangered Species
IUCN LC	Least-concerned Species
IUCN NE	Not Evaluated
IUCN NT	Near-threatened Species
IUCN RL	Red List
IUCN VU	Vulnerable Species
JPAC	Motorways of the Federation of Bosnia and Herzegovina
LALRP	Land Acquisition and Livelihood Restoration Plan
LC	Local Community
NGO	Non-governmental Organisation
NTS	Non-Technical Summary
OHS	Occupational Health and Safety
PAP	Project Affected People
PAs	Protected Areas
PIU	Project Implementation Unit
PR	Performance Requirement
RCIA	Rapid Cumulative Impact Assessment

RSA	Road Safety Audit
SEP	Stakeholder Engagement Plan
UXO	Unexploded ordnance
VEC	Valued Environmental and Social Components

1 INTRODUCTION

1.1 Overview

PC Motorways of the Federation of Bosnia and Herzegovina (the Company or "JPAC") is a public company from the Federation of Bosnia and Herzegovina (FBiH) in charge of management of motorway construction and management, maintenance and protection of motorway operation in FBiH. One of the Company's key projects is the development of the motorway which is part of the Trans-European Corridor Vc connecting Budapest (Hungary) and Port of Ploce (Croatia). The total length of Corridor Vc in FBiH is approximately 335 km. Approximately 100 km of the motorway is already constructed and operational.

General Project benefits for the local communities include improved access to tourist centres, religious, recreational, catering and health facilities; improved transport services, increased value of commercial properties, as a result of improved access to commercial activities; and reduced traffic on local roads, especially M17, which can have positive impacts on local air quality, noise, severance and quality of life. Furthermore, given that that Corridor Vc is a part of a greater Pan-European transport corridor (direction south), construction of the Project sections will lead to the better transport connectivity of South Eastern Europe.

The European Bank for Reconstruction and Development ("EBRD") is considering providing finance to JPAC to construct new motorway section from Mostar South Interchange to Tunnel Kvanj on the Corridor Vc (LOT 4). The key information about this section is given in the table below:

Table 1: Information about the project

Section	*Length*	*Category*	*Type of works*	*Available documentation*[1]
Mostar South Interchange to Tunnel Kvanj	9.2 km	A	Construction of motorway	• Preliminary Design, IPSA institute Sarajevo (2018) • EIA Study for Section Mostar South-Buna, CETEOR (2017) • Gap Analysis Report for Section Mostar South-Tunnel Kvanj, Ecoplan Mostar (2019) • EIA study for Section Mostar South-Tunnel Kvanj, IG Banja Luka (2019)

As part of the financing requirements, a review of the Project and the available EIA and other supporting documentation was undertaken which determined that additional revision, improvement and strengthening of previously prepared outputs and advisory E&S supporting services are required to meet EBRD's Environmental and Social Performance Requirements. This ESIA study has been completed in line the EBRD Performance Requirements (EBRD PRs) to meet this need. The study builds upon the work undertaken by CETEOR Sarajevo and IG Banja Luka which provided input information for environmental and social baseline and enabled further assessment of environmental and social impacts. Additional biodiversity research was performed in order to better respond to the requirements of EBRD PR6 and national and EU legislative related biodiversity protection.

[1] All documents are available at the JPAC offices in Sarajevo and Mostar.

1.2 Objectives

In line with the Bank's Environmental and Social Policy (2014) (ESP), the objective of the assessment is to carry out an Environmental and Social Assessment (ESIA) for the Project addressing the requirements of the Lenders requirements, specifically the EBRD's Environmental and Social Policy and Performance Requirements (PRs). The ESIA will form part of an ESIA disclosure package that will be publicly available and subject to a public disclosure and consultation process.

1.3 Project parties

The Project will be constructed and operated by the Public Company of the Motorways of the Federation of Bosnia and Herzegovina, a limited liability company, established in accordance with the Law on Roads of the Federation of Bosnia and Herzegovina[2]. The Company is wholly owned by the Government of Federation of Bosnia and Herzegovina (FBiH). The following activities are performed by JPAC:

- Preparation of long-term, mid-term and annual plans and development programs, maintenance, protection. Construction, reconstruction of roads and buildings on roads, as well as reports on realization of these plans and programs;
- Performing motorway maintenance work;
- Investment projects for studies and projects, reconstruction, construction, reconstruction and maintenance on motorways and facilities;
- Proposing financial plans and improving the way funds are collected for the construction of motorways;
- Keeping records (databases) of motorways, facilities, traffic signs and equipment on motorways and cadastre of the motorway land area;
- Transfer of works on reconstruction, construction, reconstruction and maintenance of motorways; Preparing and monitoring the realization of programs of measures and activities for improvement of traffic safety on the motorways running by them;
- Preparing the basis for granting concessions and providing expert and technical supervision; Organization of toll collection system;
- Collecting data and informing the public about the state of the motorways and the manner of traffic flow;
- Taking the necessary measures for preserving and protecting the environment;
- Organizing and providing services to users of motorways and motorways.

The contractor for Project construction had not been selected at the time of writing.

1.4 ESIA disclosure package structure

The ESIA disclosure package is comprised of six volumes organised as follows:

- Volume 1: Environmental and Social Impact Assessment (ESIA) Report (inclusive of Environmental & Social Management Plan (ESMP)) (this volume)
- Volume 2: Technical Annexes
- Volume 3: Environmental and Social Action Plan (ESAP)
- Volume 4: Biodiversity Management Plan (BMP)

[2]Official Gazette FBiH no 12/10, 16/10, 66/13

- Volume 5: Non-technical summary (NTS)
- Volume 6: Stakeholder Engagement Plan (SEP)
- Volume 7: Land Acquisition and Livelihood Restoration Plan (LALRP)

Volume 1 (this document) is structured as presented in Table 2.

Table 2: ESIA report structure

Section	*Description of Content*
Introduction	Presents a brief Project overview, description of key role players, and purpose of the ESIA study and report.
Project Description	Describes the Project, its main elements and activities for construction and operation.
Project Need and Analysis of Alternatives	Presents the purpose and rationale of the Project and summarises the alternatives considered to the proposed Project site and design, including the no project alternative.
Policy, Legal and Institutional Framework	Defines key national policy, legislation and international lender guidelines applicable to the Project, as well as key national institutions.
ESIA Methodology	Sets out the stages of the ESIA, key assumptions and methodologies for undertaking the ESIA.
Environmental Baseline	Provides an understanding of current environmental conditions that form the baseline against which Project impacts can be predicted and measured during Project implementation.
Social Baseline	Provides an understanding of current social conditions that form the baseline against which Project impacts can be predicted and measured during Project implementation.
Assessment of Impacts	Itemizes and describes the identified impacts, makes predictions in terms of their probability and assesses their significance. This chapter also includes assessment of cumulative impacts carried out in line with good practice guidelines and includes identification of valued environmental and social components (VECs), assessment of the predicted impacts to the viability or sustainability of the VECs, and design and implementation of mitigation measures to manage the cumulative impacts and risks.
Environmental and Social Management and Monitoring Plan	An Environmental and Social Management and Monitoring Plan (ESMP) documents the project's risk management strategy for those impacts that are assessed to be significant. It integrates the findings of all impact studies carried out during the design phase, the plans and other provisions for complying with the requirements of the Standards that were triggered as well as country- and site-specific information relevant for the project's risk management strategy. It provides monitoring related information and key performance indicators for measuring the success.
Residual impact	This chapter presents residual impacts that will remain after implementation of all mitigation measures, as well as assess their significance.

1.5 Contact details

Contact details for enquires on this ESIA are listed in Table 3.

Table 3: ESIA contact details

Project proponent	*Information*
Name of Company	Public Company Motorways of the Federation of Bosnia and Herzegovina Ltd. Mostar
Adress	Adema Buca 20, 88000 Mostar, Bosnia and Herzegovina

Project proponent	*Information*
Telephone	+ 387 36 512 300
e-mail	info@jpautoceste.ba
Webiste	www.jpautoceste.ba

2 PROJECT DESCRIPTION

2.1 Project overview

A summary of key Project details is provided in Table 4.

Table 4: Project details

<table>
<tr><td>Aspect</td><td>Details</td></tr>
<tr><td>Project name</td><td>Bosnia and Herzegovina Corridor Vc in FBiH
Sub-Section Mostar South Interchange to Tunnel Kvanj (LOT4)</td></tr>
<tr><td>Country</td><td>Bosnia and Herzegovina</td></tr>
<tr><td>Location</td><td>City of Mostar (settlements of Gnojnice, Ortijes, Kosor, Laksevine, Buna, Blagaj, Malo polje and Hodbina)</td></tr>
<tr><td>Purpose</td><td>Construction of Trans-European Corridor Vc connecting Budapest (Hungary) and Port of Ploce (Croatia)</td></tr>
<tr><td>Length of the Project</td><td>9.2 km</td></tr>
<tr><td>Predicted traffic forecast</td><td>
<table>
<tr><td>Activity</td><td>Item</td><td colspan="2">Baseline scenario (2018)</td><td colspan="3">Project scenario (2050)</td></tr>
<tr><td rowspan="2">Vehicle movement</td><td rowspan="2">Passenger cars (number of vehicles)</td><td>M6.1</td><td>M17</td><td>M6.1</td><td>M17</td><td>Corridor Vc</td></tr>
<tr><td>2,614,495</td><td>5,145,040</td><td>5,915,920</td><td>7,417,165</td><td>7,417,165</td></tr>
</table>
</td></tr>
<tr><td>Accident data</td><td>According to the Traffic Study, the project will result in 60% less of accidents compared to the baseline state</td></tr>
<tr><td>Project components</td><td>▪ Mostar South interchange
▪ Tool station
▪ Tunnel/Underpass „Mostar“, L=232m
▪ Overpass „Mostar“
▪ Overpass „Aerodrom“
▪ Underpass „Kosor“
▪ Bridge „Buna“, L=326m
▪ Bridge „Bunica“, L=211m
▪ Viaduct „Brijeg“, L=258m

Note: construction of Tunnel Kvanj is not part of this Project</td></tr>
<tr><td>Technical characteristics</td><td>▪ Design speed, Vp = 120 km/h
▪ Calculated speed, Rp = Vp = 120 km/h
▪ Horizontal curve radius, Rmin = 750 (650) km/h
▪ Longitudinal slope, Smax = 4 %
▪ Convex radius, Rmin = 19.000 m
▪ Concave radius, Rmin = 13.000 m
▪ Transverse slope, q = 2,5 %, u pravcu
▪ Traffic lanes, 2x2x3,75 = 15,00 m
▪ Emergency lane, 2x2,5 = 5,00 m
▪ Edge strip, along the traffic lanes, 2x0,5 =1,00 m</td></tr>
</table>

Aspect	*Details*
Developer	Public Company Motorways of the Federation of Bosnia and Herzegovina
Financier	European Bank for Reconstruction and Development (EBRD)
Total cost	cca 120 mil BAM / 66 mil USD
Web site	http://www.jpautoceste.ba/

Figure 1 shows the normal profile of the route of the future subsection Mostar South-Tunnel Kvanj in the cut.

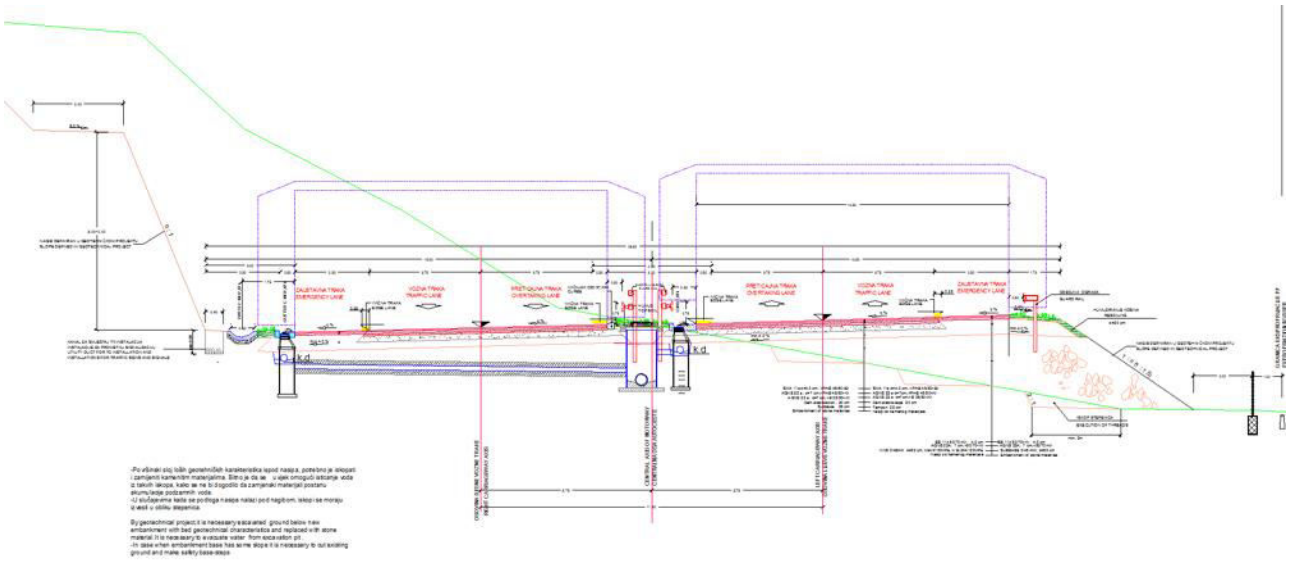


Figure 1: Normal profile of the motorway route in cut

2.2 Project location

According to the Preliminary Design[3], the 9.2 km long sub-section Mostar South-Tunnel Kvanj is the northern part of the Section Mostar South-Buna.

The sub-section begins with the Mostar South interchange and ends with the entrance into Tunnel Kvanj. The interchange is located near the Mostar Airport, and represents the intersection of the motorway with the existing main road M6.1 by connecting the motorway with the southern part of Mostar. After the interchange, the alignment is located in the immediate vicinity of the Mostar Airport where a tunnel (Mostar South Tunnel L=232 m) beneath the airport is envisaged to accommodate the development of an additional runway. After exiting this tunnel, the alignment follows the existing railway Mostar-Capljina in a very narrow 32 m corridor to the south. The route then passes parallel with the Mostar Airport runway towards Ortijes and Kosor

[3] Preliminary Design and Study for Obtaining Urban Permit for the Motorway Section on Corridor Vc, Mostar South-Buna, developed in April 2018 by IPSA Institute Sarajevo

settlements. The alignment then follows the auxiliary airport runway at a distance of 35-45m, crossing agricultural fields in Ortijes (Figure 2).

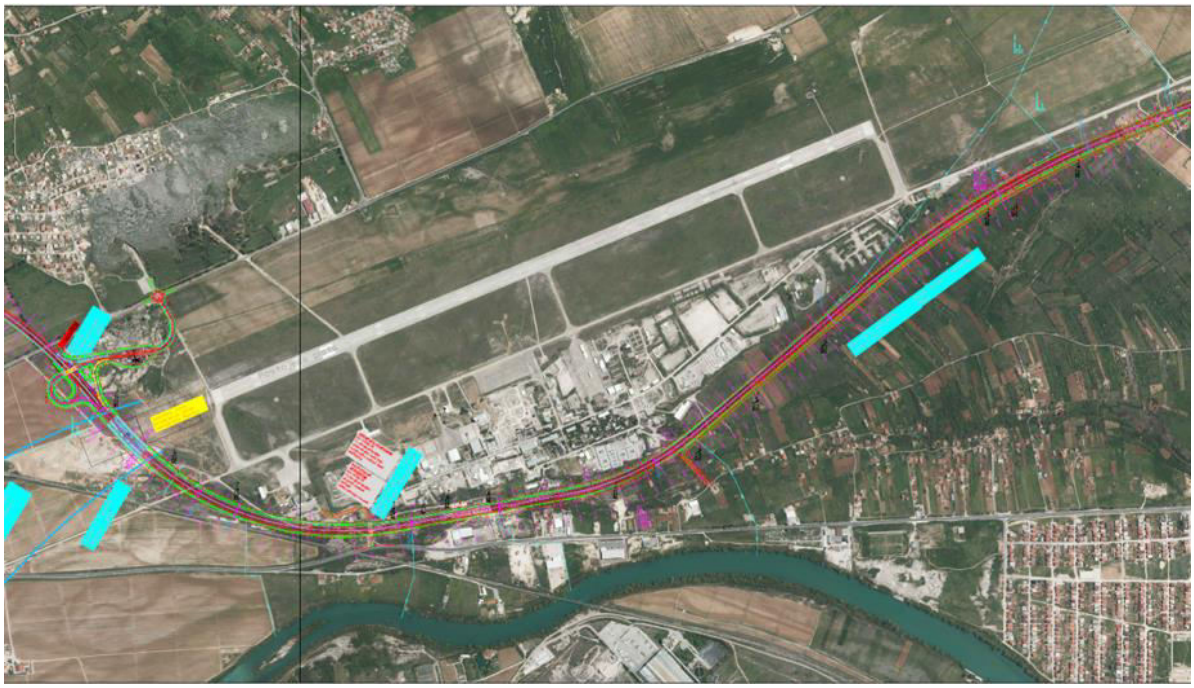


Figure 2: Mostar South Interchange and the first part of the section passing near the airport in Gnojnice Donje and the auxiliary airport runway in Ortijes

The sub-section further crosses the Buna Stream by Buna Bridge (L=326m), passes through agriculture areas of Malo Polje, crosses the Bunica Stream with a bridge (L=211m), and a viaduct (Viaduct Brijeg L=258 m) which leads to the Hodbina Hill and further to the entrance of Tunnel Kvanj[4]. The sub-section ends at chainage 9+125+000 km. This part of the section is shown on Figure 3 and Figure 4, where the bridges and viaduct are coloured in yellow.

The part of the section from Buna Stream to the entrance into Tunnel Kvanj has an inclination of 5%, and a lane for slow driving (L=2,465m) is foreseen.

Additional access roads are also planned to be designed. They are necessary for improving the local road network and to ensure access to land plots cut by the motorway crossing.

[4]Tunnel Kvanj is not part of the sub-section Mostar Sotuh-Tunnel Kvanj

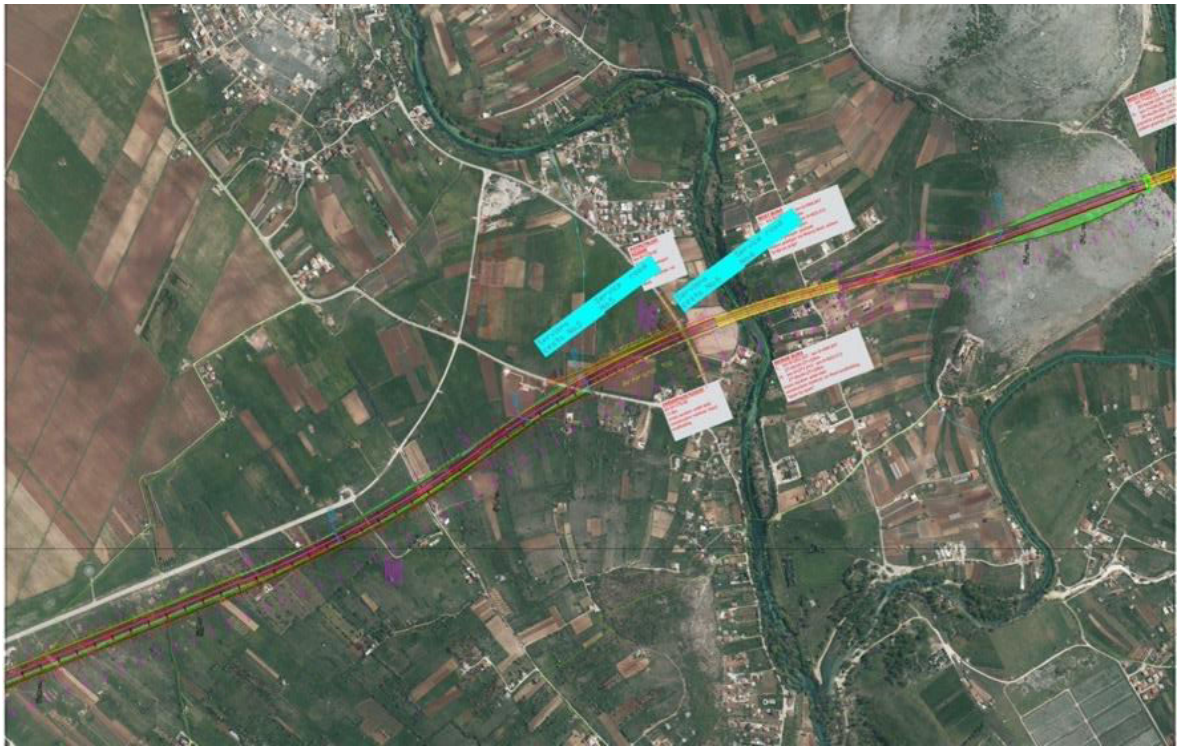


Figure 3: Part of the section passing near the auxiliary airport runway in Kosor and passing the Buna Stream by Buna Bridge

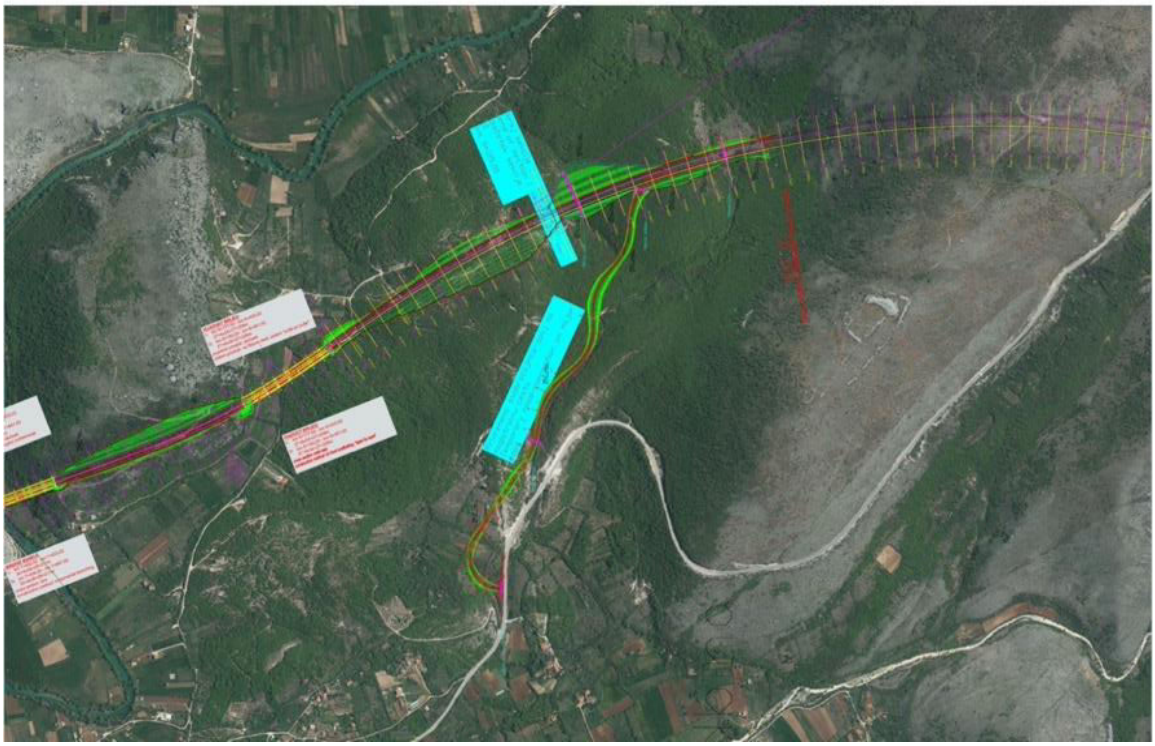


Figure 4: Part of the section passing through a tunnel and crossing the Bunica Stream before entering into Tunnel Kvanj in Hodbina

2.3 Project history and timeframe

Table 5 presents the key milestones in the Project development. More information about analysis of alternatives is given in Chapter 3.

Table 5: Project milestones

Date	*Activity*	*Description*
2003	BiH Government Decision on public interest for the motorway on Corridor Vc	BiH Ministry of Transport and Communications adopted *Decision on public interest for construction of the motorway on Corridor Vc through Bosnia and Herzegovina, based on assigned concession on the part and alignment that will be defined by the agreement*[5] and started the procedure of development of spatial, planning and technical documentation for the motorway
2005-2006	First analysis of alternative routes and development of Preliminary design for the proposed alternative	First analysis of the route and proposal of preliminary alignment for the whole Corridor Vc for LOT4. After assessing several alternatives, the one that passes through Mostar field was selected as the most appropriate. This alignment required to build two shorter tunnels (Gorica and Kicin) and one longer tunnel (Kvanj, 2.7km), and four difficult components of 1.92km length in total. The design reviewers committee objected the route around Pocitelj and Blagaj, but this objection was not taken into consideration and the preliminary design was developed for the proposed route.
2007	Local Environmental Impact Assessment (EIA) process for the entire Corridor Vc	In 2007 JPAC has conducted the local Environmental Impact Assessment (EIA) process for the entire Corridor Vc alignment in accordance with FBiH regulatory requirements[6]. However, environmental permit was never issued.
2008	Beginning of the process of development of the Spatial plan	Start of the development of *Spatial plan for an area of special interest for FBiH „Motorway on corridor Vc" for period 2008-2028* when the first request for realignment of section around Blagaj and Pocitelj was submitted.
2010	Main design for section Mostar North – Mostar South (LOT 5, 16 km) and Mostar South-Pocitelj (LOT 6, 20 km)	LOT 4 was divided to three LOTs: LOT 5 (Mostar North - Mostar South, 16 km), LOT 6 (Mostar South – Pocitelj, 20km) i LOT 7 (Pocitelj – South border, 31.33km). The main designs for LOT 5 and LOT 6 were prepared as a baseline document for expropriation and permitting. The correction of length for the section Suhi Do - Mostar South- Buna – Stanojevici was made
2011	Second analysis of alternative routes	The route passing in the hinterland of Blagaj was selected as the optimal one. The alignment has been moved towards the south, up the hill, by approximately 3.5 km (maximum distance) comparing to the first route passing through Mostarsko field. Distance of the proposed route from the sources of Buna and Bunica was 700 m and 500 m, respectively. This route is approximately 3.0 km longer than the one that passes through the Mostar field, but the degradation of the fertile land of Mostarsko field was avoided. The location of Mostar South Interchange was also moved.
2011	Adoption of Proposal of	Government of FBiH adopted the Proposal of Spatial plan for an area of special interest for FBiH „Motorway on corridor Vc" 2008-2028 following statutory

[5]Official Gazette BiH no. 23/03
[6]EIA for LOT 1: Svilaj – Doboj South (Karuse), IPSA Institute (BiH), 2007 available on http://www.jpautoceste.ba/images/llot1.pdf
EIA for Lot 2: Karuse – Tarcin, IPSA Institute (BiH), 2007 available on http://www.mkt.gov.ba/doc/default.aspx?id=1081&langTag=bs-BA
EIA for Lot 4: Mostar North – Border crossing, prepared by IGH (Croatia), 2007 available on
http://www.mkt.gov.ba/doc/default.aspx?id=1073&langTag=bs-BA

Date	*Activity*	*Description*
	Spatial Plan	consultation processes.
2014	Preliminary Water Consent obtained	The Agency for Watershed of the Adriatic Sea issues the preliminary water consent for the section Mostar North - Border with Republic of Croatia based on the design developed by IGH Zagreb in 2006. The validity of the permit is 3 years. The permit was extended several times and its validity is again confirmed by the Agency in 2019.
2015	Third analysis of alternative routes	JPAC abandons the proposed alignment between Ostri rat and intersection Mostar South (cca 13 km). This was because proposed alignment was assessed as a route with obvious spatial restrictions, unsuitable technical elements and numerous road components with high investment and operational costs. As a result, work starts on the new procedure to find the possible new alignment on the route Stanojevici-Buna-Mostar South-Ostri rat.. From the new location of Mostar South Interchange (connection to the M17 in the area of the airport Mostar), the proposed route is passing along the Mostar airport in Ortijes, crosses over the Buna Stream to Stanojevici, where it is connected to LOT 6.
2016	Multicriteria analysis of three variants, those from 2006, 2011 and 2015.	The results of this multicriteria analysis showed that the most suitable alternative is the one from 2015 where the route is passing near the airport Mostar.
2016	FBiH Government adopted the amendments to the Proposal of Spatial plan	Government of Federation FBiH adopted the amendments to Proposal of Spatial plan for areas of special interest for FBiH „Motorway on corridor Vc" 2008-2028 related to sections 1-11. These amendments changed the 60% of preliminary motorway alignment compared to the one adopted in 2011.
2017	Fourth analysis of alternative routes	The route from 2015 was slightly corrected in the zone of the Mostar Airport in Ortijes. From the airport the new route is descending toward Buna and Bunica, crosses them with two bridges, ascends toward Rotimlja, passes the hills Hum and Kvanj entering the tunnel Kvanj. From there, the route passes Rotimski creek, exits to lowland in Gubavice and connects to section Buna-Pocitelj in Stanojevici. Another alternative that was assessed required bridging the Neretva River twice, passing from the right to the left bank and again in settlements of Okuci and Hadziosmanovici rerouting to the right bank. This proposed alternative route also included construction of 3 tunnels. The results of this multicriteria analysis showed that the most suitable alternative is the one that stays on the left bank of Neretva River.
2017	FBiH Parliament adopted the Spatial Plan	Parliament of Federation BiH has adopted the Spatial plan for areas of special interest for FBiH „Motorway on corridor Vc" for period of 20 years[7] following statutory consultation procedure.
2018	Preliminary design of section Mostar South - Buna that includes the section Mostar South Interchange – Tunnel Kvanj	Preliminary design of section Mostar South Buna that treats this section Mostar South Interchange – Tunnel Kvanj is developed by IPSA Institute Sarajevo. The two amendments to the route were made: amendments to the alignment near Mostar Airport and amendments to the alignment in the village of Malo Polje. This latest alignment is the subject of environmental and social impact assessment.

[7] Official Gazette FBiH 100/17

2.4 Project components

2.4.1 Interchange "Mostar jug"

The section starts with the Mostar South Interchange[8] which is located in a rather narrow space surrounded by the main road and the airport including all its associated facilities (pist, hangars, etc.). The interchange is buried in the ground, the same as the motorway in this section, it is a shape of a trumpet and one of its legs crosses the motorway. The interchange enables the connection between the motorway and main road Mostar-Nevesinje. Technical characteristics of the Interchange are:

- The width of legs' planum is as follows:
  - One-way: 1.5+0.5+5+0.5+1.5 = 9.0 m-profile is asymmetric
  - Two-way: 1.5+0.3+2x3.5+0,3+1.5 = 10.9 m
- Minimum radius in legs is 75 m, Vr = 40 km / h
- For entrance/exit to/from the motorway 250.00 long lanes are planned.

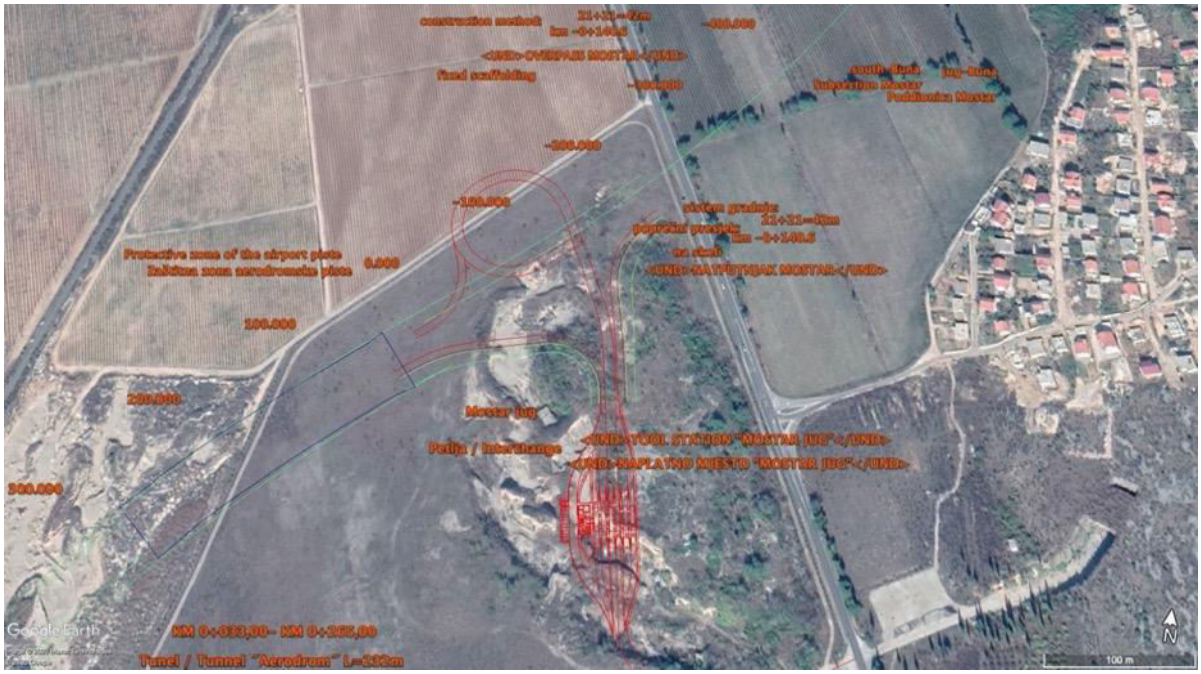


Figure 5: Location of Mostar South Interchange including toll station, Tunnel "Aerodrom" and Overpass Mostar

2.4.2 Toll station "Mostar jug"

The toll station is located on the leg 1 of the Mostar South Interchange. The location of the interchange was conditioned by the location of the main road, terrain conditions and most importantly the proximity of the airport. All these constrains contributed to placing the toll station in the only possible area that has enough space for the component. Due to the proximity of the airport, the toll station is cut into ground (the same as the intersection). The plateau is approx. 175 m long and approx. 55 m wide. The calculated number of toll booths is 3 + 3 + 1 for oversized cargo. The toll ramp has five raised islands, total length of 30 m and width of 2.0 m. Part of the road from the beginning to the end of the island is provided by a concrete structure, while

[8]The description of all project components is taken form the Preliminary design for the road section Mostar South-Buna prepared by IPSA Institute Sarajevo in 2018.

the rest is asphalt. The width of the passages is 3.50 m while the lane for oversized passage is 6.0 m. After the exit from the plateau, the road in two directions is connected to the main road by a left curve. In this part, the reconstruction of the intersection into a rotor is planned.

The toll station will have external and internal drainage system. The external drainage foresees installation of the collection channels that will collect surface run-off from the surrounding slopes and discharge it into environment. The internal drainage of the plateau is designed as a closed system where surface waters from the plateau will be collected through drains and treated in SBR rectors before the discharge.

2.4.3 Tunnel "Aerodrom"

Tunnel „Aerodrom" is located from chainage km 0+033,00 to km 0+265,00, having total length of 232m. The tunnel will be constructed using "cut and cover" method. The overall inclination of tunnel's slope is 1,25%.

The tunnel's cross section is designed as opened two-cell reinforced concrete structure that meets all criteria for traffic and clearance profile. From interchange "Mostar South" route goes directly into tunnel, so the interchange exit lane must be provided through the entire tunnel length. Dimensions of traffic and clearance profile are:

Traffic/overtaking lane – 3,75 m
Exit lane – 3,5 m
Edge lane – 0,35 m
Central reverse – 3,0 m
Revision lane – min 0,85 m
Traffic clearance height 4,0 m, clearance profile height 4,7m.

To meet all criteria that are determined by traffic profile, clear span of construction is 14.0 m (90 cm thickness concrete). On the edges, the slab is supported with impervious reinforced concrete walls C35/45, 100 cm thick. Tunnel slab has the same inclination as the pavement, which additionally improves drainage and prevents water retention on the slab. The slab is supported with beam in the middle and pillars (dimensions 90x90 cm and 3,9 m high). The spacing between pillars is 5.0 m, except for the last span where spacing is 3.9 m to avoid large stress concentration. In central reverse, below the pillars, is the wall of 1.8 m above foundation strip, that provides additional safety in case of emergency situations, such as vehicle impact or similar. Revision lanes are planned on both sides of pavement in case of emergency and for maintenance purpose. Installation channels for required tunnel equipment are located below revision lanes. Two electrical niches for lightning control equipment are provided in tunnel and located in the halfway. Tunnel portals are covered with broken stone in cement mortar, with inclination of 1:1.

2.4.4 Overpass "Mostar"

Overpass "Mostar" takes one leg of the Mostar South interchange over the motorway at the chainage km -0+146.6. The structure is designed as sloped integrated construction made of reinforced concrete, suspended over the two spans of total length of 21+21=42m.

Abutments are designed as reinforced concrete wall with variable thickness and 10.4m in width. The abutment is 0.9m thick at the junction with the superstructure, while the thickness at the junction with the foundation is 0.5m. The foundation of abutment is provided on centric footing with dimensions 4.5x10.32m. The middle pier is also founded on a centric footing with dimensions 4.0x6.4x1.0m. The pier wall has constant width of 3.4m and rounded edges. The thickness of the pier is constant at 0.80m. The pier is monolithically attached to the superstructure. The superstructure is designed as a 5.0m thick solid with vertical edges and symmetrical piers

2.46m parted. The slab thickness is 1.2m while the thickness of piers at the junction with the slab is 0.46m and at the end 0.25m. At the junction of superstructure with pier, in the length of 3m on both sides, the slab height increases linearly from 1.20m to 1.50m. In order for the overpass to better fit in the road body, the wing walls are provided with length of 4.3m and 3.2m and thickness of 0.46m. Backfilling of abutment walls should be done with permeable stone material, respecting all conditions given in the project. At the end of the structure, the transition slabs are provided.

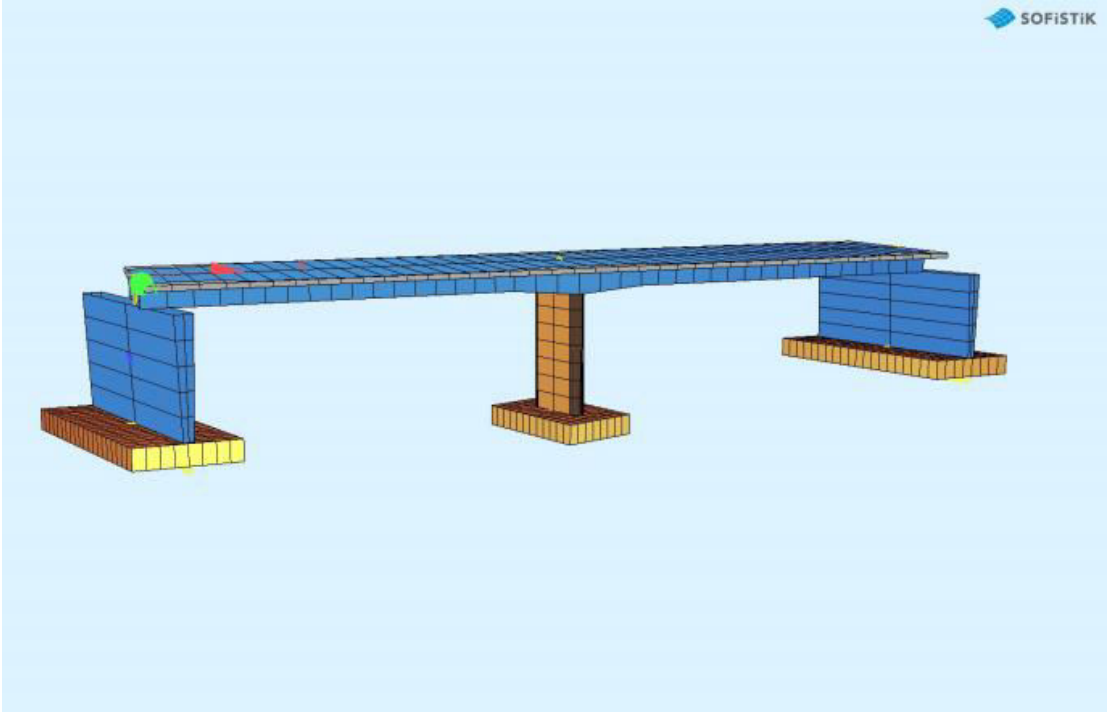


Figure 6: Design of Overpass Mostar

2.4.5 Overpass "Aerodrom"

Overpass "Aerodrom" is going over motorway Mostar South-Buna at chainage 14+197.12 and allows access to Mostar International Airport. The overpass structure is designed as asymmetric, prestressed, semi-integred construction with two spans. The structure is adapted to an asymmetric cut in a way that on the lower, right side of cut, it rests on abutment through the bearing and with the main span of 28,5m climbs above the motorway to the left side of the cut, where it rests on the inclined pier. The angle between pier and cut is 77 degree. The superstructure extends further to the top of the left side of the cut with shorter span of 11,19m. The left part of the superstructure and pier are connected with the common inclined massive foundation.

The superstructure is designed as a solid slab with variable height of 1.0 – 2.59m and width 6.20m, with both side overhangs of 1.85m length and thickness at restraint 0.35m and in the end 0.22m. The design includes 155cm pedestrian paths on both sides, separated from the carriageway with 18cm high curb. Ends of structure are designed in the way that there is no need for wing walls. Backfilling of abutment walls should be done with permeable stone material, respecting all conditions given in the project. The transition beams are provided on the end of structure.

Figure 7: *Location of Overpass Aerodrom*

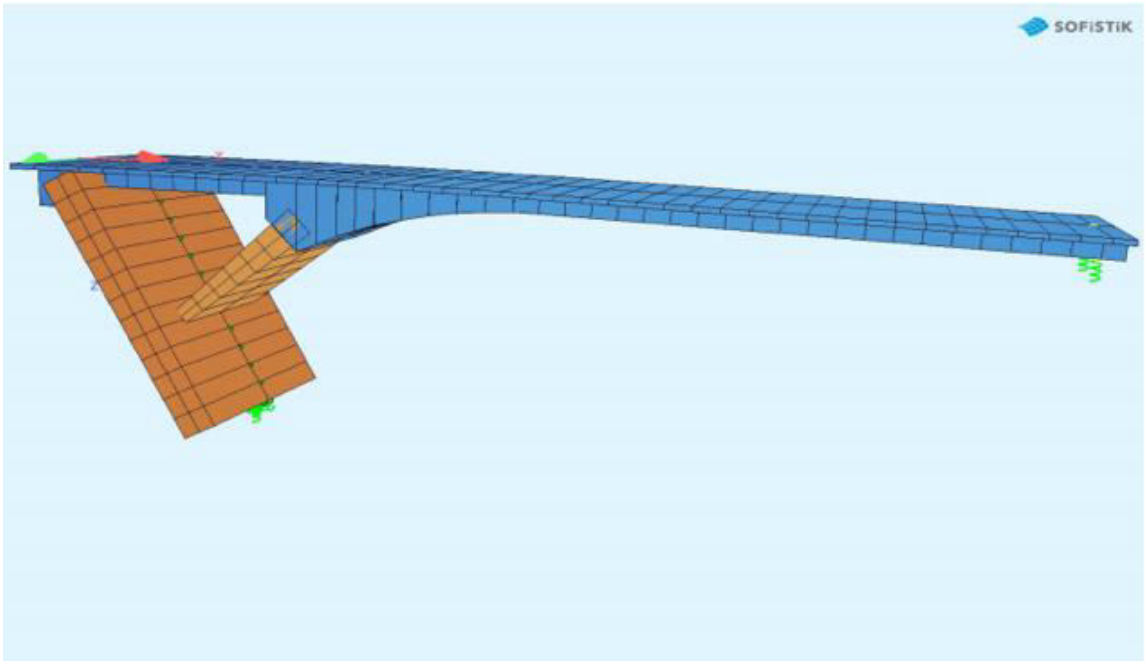


Figure 8: *Design of Overpass Aerodrom*

2.4.6 Underpass “Kosor”

Underpass “Kosor” is going through road structure of motorway Mostar South-Buna at change 6+179.82 and allows communication between neighbouring settlements. It consists of a compound structure for both carriageways. In order to satisfy traffic requirements, the underpass is designed as reinforced concrete,

integrated frame construction of span 11.8m, which is to be built in 5 segments which are basically follow the horizontal curve of local road. The underpass is founded on foundation strips of thickness 90cm. Further, the walls are relying on these strips, and they are firmly fixed at the top to a slab with varying thickness d=80-85cm. In longitudinal direction, the wall does not end with wing walls, but in slope of 4 degrees, which fully fits into the supporting structure of reinforced soil. Also, at the slab ends, there are parapets that fit into profile before and after the underpass, that ensures the unhindered setting of the edge beam, which is also the part of the supporting construction.

Figure 9: Location of Underpass Kosor

2.4.7 Bridge “Buna”

Bridge Buna (L=326m) crosses over the Buna Stream and the local road. The left bridge starts at chainage 6+262.957 and ends at chainage 6+588.957 respective to the left carriageway, while the right bridge starts at chainage 6+277.013 and ends at the chainage 6+603.013 respective to the right carriageway.

Both bridges are designed as continuous prestressed concrete structure with spans. The superstructure is designed as 1.4m high solid slab with pronounced overhangs separated at 2.6m distance. Lateral sides of slab are inclined. Total width of cross section for one bridge is 0.46+11.5+0.46=12.42m.

Piers are designed as 1.2x4.2m walls with rounded edges. Vertical flutings on piers break down the monotony of concrete surface and contributes to the aesthetic value of the solution. Piers S2, S3, S4 and S5 are monolithically connected with superstructure, while the connection with the other piers and abutments is achieved through the bearings. A pier foundation on piles is decided based on the Study on engineering geological, hydrological and geomechanical characteristics of the terrain. The piles will be erected in the riverbed.

Figure 10: *Location of Bridge Buna*

The abutments will be constructed on the riverbanks without entering the riverbed. The abutments are designed as 1.1x1.75m massive blocks with inspection walkways. The embankment of the motorway before and after the bridge was retained by the support structure of reinforced soil, so the same is foreseen for the abutments but leaving the walkway for the inspection of the bearings. The abutment body is actually the head beam for piles. Finishing the embankment in a form of cone around the abutment is enabled by wing walls of length 4.7m and thickness 0.46m. Considering the height of embankment, the two transition slabs are provided on each abutment no make the transition from bridge to the road smooth.

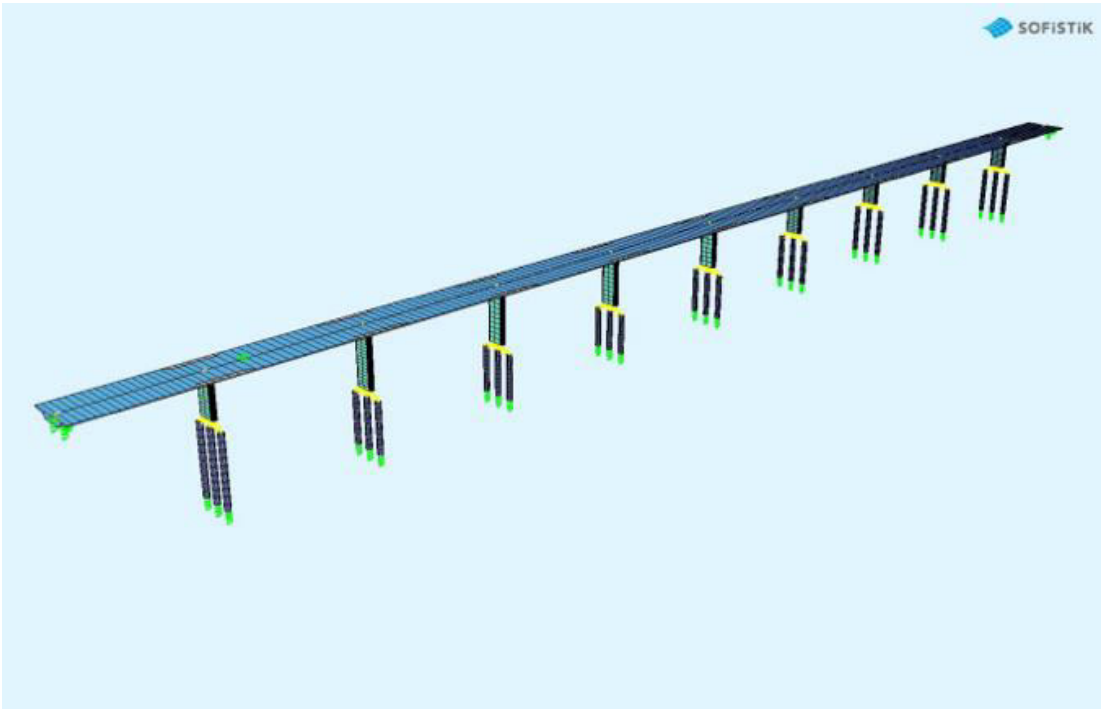


Figure 11: *Design of Bridge Buna*

2.4.8 Bridge “Bunica”

Bridge Bunica (L=211m) crosses over the Bunica stream and the local road. The left bridge starts at chainage 7+422.02 and ends at the chainage 7+633.02 respective to the central axis of the motorway, while the right bridge starts at chainage 7+436.00 and ends at the chainage 7+647.00 respective to right carriageway of the motorway.

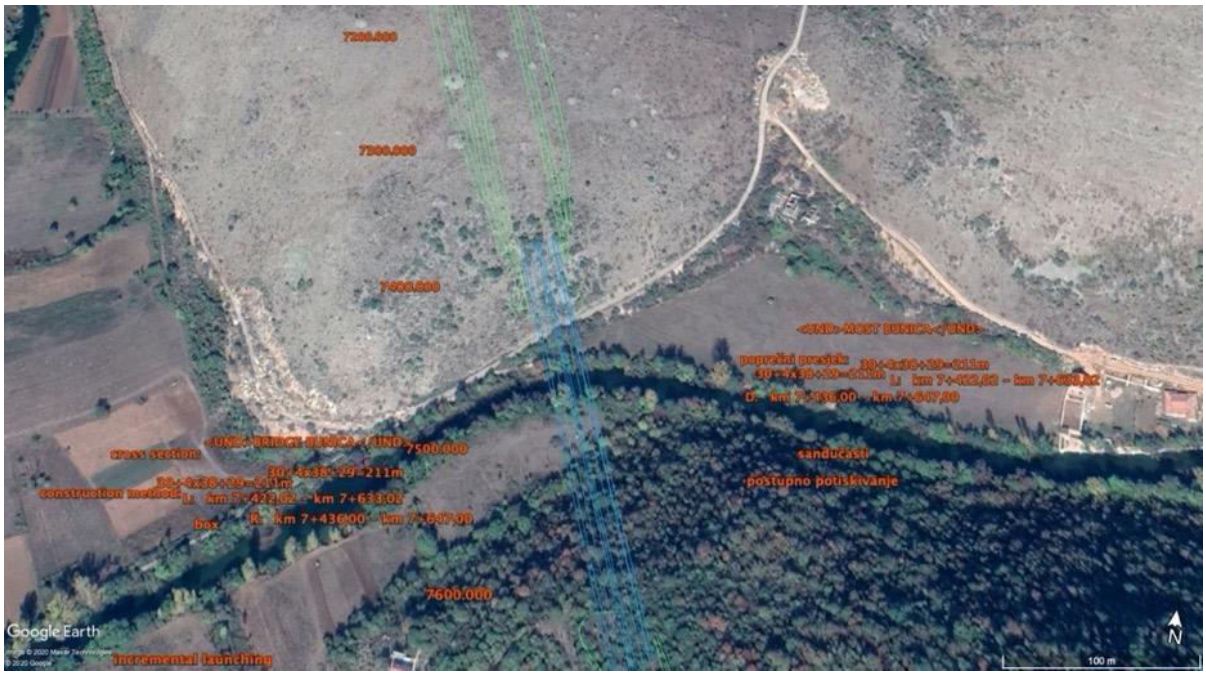


Figure 12: Location of Bridge Bunica

Geometric elements of the route, as well as the character of the obstacle, can be considered very favourable from the aspect of designing bridges and viaducts. The intersection angle between axis of motorway and local road is 75 degree for both bridges, and Bunica stream is flowing under the bridge in rather irregular pattern. The spans, or arrangement of piers have been selected in a way to avoid foundation in the water, as well to ensure a undisturbed passage of local road.

Both bridges are designed as continuous prestressed concrete structure with spans 30+4×38+29=211m. The superstructure has a 3.0m high box-like cross-section. Lateral sides of box are inclined, so the width is 5.0m at the bottom and 6.3m at the connection to cantilevers. The cantilevers have length of 3.06m and thickness of 0.55m at restraint and 0.25m at the end. Total width of cross section for one bridge is 0.46+11.5+0.46=12.42m.

A pier foundation on piles for piers S2 and S3 is decided based on the Study on engineering geological, hydrological and geomechanical characteristics of the terrain. The piles will be erected in the riverbed. The remaining piers are founded on foundation slabs located on the riverbanks. The piers have I-shaped cross section with powerful flanges and relatively thin rib that connects them. The thickness of the rib is 0.5m, while the flanges have dimension 2.2x1.4m. All piers have the same cross section and head beams. Total width of a pier is 5,4m.

The design of abutments is in direct relation with chosen direction of thrus. This primarily relates to the foundations, meaning a wider footing for the abutments from which the launching is carried out. For better abutment fitting into the road structure, 4.0m long and 0.46m thick wing walls are provided. Each abutment

has the inspection walkway and appropriate entrance doors. After concreting and prestressing the superstructure, the 30cm thick front walls will be constructed to close the front part of an abutment. Backfilling of abutment walls will be done with stone material.

Considering the embankment height of 6m, one transition slab is provided for each abutment. The bearing will be placed on all abutments and piers. Bearings on piers S2, S3 and S4 are designed as stationary bearings while the remaining ones are movable.

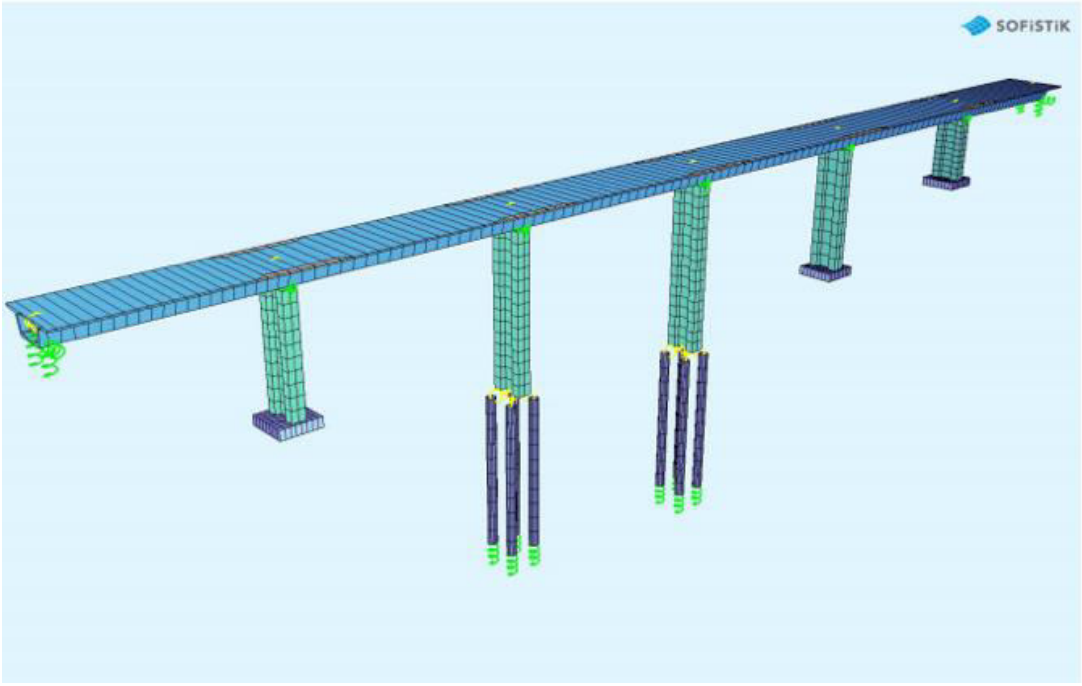


Figure 13: Design of Bridge Bunica

2.4.9 Viaduct "Brijeg"

Viaduct Brijeg (L=258m) crosses over the dry valley. The left bridge starts at the chainage 8+177.00 and ends at chainage 8+435.00 respective to the left axis of the motorway, while the right bridge starts at chainage 8+193.00 and ends at 8+451.00 respective to the right axis of the motorway. Geometric elements of the route can be considered unfavourable; however, it is a dry valley which is considered to be favourable from the aspect of designing bridges and viaducts.

Both bridges are designed as continuous prestressed concrete structure with spans 27+6×34+27=258m. The superstructure is designed as 1.4m high solid slab with overhangs spaced every 2.6 m. Lateral sides of slab are inclined, so its width is 4.9 at the bottom of the section and 6.3m at the connection with the cantilevers. Thickness of cantilevers at the intersection with the superstructure is 55cm, on free ends 25 cm. Total width of cross section for one bridge is 0.46+11.5+0.46=12.42m.

Piers are designed as 1.2x4.2m walls with rounded edges. Vertical flutings on piers break down the monotony of concrete surface and contributes to the aesthetic value of the solution. Piers S2, S3 and S4 are monolithically connected to superstructure, while the connection with the other piers and abutments is established using bearings. A pier foundation on piles is decided based on the Study on engineering geological, hydrological and geomechanical characteristics of the terrain. All piers will be founded on 6.0x8.0m slabs.

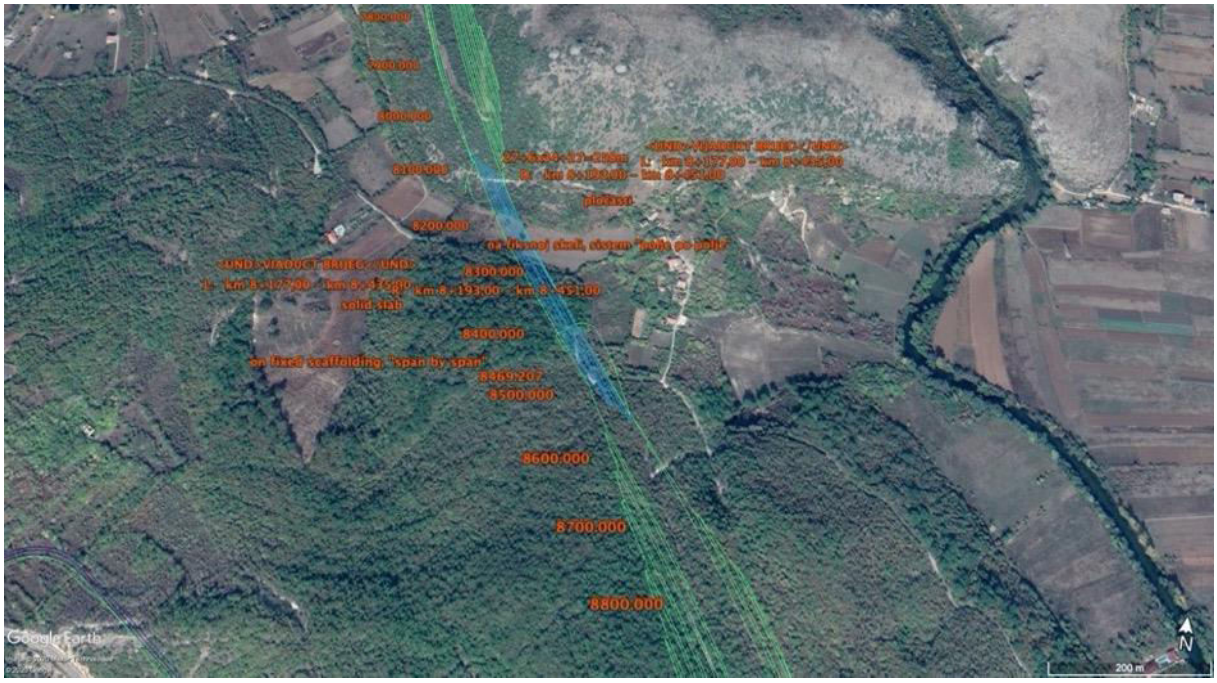


Figure 14: Location of Viaduct Brijeg

The abutment U1L is designed as a thin massive block, while other abutments consist of the foundation slab and the massive wall. The motorway embankment passes below the abutment body. The embankments will enable access to the bearings. For better abutment fitting into the road structure, 3.7m and 5.1m long and 0.46m thick wing walls are provided. The backfilling of abutment walls will be done with stone materials. Considering the height of embankment, one to two transition slabs are provided on each abutment no make the transition from bridge to the road smooth.

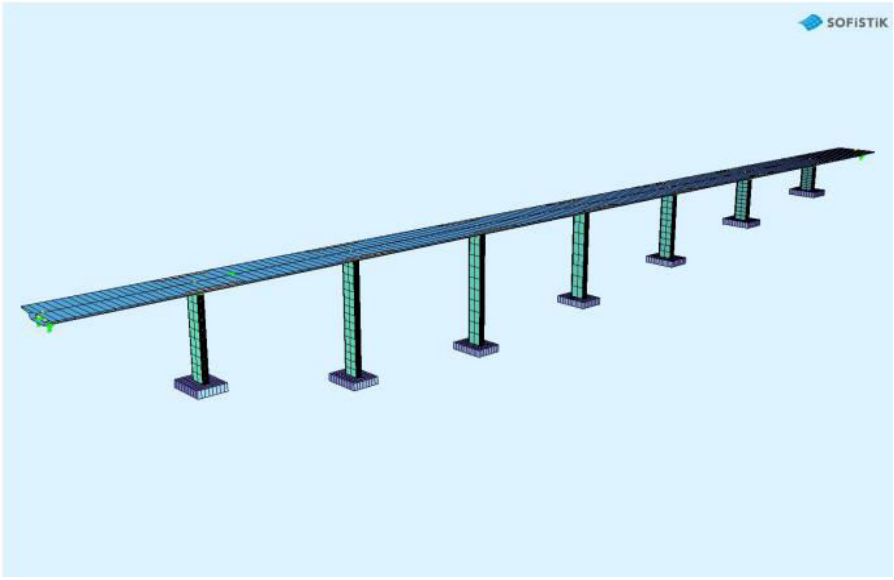


Figure 15: Design of Viaduct Brijeg

2.4.10 Surface water drainage and treatment system

Drainage of surface water from the location of the highway route and the plateau of CP Mostar South is planned as external and internal drainage.

External drainage implies the collection of rainwater through peripheral canals in order to prevent it from reaching the body of the motorway. The system is designed to accept the 100 year waters. Surface runoff without a specific concentration of flow, which is formed at an angle to the route and has a direction towards the route, is captured either by drainage or through canals along the route as cuts or embankments in cases of pronounced surface flow. Perimeter canals are designed at those locations of the route where, according to the nature of the terrain configuration, increased flows and possible instability of the slope are expected.

In cuts, the primary protection against external waters is performed by circumferential ditches of dimensions 30/30, 50/50 or 130/100, depending on the calculated quantities of water. In the berms of the notch, a segmental channel 80 cm wide is laid, in a slope equal to the longitudinal slope of the road, to protect the motorway from water from the slope. At the transition from the notch to the embankment, the canal descends to a ditch that begins at the foot of the embankment and further to a culvert or some occasional watercourse.

In the parts where the motorway route is in the embankment, trapezoidal ditches of dimensions 30/30 and 50/50 are designed, with a slope of 1: 1. The dimensions of the ditches are aligned with the hydraulic calculation. The ditches are intended to be constructed in such a way that reinforcement is placed on the excavated stone material, and then concrete is poured on the installed formwork. The detail of the segmental ditch is shown in Figure 16.

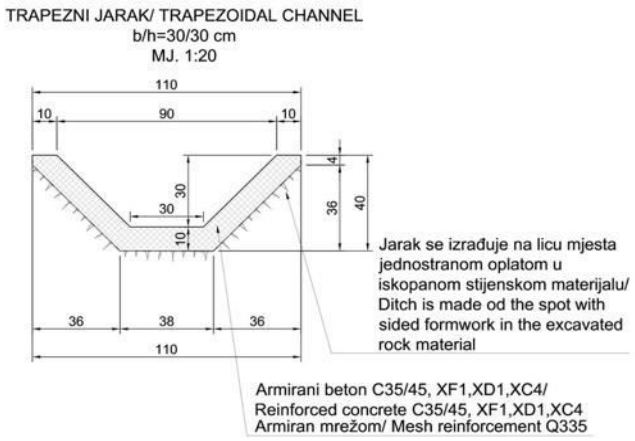


Figure 16: Segmental ditch

External drainage at the location of the tool station foresees construction of a canal surrounding the plateau (Figure 17).

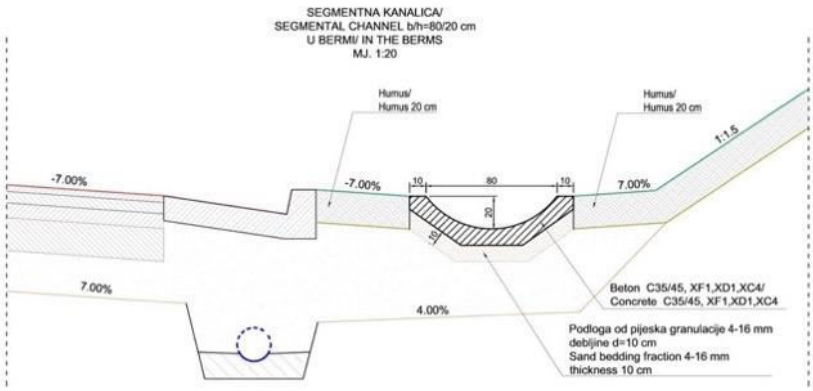


Figure 17: Segmental canal

The treatment of surface run-off is not foreseen because these waters are considered not to be contaminated and can be discharged into closest recipient (surface water) depending on the location along the motorway section and configuration of the terrain.

Run-off from asphalt surfaces, depending on the section slope, will be collected by internal drainage system i.e. drains located in the 50-75 cm wide gutters. The adopted slope of the gutter is 15%. From there, surface water enters the pipeline system and is taken to the nearest oil and grease separator for treatment. After the treatment, the wastewater is discharged to the nearest recipient (surface water).

The asphalt surface run-off will be treated in oil and grease separators with full equipment in accordance with the standard BAS EN 858-1 i BAS EN 858-2 (concentration of oily matter in treated <10mg/l). The ration of wastewater inflow is 100 %. The plant has coalescent cartridge (changeable filter), automatic valve and a sampling point. A manhole is foreseen for monitoring of treated wastewater quality. The effluent quality must be in line with the Regulation on conditions for wastewater discharge in environment and public sewage system[9].

One oil and grease separator of 150l/s capacity is foreseen on the location of the tool station while eight separators are foreseen along the route as follows:

- Network 1 (route) collection tank 50m^3, separator AC 20l
- Network 2 (route and underpass „Mostar jug“) collection tank 75m^3, separator AC 60l
- Network 3 (route) collection tank 50m^3, separator AC 40l
- Network 4 (route) collection tank 50m^3, separator AC 30l
- Network 5 (route) collection tank 75m^3, separator AC 50l
- Network 6 (route and Bridge Buna) collection tank 75m^3, separator AC 50l
- Network 7 (route and Bridge Bunica) collection tank 50m^3, separator AC 40l
- Network 8 (route and Viaduct Brijeg) collection tank 50m^3, separator AC 30l

Figure 18 gives an overview of the planned oil and grease separators o the location of Network 4 and 5 while Figure 19 shows the cross section of an oil and grease separator on Network 5.

[9]Official Gazette FBiH, no. 26/20

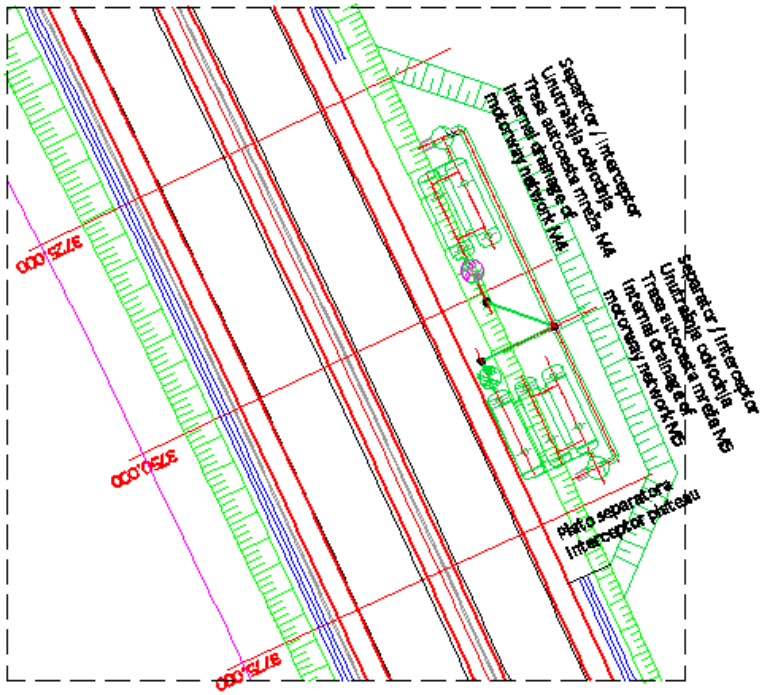


Figure 18: Oil and grease separators on Network 4 and 5

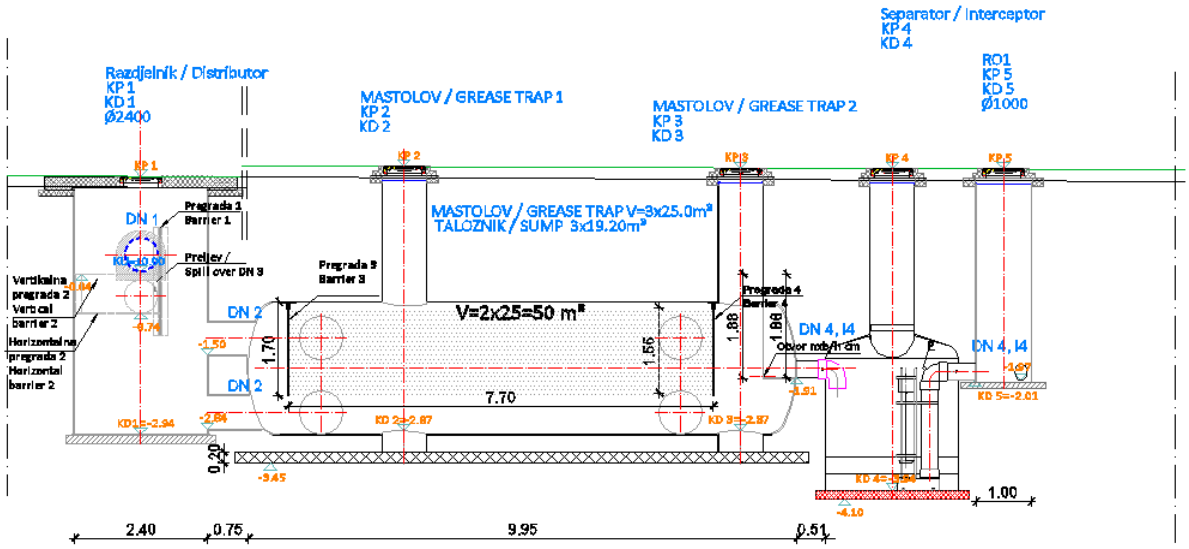


Figure 19: Cross section of oil and grease separator on Network 5

2.5 Associated facilities

2.5.1 Local roads

Near the Mostar airport, the route alignment is surrounded by the airport, main road M17 and the railway. The access to Mostar airport will be cut with the new motorway alignment. Therefore, this access road is redesigned to respond to new spatial arrangements. The route of the new road blends into the existing state and then with the right curve cuts the motorways vertically at the location of Overpass Aerodrom. The road is

laid down vertically on the main road M17. Total length of reconstructed road is 283.60 m, applied horizontal radius R=35 m and design speed Vr=30 km/h.

Figure 20: Access road to Mostar Airport

Close to the airport and south of Kosor, the route is cutting road access to many land parcels. In order to enable access to those parcels, JPAC s decided to construct a two-way local road, on the right side of the motorway. The local road will be aligned with the motorway route, starting from the chainage km 2+100.00 until km 5+900.00. Total length of this road is 3.90 km. At the beginning of the route, this local road is connected to the existing road via the legged intersection.

Another smaller parallel local road will be constructed in order to enable connection from Blagaj (Kosor) to main road M17. This connection is cut in the motorway. In In order to be able to design the passage, road is moved along the motorway in length of 354m. The new road is connected to road Blagaj - Mostar with the T intersection.

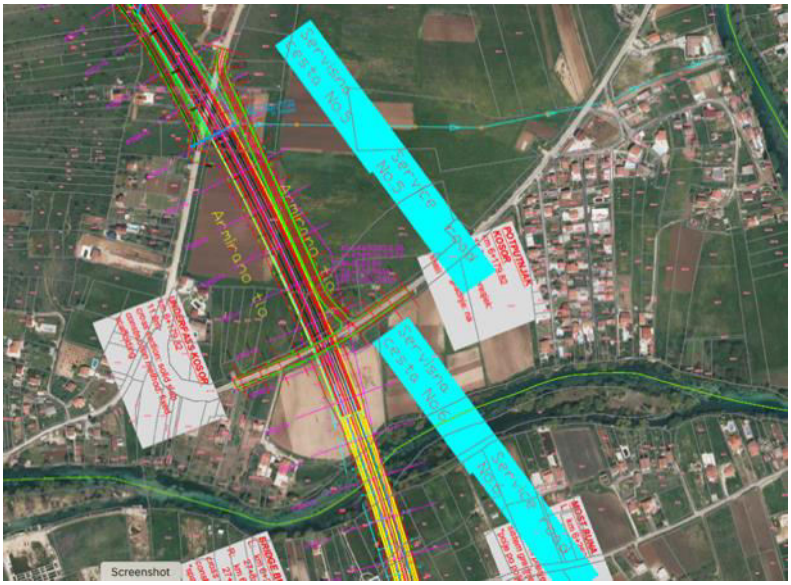


Figure 21: Junction of local roads near Overpass Kosor

At the location of Overpass Kosor local road that passes under the Overpass is also going to be reconstructed to enable connection of settlement Kosor with Mostar via main road M17. The total length of the underpass road is 233.25m. The reconstructed route is aligned with the existing road and will have characteristics of a main road due to the lines' width and its overall importance. The maximum allowed speed is 50 km/hr.

2.5.2 Local infrastructure

The local communities of Malo Polje and Kosor[10] requested from JPAC construction of the local infrastructure as a compensation for the motorway passage. The list of their requests is given in the table below. In order to satisfy the width requirements for local roads, there might be a need to enter private plots on 4 short sections. However, the local community representatives in the letter explained that they will negotiate with the owners to give the land free of charge in compensation for construction of a support wall that will benefit these owners (willing buyer/willing seller). According to the information obtained from JPAC, all their requests will be accommodated except for the reconstruction of bridge Lehina cuprija which is a historical monument and must be reconstructed under special conditions.

Table 6 Requests of local communities for local infrastructure

Local Community	*Infrastructure requested*
Kosor	Road no 6. from entrance to Blagaj to the turn for under Petak L=2730: ▪ Water supply pipe all the way along the route ▪ Surface run-off collection system ▪ Asphalting the road (L = 2730m, W = 6m) ▪ Construction of curb side and pedestrian lane from one side (L = 2730m, W = 1.5m) ▪ Lightning
	Road no. 7 L=1734 ▪ Asphalting L=1734 W= 3.5 m ▪ Construction of road verge
	Road no. 8 L=435 ▪ Asphalting L=435 W= 3.5 m ▪ Construction of road verge
Malo polje	Road no 10. from the main church to the Roman bridge L=3540 ▪ Water supply pipe all the way along the route ▪ Surface run-off collection system ▪ Asphalting the road (L = 3540, W = 6m with curb sides) ▪ Construction of curb side and pedestrian lane from one side (L = 2730m, W = 1.5m) ▪ Lightning ▪ Reconstruction of bridge Lehina cuprija ▪ Supporting wall L=40 Lehin vir and road verge ▪ Surface run-off drainage system in Viricak, Orah, Hadajlovina, Rimski most
	Road no.13 L=180 ▪ Asphalting the road until the mosque ▪ Flood protection on Buna stream, from Harem to Lukovac L=200 m
	Road no. 12 Lukovac-Kaporova luka- Bocine- Podgorica L=2430 ▪ Preparation and earth work ▪ Asphalting L=2430 W= 3.5 m ▪ Construction of road verge

[10] Request from local communities Kosor and Malo Polje, Municipality of Mostar, prepared on 03.05.2019 and received by JPAC 07.05.2019. Request field under number 05-1807/19.

Local Community	*Infrastructure requested*
	Road no. 12 Bukvica-Pecine-Malo polje. Brutak L=4950 ▪ Preparation and earth work ▪ Asphalting L=4950 W= 3.5 m ▪ Construction of road verge
	Road no. 9 ▪ Construction of new bridge for two-way traffic over Buna stream parallel to the motorway Buna Bridge with connection to local road Malo polje (road no. 10) and local road Kosor (road no. 7)

2.5.3 Disposal site Rotimlja

The Rotimlja Landfill will serve as a location for disposal of excess soil material generated during the construction of the motorway section from Mostar South to Buna (Stanojevici) including two sub-sections, Mostar South – Tunnel Kvanj and Tunnel Kvanj-Buna. The Preliminary Design defines the location of the landfill, surface and capacity. Figure 22 shows the location of Rotimlja Landfill in respect to the locations of the section Mostar South-Buna (Stanojevici) and sub-section Mostar South-Tunnel Kvanj. The distance between Rotimlja construction waste landfill and interchange Mostar South is approximately 12 km.

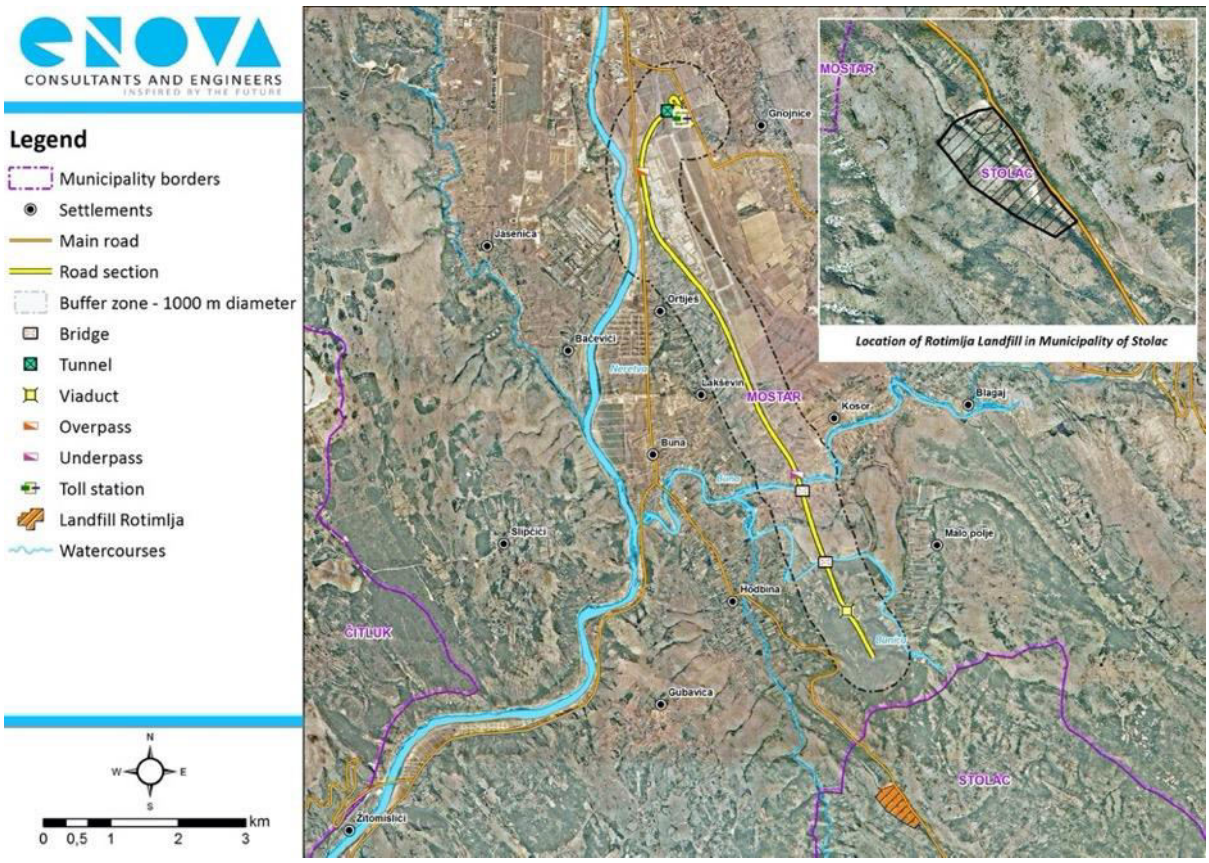


Figure 22: Location of Rotimlja Landfill

The total surface of the newly designed landfill for construction waste is 181,573 m^2, capacity 2,450,257 m^3. Layout map of the newly designed landfill is showed in Figure 23. The capacity of Rotimlja landfill will be used

approx. 82%. The landfill can receive total quantity of 429,516.45 m^3 of construction waste which is enough to serve the whole section from Mostar South to Buna.

The run-off collection ditches are designed around the landfill perimeter to collect storm water from the slopes and the water draining from the landfill body. Collected waste will be channeled to the closest recipient, the stream Rika.

After the motorway construction finish, the landfills will be levelled and capped. Surfaces of landfill capping plateaus are designed horizontally. Slope between two layers is 1:2 to prevent sliding of material and ensure stability of the slope.

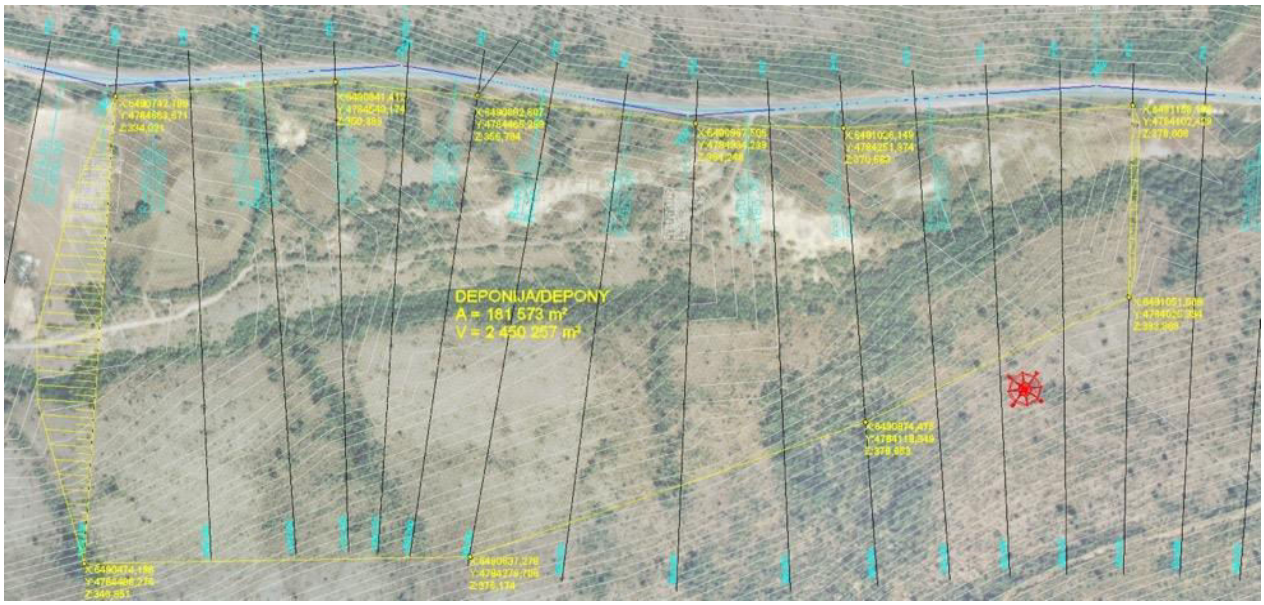


Figure 23: Overview of Rotimlja Landfill

2.5.4 Borrow pits

The information about borrow pits is not available in the Preliminary design. The bill of quantities specifies that the material will be transported to the site "from other locations" in the following amounts:

Material transported from other locations	
Purchase and transport of sand and gravel – embankment	198.762.64 m^3
Other sand and gravel	244,000 m^3
Bitumen	578,104.80 m^2

Suitable locations of borrow pits are defined in the spatial planning documentation at the municipal level[11]. In the phase of main design development for a specific sub-section of the Corridor Vc, the designer is proposing a suitable location based on the municipal spatial planning documentation. The final decision about the borrow pit location is made by the Contractor. The Contractor is obliged to select one of the locations proposed in the Main design. However, in practice, the Contractors are usually sub-contracting a licenced material provider (stone gravel, soil, etc.) who sell and transport necessary material to the construction site.

[11] As defined in the Spatial plan for an area of special interest for FBiH „Motorway on corridor Vc" for period 2008-2028

2.6 Construction activities

The most significant works that are planned to be carried out during the construction of the subway section of the Mostar South - Kvanj tunnel are:

- preparatory works - clearing the terrain (removal of bushes, felling and removal of trees, demolition and removal of prefabricated and other buildings)
- earthworks and foundations - excavations (surface layers of humus with loading, excavations of soil material for foundations, canal trenches, culverts, manholes and drainages), embankments
- placement of sub-base aggregate
- protective layers with bituminous mask
- asphalting
- installation of concrete fences
- making of longitudinal and transverse drainage.

Bearing in mind that in addition to the construction of the motorway route, the project also envisages the building of ancillary facilities that require specific construction works, Table 7 gives an overview of the planned works depending on the type of facility in question.

Table 7: Type and approach to execution of works during the construction of the sub-section loop Mostar south-tunnel Kvanj

R. no.	*Structure*	*Description of planned works*
1.	Motorway route	▪ Preparatory works - Removal of shrubs and trees with trees, stumps and branches from sparsely overgrown areas by machines in the zone of the expropriation line ▪ Execution of earthworks - excavation and embankment works that are performed manually and with machines depending on the depth of excavation / embankment for the purpose of arranging the foundation soil plan, construction of stairs, foundations, canals, ditches, culverts, manholes, etc. ▪ Construction of pavement structure - Making of unbound bearing layer, upper bearing layer of bituminized crushed stone of granulation 0 / 22s with road bituminous binder, wearing and protective layer of fines with bituminous mastic SMA 11s from crushed fractions from silicate rocks 4mB and debris cement concrete ▪ Execution of works on water drainage – making of longitudinal and transverse drainage of cement concrete with adequate filling with delivered bulk materials
2.	Buna and Bunica bridges Brijeg Viaduct	▪ Preparatory works - Removal of bushes and green areas by machines, staking out the location, construction of all temporary structures required for the construction of the bridge ▪ Execution of earthworks - excavation works by machines for the foundations of the planned pillars, installation of hard rock embankments between the abutment wings, soil reinforcement, on parts next to abutments, is done using uniaxial HDPE (High-density polyethylene) geogrids, which are clamped between segmental concrete blocks ▪ Concrete works - installation of drilled piles of reinforced cement concrete, installation of reinforced cement concrete C30 / 37 in abutments, abutment wings and middle pillars, installation of reinforced cement concrete C40 / 50 in span structure of solid slab type, installation of reinforced cement concrete C25 / 30 in piles , head beams and transition plates ▪ Reinforcement works - installation of ribbed bars made of high-quality steel BSt 500 S and installation of ropes made of smooth steel wires of round cross-section, high tensile strength in the span structure
3.	Toll collection facility "Mostar"	▪ Execution of earthworks - Excavation for footing in material of III. and IV. category depth up to 1.0 m^1, backfilling of material around the footing, spreading and compaction of a

R. no.	*Structure*	*Description of planned works*
		buffer layer of gravel under the floor of the structure ▪ Concrete works - Concreting of base concrete 10 cm thick below the footing, with concrete MB 20 (C16 / 20), concreting of AB footing with concrete C25 / 30, concreting of AB foundation beams with concrete C25 / 30 - MB 30 partially in formwork, concreting of AB slab thickness d = 15cm, on the ground with concrete C25 / 30 - MB 30, concreting of AB ceiling slab d = 18cm, with concrete C25 / 30 - MB 30 in formwork, concreting of AB columns S1o dimension 25/30, with concrete C25 / 30 - MB 30, in smooth formwork, production of ceiling AB horizontal beams, production of cement lightly reinforced ▪ Screed 4.7 cm thick ▪ Masonry works - Masonry of facade (external) walls made of modular brick blocks, Mechanical plastering of brick walls with extension mortar 2: 6: 9, in two layers ▪ Waterproofing and thermal insulation works ▪ Sheet metal work and, ▪ Installation works ▪ Ceramic, facade and roofing works
4.	Mostar Airport Tunnel	▪ Execution of earthworks - mechanical excavation of a wide excavation of materials for making incisions for a covered tunnel, mechanical excavation of soil for foundations and drainage pipes ▪ Execution of concrete works - installation of reinforced cement concrete C30 / 37 in foundation strips, installation of reinforced cement concrete C35 / 45 in the walls, wing walls and pillars of the tunnel, the installation of reinforced cement concrete C35 / 45 into the tunnel slab. ▪ Reinforcement works - installation of ribbed bars made of high quality BSt 500 S steel, installation of ropes made of smooth steel wires of round cross-section, high tensile strength in the tunnel plate ▪ Construction of pavement construction - installation of stone material 0/63 as a base for pavement construction, production of mechanically stabilized tampon at least 20 cm thick, production of cement stabilization 20 cm thick, production of upper bearing layers of bituminized material BNS 22s, production of wearing layer (bituminous concrete SBM 11s + PmB), installation of prefabricated curb made of concrete C35 / 45, installation of prefabricated slabs for inspection tracks made of concrete C35 / 45. ▪ Execution of works on adequate tunnel drainage

2.7 Project area of influence

The **project footprint** area refers to land take determined by the expropriation line and covers the area of 55.32 ha. This area will be permanently and irreversibly changed and is therefore assessed as the area with significant direct impacts (purple line on Figure 24). The Construction Landfill Rotimlja will directly affect additional 18.15 ha, therefore the total project footprint that will cause permanent and irreversible change in the physical space is 73.47 ha.

The **project area of influence** has been determined as part of this assignment as the surrounding buffer zone of the motorway route in which most of the impacts are expected, including both environmental and social impacts. The area of influence has been set preliminary to include the buffer of 500 m at each side of the road route, resulting in the total of 1071.32 ha that may be indirectly affected during construction and/or operation phase of the project and that has been re-assessed during baseline surveys (red line in Figure 24).

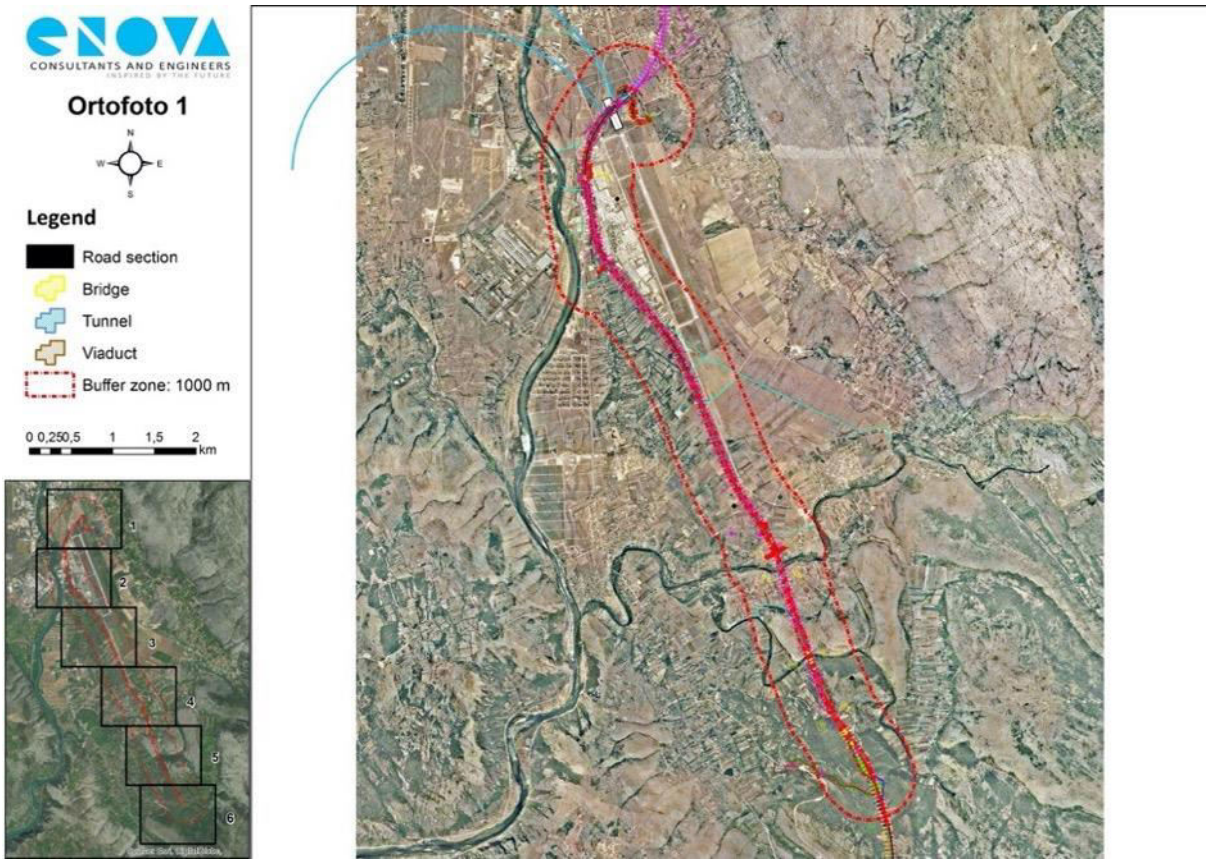


Figure 24: Project footprint (purple line) and project areas of influence (red line)

The project area of influence of 1,000 m in diameter is confirmed to be sufficient to appropriately assess majority of impacts. The exceptions to this are the two types of biodiversity related impacts for which **ecologically appropriate area of analysis** is determined:

- bird colonies of sand martin (Riparia riparia) and bee-eater (Merops apiaster) which are located 750-800m west from the motorway alignment. Since these species are feed by flying low and catching insects just above the ground and there is a risk from collision with vehicles, the ecologically appropriate area of analysis is extended to these areas to appropriately assess the impact.
- aquatic habitats where the pollution caused by accidental spillages of hazardous substances on the motorway can extend further downstream of Buna and Bunica watercourses and even reach the Neretva River thus having extended have negative impact on water quality and aquatic flora and fauna (fish and aquatic invertebrates).

3 ANALYSIS OF ALTERNATIVES

3.1 No-project alternative

A "no project" alternative is not a viable option at the moment because the setup of Corridor Vc is crucial to launch a large number of economic activities and enables BiH to be included in the main traffic flows (the extension of the TEN-T Network to the Western Balkans) and the global European economic system. Improving transport conditions will improve the quality of life, which will be manifested through:

- reduction of the road length and travel time of goods and passengers in relation to existing sections
- reduction of costs of transporting goods and passengers
- reduction of harmful effects on the environment, by directing part of the traffic from the existing relevant network to the future route of the motorway
- increased employment
- valorization of the geo-traffic position of BiH
- increasing the competitiveness of the economy in the area oriented towards the corridor
- launching new projects and increasing private investment in the regional economy.

3.2 Alternative routes

During 2006, the initial analyses of the motorway route in the project area were made as a part of the development of the project planning documentation for LOT 4 of the motorway on Corridor Vc for the period from 2005 to 2006. The aim was to determine the optimal route of the Motorway on Corridor Vc through BiH, and/or the economic justification of the construction of certain sections on Corridor Vc. A total of 12 potential options (Corridors 5c and 4) of the future motorway were considered, for which a multicriteria analysis was performed and based on which one potential option passing through Mostarsko polje was selected. A Conceptual Design[12] and Environmental Impact Study[13] were prepared for this option. The motorway included the construction of two shorter tunnels (Gorica and Kicin) and one long tunnel (Kvanj 2.7 km), a bridge over the stream Buna (300 m), a longer viaduct in the area of Posrt (485 m) and the Kebe viaduct (120 m). The total length of the route on LOT 4 was 67,329 km. With the conceptual design, the route LOT 4 is presented by sub-sections (from 1 to 5), of which it is important to single out the route of sub-section 3 (Mostar South - Pocitelj). Sub-section 3 (Mostar South - Pocitelj) begins at the end of Sub-section 2 of LOT 4 (Mostar North - Mostar South), at km 26 + 250.00, and ends after the junction Pocitelj North at km 45 + 900.00. The total length of sub-section 3 is 19,650 m. The motoray stretches from the area of Posrt, crosses the valley of the streams Buna and Bunica (at the exit from the canyon), climbs towards Gorica, Kvanj and Hum, and exits to the plateau around D. Stanojevic. The route continues along this plateau towards Bivolje Brdo where it ends at the Pocitelj junction. Acting upon the Request, and based on the submitted Environmental Impact Study, the Federal Ministry of Environment and Tourism issued a Decision approving the Study for the section LOT 4: Mostar North - South Border, number: UPI / 03 / 02-23-4-53 / 05 on 19 September 2007. After the approval, the Investor initiated the procedures for the preparation of relevant project documentation.

[12] Conceptual Design of the route on LOT 4, IGH Zagreb, May 2005.
[13] Environmental Impact Study on Corridor Vc Mostar North – southern border LOT 4 (0+000,00 - 67+329,00), Institut građevinarstva Hrvatske Zagreb and institut građevinarstva Hrvatske Mostar, Zagreb, March 2007.

During 2010, the section marked "LOT 4" (Mostar North - Southern Border, l = 67,329 km) was divided into three LOTs: LOT 5 (Mostar North - Mostar South, l = 16 km), LOT 6 (Mostar South - Pocitelj, l = 20km) and LOT 7 (Pocitelj - Southern Border, l = 31.33km). In that year, projects for LOT 5 and 6 (Suhi Do - Mostar south - Buna - Stanojevici) were made in order to meet the conditions for land expropriation. The project documentation for the section Suhi Do - Mostar south - Buna - Stanojevici (LOT 5 and LOT 6) was developed in 2010. The deviation from the first project for LOT 4 is reflected in terms of shorthening the length for 6.41% which makes the route shorter by the length of 4,320 km compared to 67,329 km.

During 2011, an additional analysis was performed[14], including several options, all in order to avoid the passage of the motorway through Mostarsko polje. As part of these analyses, the possibilities of relocating the "Mostar South" junction to a new location were also investigated. After the analysis of several options, the option of the motorway passing through the hinterland of Blagaj proved to be optimal. The proposed alternative to the motorway passing through the hinterland of Blagaj was to moved it toward south, i.e. to the hill by approximately 3.5 km (maximum distance) as compared to the option passing through Mostarsko polje. The distance of the proposed route of the motorway from the spring of the stream Buna is 700 m, and from the stream Bunica 500 m. The new junction is located at an altitude of approx. 170 m. The route variant in the hinterland of Blagaj is approximately 3.0 km longer than the route through Mostarsko polje, but the passage of the motorway through the most fertile land of Mostarsko polje was avoided. As part of this option, the "Mostar South" junction has been designed at the new location. The junction is connected by an access road with the road M-6.1 Mostar - Nevesinje. The new junction "Mostar South", measured from the point where "North Boulevard" exits to M17, is 450 m further than the junction given in the option of the motorway passing through Mostarsko polje

During 2015, JPAC abandons the route on the end section pf LOT 5 and the initial section of LOT 6 and initiates the procedure of finding a new possible route in between Ostri rat - Mostar South - Buna – Stanojevici. The new proposed route passes very large spatial-relief restrictions, with unfavourable technical elements and has a large number of facilities (high investment costs, high costs of maintenance, management and operation). Preliminary design defined the modified route in the area of Suhi Do via the newly proposed Mostar South junction (connection to the M17 in the area of Mostar Airport), then via Buna to Stanojevici area where it joins the route of LOT 6 according to the main project. The total length of the route around Mostar is 26,627.18 m.

During 2016, and bearing in mind that the route of the Corridor Vc motorway on the section of LOT 4 in the period from the finalization of the Conceptual Design[15] and Environmental Impact Study[16] until 2016 has undergone various changes through the preparation of other project documentation (Preliminary and Main projects), and that other variants have appeared on the part of the Mostar North - Buna motorway route, the Investor has initiated the procedure of developing a multicriteria analyses (the two analyses in total) for the motorway section on Corridor Vc: Mostar North - Buna.

The first multicriteria analysis[17] for the motorway section on Corridor Vc: Mostar North-Buna considered a total of three variants of selecting the most optimal motorway route. The first analysis assessed the route defined by the design and environmental documentation for LOT 4 from 2006, the second analysis assessed the 2011 alternative of motorway passage in the hinterland of Blagaj and the third analysis dealt with the

[14] Analyzed within the development of the Zoning Plan of the area of special features of importance for FBiH Motorway on Corridor Vc, IPSA Institut, Sarajevo; Ecoplan, Mostar; Institute of Urbanism, Sarajevo, 2011.
[15] Preliminary design for LOT 4, IGH Zagreb, May 2005.
[16] Environmental impact assessment study for motorway on Corridor Vc Mostar North- South Border LOT4 (0+000,00 - 67+329,00), Institut građevinarstva Hrvatske Zagreb and institut građevinarstva Hrvatske Mostar, Zagreb, March 2007.
[17] IPSA Institute d.o.o. Sarajevo, 2016

route proposed in 2015. Figure 25 shows the situation of the planned motorway routes within the considered variants, where the route of the first analysis is marked in black, the route of the second analysis in blue, and the route from the third analysis in yellow.

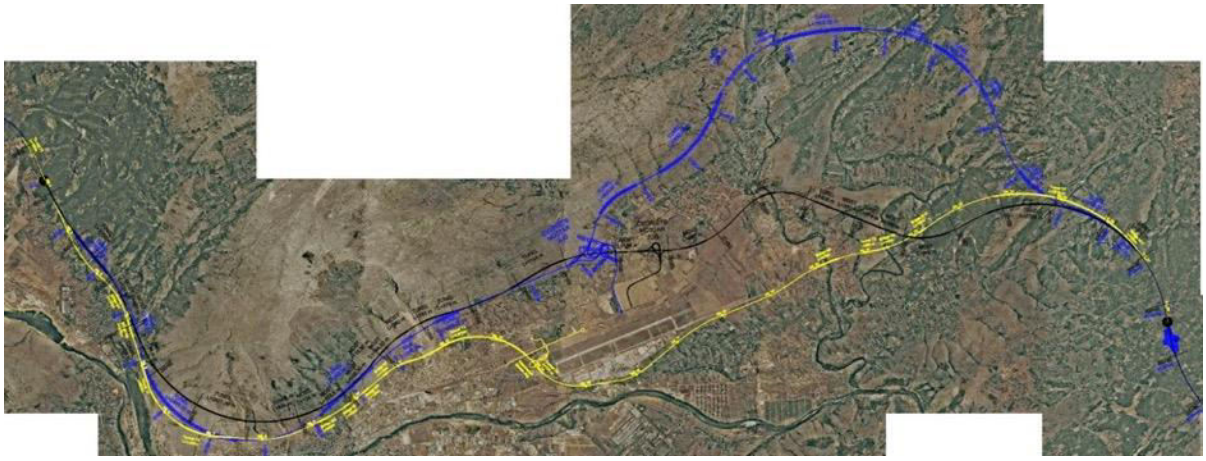


Figure 25: Overview of alternatives subject to first multicriteria analysis (black route - 2006, blue route -2011, yellow route-2015)

The first alternative was rejected mainly due to complains received in the past period by the local population, non-governmental organizations and the Ministry of Physical Planning of FBiH. The most important complaint was related to the fact that the selected route is not in accordance with the current Spatial Plan of BiH, and that the impact on the preservation of cultural heritage and natural resources of the region has not been adequately addressed. The multicriteria analysis revealed that, from the aspect of technical-operational costs, the variant of the motorway near Ortijes airport is more favourable, while from the aspect of spatial-economic and spatial-ecological criteria, the variant of the motorway in the hinterland of Blagaj is more favourable. The results of this multicriteria analysis[18] have shown that the alternative solution of the motorway route near the Mostar airport is the most acceptable solution for the citizens and the state of BiH.

In 2017 the second multicriteria analysis[19] was done for the two alternative routes:

- The first variant involved the analysis of the motorway route near Mostar Airport (the variant selected by the first multicriteria analysis) with certain changes. According to the new solution, the route of the motorway near the Mostar airport crosses the main road M6.1. and enters the protected zone of Mostar Airport. In the continuation, the route of the motorway passes through the tunnel near the northern threshold of the airport runway (taking into account the future extension of the runway), runs between the Mostar-Capljina railway and the airport edge (distance between the railway and the airport entrance is approx. 32 m), and continues through Ortijes and follows the runway corridor at a lateral distance of approximately 35-45 m and descends towards Buna. In the continuation, the route crosses the streams Buna and Bunica with bridges, and continues the ascent towards Rotimlja, overcoming the peaks of Hum and Kvanj through a tunnel. The Rotimski stream crosses the bridge, erupts on the Gubavica plateau and joins the Buna-Pocitelj section in the Stanojevic area. In this position, the height fits into the route of the section Buna-Pocitelj.

[18] The following criteria were used: eliminatory criteria (water supply sites - zone I, cultural and historical heritage (facilities and zones defined by decisions and planning documents), natural values and rarities (based on valid documents), urban structures, built industrial complexes, significant energy facilities, land of I category, amelioration), technical and operational costs, spatial-economic criteria, and spatial-ecological criteria.
[19] IPSA Institut d.o.o. Sarajevo, 2017.

- The second proposed variant analysed the position of the route that crossed the Neretva River in the part of Kadijevic and stretched along the left bank of the Neretva along the existing railway with quite favourable terrain. Then, in the part of Okuc and Hadziosmanovic, they waved the left curve and returned to the right bank of the coast via the bridge over the Neretva. Due to the terrain, three tunnels are planned in this part. In the part of Vrseljka, the route reaches its highest point and after that it falls to the junction on the section Buna - Pocitelj.

Applying the second multicriteria analysis, it was concluded that, from the aspect of technical-operational costs and spatial-ecological criterion, the motorway variant near Mostar airport is more favourable (first variant), while from the aspect of spatial-economic criterion the second alternative is the most favorable. Based on the results of the second multicriteria analysis, it was recommended to the Investor to continue activities on the implementation of the motorway section project on Corridor Vc with a variant solution of the motorway near Mostar Airport.

Figure 26 shows the alternatives that were subject to second multicriteria analysis, where the green line shows the first alternative and the yellow line the second alternative assessed.

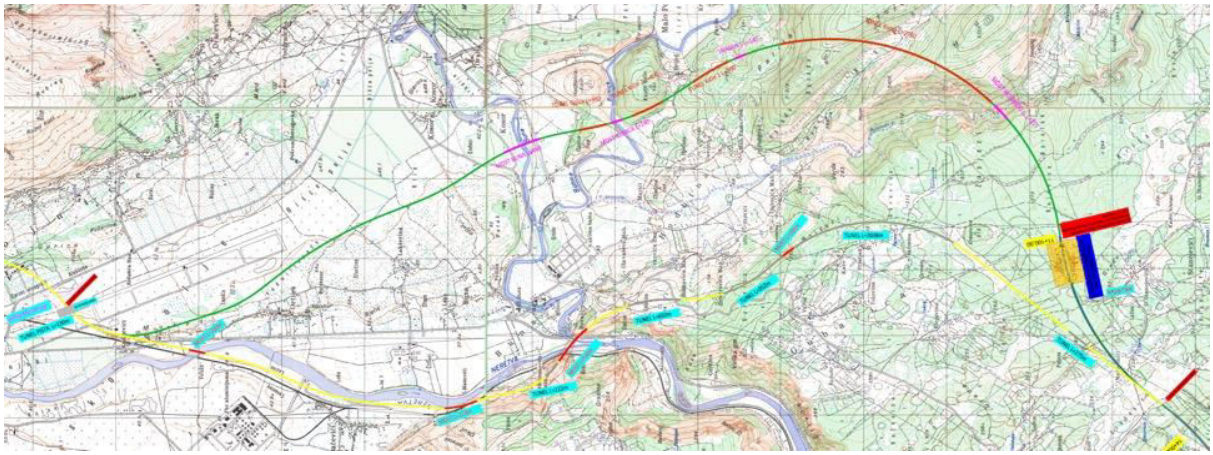


Figure 26: Overview of alternatives subject to second multicriteria analysis (green-first alternative, yellow-second alternative)

In 2017, Pursuant to Article 19 paragraphs 1 and 7 of the Law on Spatial Planning and Land Use at the Level of the Federation of Bosnia and Herzegovina[20], the Parliament of the Federation of Bosnia and Herzegovina, at the session of the House of Representatives on January 25, 2017, and at the session of the House of Peoples from 9.2.2017, passed the Decision on the adoption of the spatial plan of the area of special features of importance for the Federation of Bosnia and Herzegovina "Highway on Corridor Vc" for a period of 20 years. The scope of the plan is determined by the Decision on determining the area of "Highways on Corridor Vc" as an area of special interest for the Federation of Bosnia and Herzegovina. These documents determine the approximate spatial coverage of the plan with a description of the route of the Motorway over the coordinate points of the axis and coverage, with an average width of 500 m on all sections.

The Decision defines the final route of Corridor Vc, and thus the considered sub-sections of the loop Mostar South - Tunnel Kvanj. The spatial plan defines 11 sections on the Corridor Vc. The sub-section Mostar South Interchange – Tunnel Kvanj is described in sections 9 and 10 of the Spatial plan, which defines the following (

[20] Official Gazette of the Federation of BiH, No. 2/06, 72/07, 32/08, 4/10, 13/10 and 45 / 10

Figure 27):

- Section 9 starts at chainage 263 + 812 km in Kuti. The route continues south mostly through bridges and tunnels over the settlements of Potoci and Vrapcici, and descends towards the city of Mostar, whose urban area touches the west, and ends north of Mostar International Airport in front of the Mostar South loop.
- Section 10 starts at chainage 277 + 946 km from where it continues on an open route without tunnels and bridges to the south, crosses the streams Buna and Bunica, continues in the southwest, and comes to the area of Pocitelj.

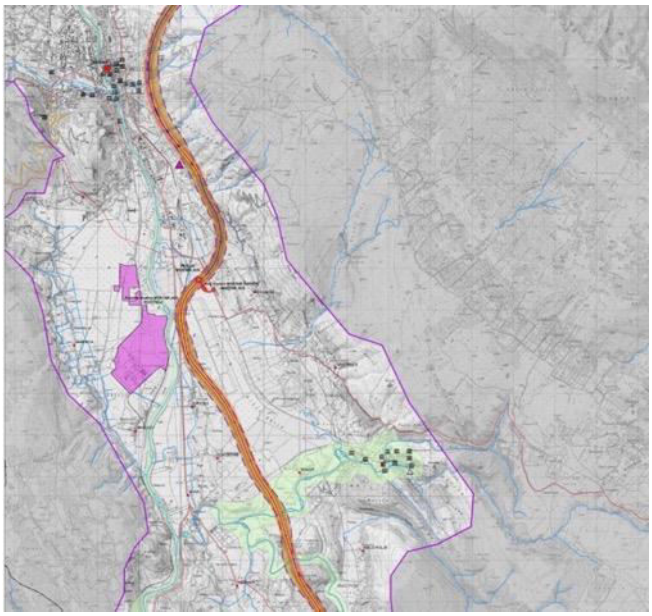


Figure 27: Overview of the route for the sections 9 and 10 [21]

In the period between 2017-2020, the route is again realigned in line with the limits prescribed by the Spatial Plan. JPAC made two corrections to the alignment of the Mostar South-Tunnel Kvanj section initially proposed in the *Concept Design of Route Modification for the Stanojevici-Buna-Mostar South-Ostri rat section*[22]. The corrections are described in the Preliminary Design and the Study for Obtaining the Urban Permit for the Section Mostar South-Buna[23], and are in line with the Spatial Plan for the Motorway on Corridor Vc in FBiH adopted in 2017 by the FBiH Parliament. The two changes relate to the acquisition of buildings near the Mostar Airport and in the village of Malo Polje as described below.

Alternative	*Description*
Amendments to the alignment near Mostar Airport	In 2016, two alternatives were foreseen for the part of the section passing near the Mostar Airport. As shown in Figure 28, according to these two alternatives, the section was planned to enter the BiH Ministry of Defence zone and cross the existing hangars. This was changed in the Preliminary Design from 2018, so the section follows the perimeter of land owned by the Ministry of Defence and bypasses the mentioned hangars.
Amendments to the alignment in	According to the Concept Design from 2016, the route was planned to pass over

[21] Spatial plan for an area of special interest for FBiH „Motorway on corridor Vc" for period 2008-2028
[22] October 2016 (IPSA Institute Sarajevo and IGH Mostar)
[23] April 2018 (IPSA Institute Sarajevo)

the village of Malo Polje	newly constructed houses after passing the Buna Stream (as shown in Figure 29). This option was not accepted by affected house owners, who were against the acquisition of these houses. Therefore, this was changed and the Preliminary Design from 2018 foresees that the route section passes over two older houses whose owners agreed with acquisition.

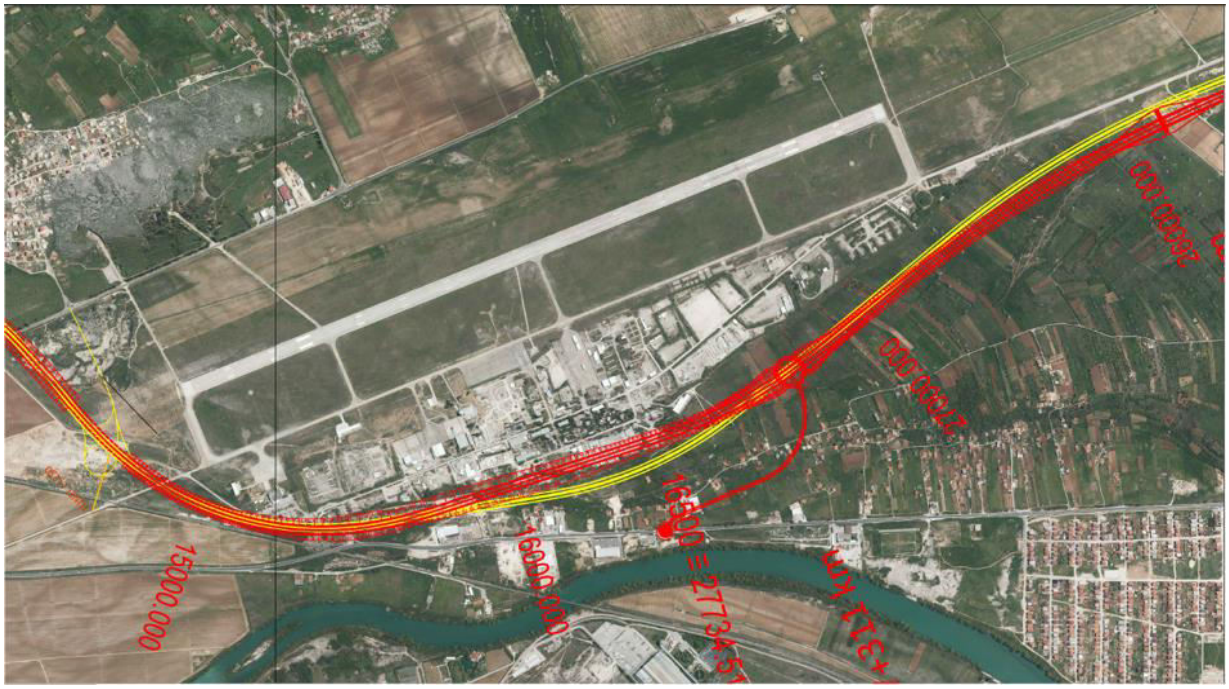


Figure 28: Initial alignment of the part of the section near the Mostar Airport passing over the hangars (2016)

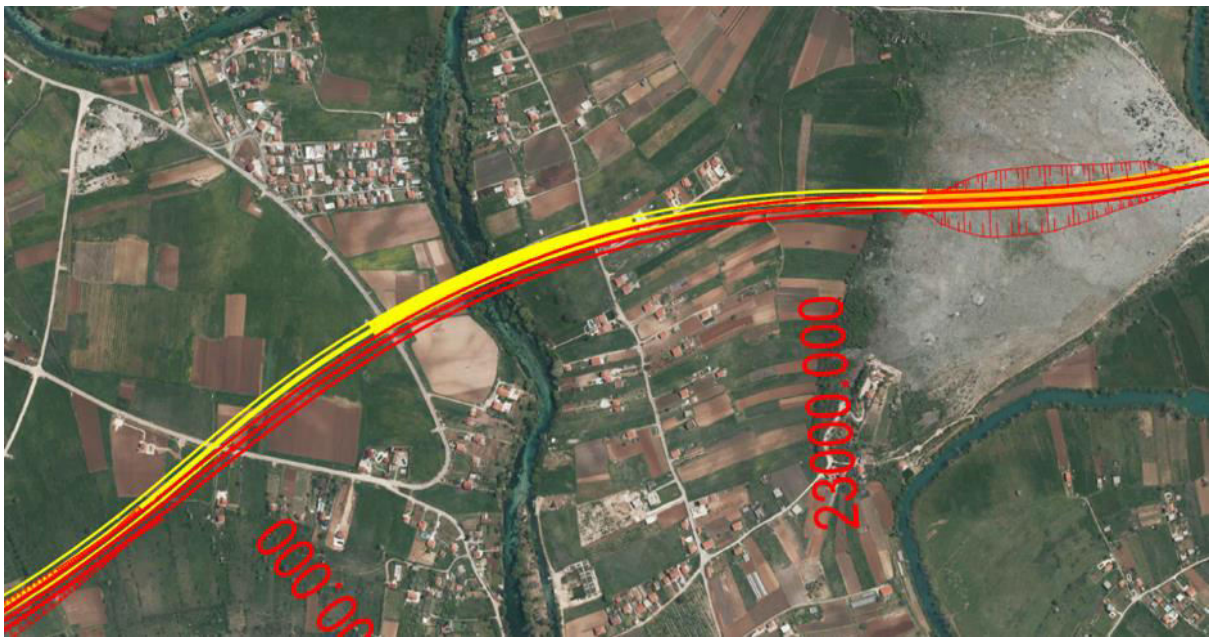


Figure 29: Initial alignment of the part of the section passing over newly constructed houses in Malo Polje (2016)

The Government of BiH adopted letter of Prime Minister Novalić dated 12.5.2020 that confirms that no legal barriers exist to the construction of the road[24].

3.3 Alternative project components

The comparison of the *Preliminary design for section Stanojevici-Buna-Mostar South-Ostri rat section*[25] and *Preliminary design for section Mostar South - Buna (Stanojevici)*[26] reveals the differences related to project components. The alternatives are listed in following table.

Table 8: Alternative project components

No.	*Project component*	*Preliminary design (2016)*	*Preliminary design (2018)*
1.	Tunnel Aerodrom Mostar	Not foreseen	L=232m
2.	Bridge Buna	L=460m	L=326m
3.	Tunnel Gorica (in between the two bridges)	L = 410 m	Not foreseen
4.	Bridge Bunica	L=820m	L=211m
5.	Tunnel Kicin	L=400 m	Not foreseen
6.	Viaduct Brijeg	Not foreseen	L=258 m

[24] Official Gazette No. 100/17 dated 25 December 2017 with Parliament Decision on the alignment of this section; Official Gazette No. 101/18 dated 19 December 2018 with FBH Government decision on public interest; Official Gazette No 29/18 with decision FBH Constitutional court on request from vice president of the FBH related to the procedure for adoption of the alignment.
[25] October 2016 (IPSA Institute Sarajevo i IGH Mostar)
[26] April 2018 (IPSA Institute Sarajevo)

4 POLICY, LEGISLATIVE AND INSTITUTIONAL CONTEXT

4.1 National requirements

Implementation of the Project requires compliance with the provisions of relevant local legislation on environmental and social issues, physical planning, construction and roads maintenance and management, construction of Motorway on the Corridor Vc, health and safety at work, labour, and land acquisition and resettlement. The review of applicable national requirements is given in Table 9.

Table 9: Overview of National Requirements Relevant to the Project

Issue	*National requirements*
EIA and environmental permitting	Construction of motorways is subject to mandatory EIA and permitting procedures at the level of FBiH, as prescribed by the: ▪ Law on Environmental Protection[27], and ▪ Regulation on Facilities Subject to Obligatory Environmental Impact Assessment and Facilities Which May be Constructed and Operated Only with a Valid Environmental Permit[28]. For plants and facilities requiring a mandatory EIA, the investor is required to submit an EIA Study along with the request for the Environmental Permit (EP). The EIA Study has to be developed by the institution/company authorised by the Federal Ministry of Environment and Tourism (FMoET). After the investor submits the Request for EP with the EIA Study to FMoET, the Ministry makes the EIA Study available to the public, sends a copy to relevant authorities and other interested parties, allowing 30 days for receiving comments, and appoints the expert committee to review the submitted EIA Study. Furthermore, the FMoET is obliged to organize a public discussion as near as possible to the sub-project location, and to invite the public to consultations via printed (or electronic) media/radio/TV. The public needs to be informed about the public consultations at least 15 days in advance. The investor needs to assist the FMoET during the consultation process. After the EIA Study is revised and all the relevant comments received from the public are incorporated, and after positive evaluation of the expert committee, FMoET issues the EP (within 30 days following receipt of the evaluation of the EIA Study). Pursuant to the Law on Environmental Protection, the EP contains the following: ▪ Limit values for emissions of polluting substances[29]; ▪ Conditions for the protection of air, soil, water, flora and wildlife; ▪ Measures for management of waste generated by a plant or facility[30]; ▪ Measures for reduction of transboundary pollution; ▪ A system of self-monitoring with determination of the methodology and frequency of the measurements of emissions, and ▪ Measures related to working conditions in extraordinary situations[31].

[27] Official Gazette of FBiH, No. 33/03 and 38/09
[28] Official Gazette of FBiH, No. 19/04
[29] In line with FBiH regulation governing protection of air, water and soil, waste management, and in line with Technical Instructions on BAT for specific industry sectors.
[30] In line with Technical Instructions on BAT for specific industry sectors, taking into account the pollution potential and technologies already in place, as well as real implementation capacity.
[31] Plants and facilities where hazardous substances are present in quantities higher than specified in the Ordinance on the content of the Report on the State of Security, on the content of Information on Security Measures and on the content of Internal and External Contingency Plans (Official Gazette of FBiH, No. 68/05) are obliged to develop Large-Scale Accidents Prevention Plan

Issue	*National requirements*
	Limit values for emissions of polluting substances and equivalent parameters and technical measures are based on best available techniques, taking into account technical characteristics of plants and facilities, their geographic position and other conditions. EPs are valid for five years.
Water permits	The water permitting procedure in FBiH is regulated by the *Law on Waters*[32] and the *Regulation on Content, Scope, Conditions, Ways of Issuing and Archiving of Water Documents*[33]. The required water acts are: ▪ Preliminary Water Consent - defines whether the applicant has met the conditions for (i) exercising water rights; (ii) the manner of exercising this right; (iii) the documentation for the construction of new, reconstruction or removal of existing facilities. It needs to be obtained before applying for an Environmental Permit. It is valid for 3 years. ▪ Water Consent - confirms that the documentation attached to the request for the Water Consent is in accordance with the Preliminary Water Consent, local legislation on water and spatial planning documents. It has to be obtained before obtaining the Construction Permit. It expires after 2 years if a Construction Permit has not been issued and construction works initiated. ▪ Water Permit - defines: (i) the purpose, manner and conditions for water use; (ii) the operation of facilities; (iii) the manner and conditions for discharge of wastewater and disposal of solid and liquid waste. It confirms that the conditions defined by the Water Consent have been fulfilled. It is valid for up to 15 years. The agency responsible for issuing water acts for this project is the Water Agency for Adriatic Sea Watershed.
Other permits	According to the *Law on Motorway on Corridor Vc*[34], the request for obtaining an Urban Permit (UP) is submitted by the investor to the Federal Ministry of Physical Planning (FMoPP). FMoPP issues the UP within 15 days. For the construction of motorway on Corridor Vc, the UP is valid until the Construction Permit is issued. The request for obtaining a Construction Permit (CP) is submitted to FMoPP which issues the CP within 30 days. CPs are issued for a 5-year period. Motorway sections may be used only after obtaining a Use Permit. It is necessary to submit to FMoPP the request for technical inspection and the Use Permit. The Use Permit may be issued only after a technical inspection of the construction is performed by an expert committee appointed by FMoPP within 8 days. The technical inspection must be performed within 30 days from the day the request for Use Permit is submitted to FMoPP. The expert committee submits its report to FMoPP within 8 days from the day of the completed technical inspection. If the expert committee reports any identified defects on the construction that need to be eliminated, the FMoPP sets a deadline for the completion of the elimination of defects (max. 90 days). If the committee reports that the construction may put into use /operation, FMoPP issues the Use Permit after the submission of the report on technical inspection by the committee and within 7 days from the receipt of the EP by the investor.

[32] Official Gazette of FBiH, No. 70/06
[33] Official Gazette of FBiH, No. 31/15
[34] Official Gazette of FBiH, No. 8/13

Issue	*National requirements*
Air quality	According to the *Regulation on the Monitoring of Air Quality and Defining Pollutants Types, Limit Values and Other Standards*[35], air quality is monitored by measuring the concentration of sulphur dioxide, nitrogen oxides, particulate matter PM_{10} and $PM_{2.5}$, lead, benzene, carbon monoxide, arsenic, cadmium, mercury, nickel and benzo-a-pyrene, with instruments for automatic measurement and sample analysis. The maximum allowable daily concentrations, target values and alert thresholds for pollutants are also regulated by the mentioned Regulation.
Noise	The *Law on Protection Against Noise*[36] regulates the permissible noise levels, noise protection measures, the way of measuring and recording noise, noise limits classified according to the atmosphere, land use and the time of day (day or night), in order to protect human health, working and living space, and the environment in general. The Law defines the limit values of external noise for planning new facilities and sources of noise in FBiH. Vehicle noise standards are defined by the *Rules on the Dimensions, Total Weight and Axle Load of Vehicles, on Obligatory Vehicle Devices and Equipment Vehicle, on Basic Requirements to be Met and Traffic Equipment on Roads*[37]. The Rules define the permissible sound level limits for individual vehicles.
Waste management	The *Law on Waste Management*[38] sets general requirements concerning construction waste management and management of waste generated during decommissioning. Pursuant to the Law, a Waste Management Plan must be enclosed to the Environmental Permit Request. The plan should include: ▪ Documentation on waste produced by enterprises (origin, type of waste in accordance with the list of wastes, composition, quantity), ▪ Measures to be taken for prevention of waste production, especially concerning the hazardous waste, ▪ Separation of waste, especially separation of hazardous and other types of waste from the waste to be reused, ▪ Disposal of waste to the landfill, ▪ Treatment and/or disposal methods. In addition, according to the *Regulation on Construction Waste*[39] a Preliminary Construction Waste Management Plan needs to be submitted for the issuance of the Urban Permit, while a Detailed Construction Waste Management Plan must be enclosed to the Construction Permit Request.
Water and wastewater management	The *Law on Waters*[40] regulates water and wastewater management and planning. The maximum permitted quantities of hazardous and harmful substances in wastewaters before discharging into natural recipients (surface waters) or into public sewerage system are stipulated by the *Decree on Conditions for Discharge of Wastewater into Environment and into the Public Sewerage System*[41].

[35] Official Gazette of FBiH, No. 1/12
[36] Official Gazette of FBiH, No. 110/12
[37] Official Gazette of BiH, No. 23/07
[38] Official Gazette of FBiH, No. 33/03, 72/09 and 92/17
[39] Official Gazette of FBiH, No. 93/19
[40] Official Gazette of FBiH No. 70/06
[41] Official Gazette of FBiH, No. 26/20

Issue	*National requirements*
Nature protection	The *Law on Nature Protection of FBiH*[42] defines the bodies for nature protection, general conservation measures, evaluation of operations in nature, habitats and ecologically important areas, species and subspecies, protection and conservation of biodiversity and ecosystems, the establishment of Natura 2000, etc. The Red List of Flora and Fauna of FBiH was developed based on the requirements of this Law.
Labour and employment	Both JPAC and the contractors are required to implement the provisions of the *Labour Law of FBiH*[43] which regulates all issued related to employment. The provisions of the Law are in line with International Labour Organisation (ILO) conventions related to forced labour, discrimination, child labour, equal remuneration, freedom of association, right to organise and collective bargaining.
OHS	OHS is regulated by the *Law on Safety at Work*[44] and the *Law on the Protection against Fires and Protection of Fire-fighters*[45]. JPAC has to require from its Contractors, through the public procurement procedure, to comply with the legal requirements regarding health and safety at work and during construction works in order to prevent any dangerous situation or harm to workers and local communities. Safety during construction works and documentation needed at construction sites are regulated by the *Decree on Construction Site Organization, Mandatory Documentation on Construction Site and Construction Work Participants*[46].
Construction site organisation	According to the *Decree on Construction Site Organisation, Mandatory Documentation on Construction Site and Construction Work Participants*[47], Contractors are required to develop a Construction Site Organization Plan (CSOP). CSOP includes organization of preliminary works, organization of site during construction, organization of site after construction phase, technological scheme, the Environmental Protection Plan and Safety Management Plan. Therefore, this Plan requires the development of other accompanying Plans: ▪ *Environmental Protection Plan* - suggests detailed measures of environmental and social management by covering the following aspects (sub-plans): air quality, noise and vibration management, soil management, hazardous material management, spill response management, emergency preparedness and response, ▪ *Fire and Explosion Management Plan* (preliminary fire-fighting activities in case of fires; plan for alerting fire-fighting services), ▪ *Occupational Health and Safety Management Plan* (prescribes the mandatory equipment for occupational health and safety, preliminary medical assistance and plan for alerting the official medical emergency assistance). The CSOP must be developed by the Contractor prior to the commencement of construction works. The Plan has to be controlled and signed by the Supervisory Authority which is the legal entity responsible for the overall supervision of construction works, as stipulated by the above-mentioned Decree. The Plan should correspond to the requirements, safety measures and obligations contained in the Environmental Permit or environmental requirements laid down in the approval process for the construction.

[42] Official Gazette of FBiH, No. 66/13
[43] Official Gazette of FBiH, No. 26/16
[44] Official Gazette of SR BiH, No. 22/90
[45] Official Gazette of FBiH, No. 64/09
[46] Official Gazette of FBiH, No. 48/09, 75/09 and 93/12
[47] Ibid.

Issue	*National requirements*
Land acquisition	Land acquisition in FBiH is regulated by the *Law on Expropriation of FBiH*[48] which defines the conditions and procedure for expropriation of property for construction of facilities in public interest, compensation eligibility and amounts, handling of grievances and disputes handling and other issues pertaining to the expropriation process. In addition, a Land Acquisition and Resettlement Framework was prepared and publicized by JPAC in March 2017 in order to outline the general principles, procedures and entitlement framework with regard to the potential impacts of land acquisition required for the Project (construction of Corridor Vc), in line with national legal regulations and EBRD requirements, in particular EBRD's PR 5.
Cultural heritage	The *Law on Protection and Use of Cultural, Historical and Natural Heritage*[49] requires JPAC to cooperate with the Institute for Protection of Monuments (within the Federal Ministry of Culture and Sports) at different stages of project development. JPAC is obliged to obtain the formal opinions and conditions related to protection of cultural heritage along the alignment. As part of the Construction Permit procedure, JPAC is required to apply for detailed conditions for cultural heritage protection. The Institute may require provision of archaeological supervising during the earth works.
Road safety	A General Audit of project documentation that includes the audit of Traffic Signalization and Equipment Design is required by local legislation (*Law on Basis of Road Safety on Roads of BiH*[50], and the accompanying key Regulations[51], *Law on Roads of FBiH*[52], and the accompanying key Regulations[53]). Upon the completion of the Main Design (including the Main Traffic Signalization and Equipment Design), investors publish a public call for an auditor who prepares the first report on compliance with the existing legislation, guidelines and specific standards. The investor forwards the report to the designer for review and response. The designer analyses the report and may accept or reject the provided comments. The report is then sent back to the auditor. If the auditor does not accept the rejections (if any) of his/her comments, an attempt is made to reconcile the opinions of the auditor and designer. In case such reconciliation is not achieved, the investor makes the final decision. The auditor prepares the final audit report which is an integral part of the Main Design (the audit report is attached as the first page of the Traffic Signalization and Equipment Design, verified by the seal of the auditor). An inspection report by the committee for technical acceptance of buildings and facilities is required prior to the issuance of a Use Permit for any built structure including roads. The *Regulation on Technical Inspection of Built Structures*[54] defines the manner of appointment of the committees for technical acceptance, the procedure of technical inspection and other related issues. The committee for technical acceptance prepares a report.
Motorway design	According to the *Law on Motorway on Corridor Vc,* JPAC defines the Technical Specifications (TS) for the design, construction and maintenance of motorways on Corridor Vc. According to this Law, TS are developed taking into consideration BAS, EN and ISO standards as well as specific requirements

[48] Official Gazette of FBiH, No. 70/07, 36/10, 25/12 and 34/16
[49] Official Gazette of SR BiH, No. 20/85, 12/87 and 3/93
[50] Official Gazette of BiH, No. 6/06, 75/06, 44/07, 84/09, 48/10, 18/13, 08/17, 89/17 and 09/18
[51] All published in the Official Gazette of BiH, No. 16/07
[52] Official Gazette of FBiH, No. 12/10, 16/10, 66/13
[53] All published in the Official Gazette of FBiH, No. 48/03
[54] Official Gazette of FBiH, no. 23/08

Issue	*National requirements*
	for BiH. TS include: ▪ *Set of Instructions for the Design, Procurement, Installation and Maintenance of Motorway Elements, Structures or Their Parts on the Motorway* developed by JPACin order to standardize and uniform as much as possible necessary requirements regarding the construction of motorways and to give instructions for designers, supervisory teams and contractors ▪ BAS standards, European EN and ISO International Standards ▪ *Guidelines for the Design, Construction, Maintenance and Supervision*[55], in line with FBiH legislation as well as European and international requirements and legislation. These Guidelines are adopted into the FBiH legislation by FBiH Government through the *Decision on the Guidelines for the Design, Construction, Maintenance and Supervision of Roads in FBiH* (Official Gazette of FBiH, No. 80/06) ▪ Laws, regulations, decrees and other legal acts adopted by the FMoPP.
Public consultations	The primary law that ensures the rights of citizens to information is the *Law on Free Access to Information* in FBiH (Official Gazette of FBiH, No. 32/01, 48/11), which stipulates that all citizens and legal entities have the right to access information in the control of a public authority, and each public authority has a corresponding obligation to disclose such information. Procedures related to environmental information disclosure are further elaborated in *the Law on Environmental Protection* (Official Gazette of FBiH, No. 33/03 and 38/09), which stipulates that every person and every organization must have adequate access to information regarding the environment at the disposal of public authorities, including information on hazardous materials and activities in their communities, and be enabled to participate in the decision making process. Regulatory bodies and governments are obliged to encourage public awareness and participation, facilitate access to information, judicial and administrative procedures, as well as to registers of installations and polluters in the future. Furthermore, BiH acceded to the Aarhus Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters in 2008. This Convention regulates rights related to the environment and links the responsibility of public authorities with environmental protection. It aims at democratic cooperation of the public and public authorities and introduces a new procedure for public participation in negotiating and implementing international agreements. Under the Convention, access to information, public participation in decision making and access to justice are an integral part of environmental protection management. The public consultation requirements for the EIA procedure are described above under item “EIA and environmental permits”.

4.2 Lender’s requirements

The Environmental and Social Policy (ESP) is a key EBRD document, which details the commitments of the Bank’s Funding Agreement to promote in the full range of its activities, environmentally sound and sustainable development. Bank-financed projects are expected to meet good international practice related to sustainable development. The Bank has defined specific Performance Requirements (PR) for key areas of environmental and social issues and impacts. The EBRD PRs and their applicability to this Project are given in Table 10. New

[55] Faculty of Civil and Geodetic Engineering of the University of Ljubljana and DDC Consulting & Engineering Ltd, 2005

facilities or business activities to be financed by EBRD should be designed to meet PRs from the outset. If a proposed business activity to be financed relates to existing facilities that do not meet PRs at the time of Board approval, the client will be required to adopt and implement an Environmental and Social Action Plan (ESAP). This project is subject to requirements of ESP 2014.

Table 10: EBRD PRs applicable to the Project

Performance requirements	*Applicability to the project*
PR1: Assessment and Management of Environmental and Social Impacts and Issues	Yes
PR2: Labour and Working Conditions	Yes
PR3: Resource Efficiency and Pollution Prevention and Control	Yes
PR4: Health and Safety	Yes
PR5: Land Acquisition, Involuntary Resettlement, Economic Displacement	Yes
PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes
PR7: Indigenous Peoples	No
PR8: Cultural Heritage	Yes
PR9: Financial Intermediaries	No
PR10: Information Disclosure and Stakeholder Engagement	Yes

Under the EBRD Environmental and Social Policy 2014 (ESP), EBRD categorises each project to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. The categorisation of each project depends on the nature, location, sensitivity and scale of the project, and the significance of its potential adverse future environmental and social impacts.

- Category A: A project is categorised A when it could result in potentially significant adverse future environmental and/or social impacts which, at the time of categorisation, cannot readily be identified or assessed, and which, therefore, require a formalised and participatory environmental and social impact assessment process.
- Category B: A project is categorised B when its potential adverse future environmental and/or social impacts are typically site-specific, and/or readily identified and addressed through mitigation measures. Environmental and social appraisal requirements may vary depending on the project and will be determined by the EBRD on a case-by-case basis.
- Category C: A project is categorised C when it is likely to have minimal or no potential adverse future environmental and/or social impacts and can readily be addressed through limited environmental and social appraisal.

Based on an assessment review of the Project against EBRD criteria and having in mind that this section belongs to the 335 km long motorway, the Project is classified as Category A.

4.3 EU requirements

EBRD as a signatory to the European Principles[56] for the environment, is committed to promoting the adoption of EU environmental principles, practices and substantive standards[57] by EBRD financed projects, where these can be applied at the project level, regardless of their geographic location. When host country regulations differ from EU substantive environmental standards, projects will be expected to meet whichever is more stringent. Table 11 gives an overview of EU requirements applicable to this Project.

Table 11: Overview of EU Requirements Relevant to the Project

Directive	*Brief description*
EIA Directive (Directive 2014/52/EU on the assessment of the effects of certain plans and programmes on the environment)	The amended EIA Directive simplifies the rules for assessing the potential effects of projects on the environment that were part of the previous EIA Directive (85/337/EC) and its amendments. It requires an assessment to be carried out by the competent national authority for certain projects which have a physical effect on the environment. The EIA must identify the direct and indirect effects of a project on the following factors: man, the fauna, the flora, the soil, the water, the air, the climate, the landscape, the material assets and cultural heritage, and the interaction between these various elements.
SEA Directive (Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment)	The objective of the SEA Directive is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment. The SEA and EIA procedures are very similar but have some differences.
Birds Directive (Directive 2009/147/EC on the conservation of wild birds) and Habitat Directive (Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora)	The two principal EU Directives relating to nature conservation provide a legal framework for the protection of habitats and fauna and flora species. Both Directives promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance. The Habitats Directive led to the setting up of a network of Special Areas of Conservation to protect the 220 habitats and approximately 1000 species listed in Annex I and II of the Directive which are considered to be of European interest following criteria given in the Directive. Together with Special Protection Areas which are designated under the Birds Directive, these form a network of protected sites across the European Union called Natura 2000. The Emerald network is an ecological network to conserve wild flora and fauna and their natural habitats of Europe, which was launched in 1998 by the Council of Europe as part of its work under the Convention on the Conservation of European Wildlife and Natural Habitats or the 'Bern Convention'.
EC Directive 2008/96/EC Road Infrastructure Safety Management	This Directive applies to all road schemes on the Trans-European Road Network at the design stage, under construction or in operation. The provisions of the Directive may also be applied as a set of good practices for national road transport infrastructure. The Directive imposes road safety responsibilities on Project Sponsors to demonstrate that road safety risks have been considered during the design and delivery of the project. During the initial planning stage, this would comprise the production of a Road Safety Impact Assessment, in line with Annex I of the Directive. Subsequently Road Safety Audits should be undertaken as an integral part of the design in line with the criteria set out in Annex II of the Directive. Annex III of the Directive sets out criteria and requirements for the ranking of high accident concentration sections and network safety ranking during operation.

[56] https://www.nib.int/filebank/a/1521315365/9ae732ab406cefafa3525b7bd10ad134/7215-European_principles_for_the_environment.pdf

[57] Substantive environmental standards of the EU are comprised in EU secondary legislation, e.g., regulations, directives and decisions.

Directive	*Brief description*
Water Framework Directive (Directive 2000/60/EC establishing a Framework for Community Action in the Field of Water Policy)	This Directive establishes a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. Member States shall implement the measures necessary to prevent or limit the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater, subject to the use for the abstraction of water intended for human consumption and those bodies of water intended for such future use. Member States shall ensure the establishment of programmes for the monitoring of water status in order to establish a coherent and comprehensive overview of water status within each river basin district for groundwater such programmes shall cover monitoring of the chemical and quantitative status.
Flood Directive (Directive 2007/60/EC on the Assessment and Management of Flood Risks)	The aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. It requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU. This Directive now requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. With this Directive also reinforces the rights of the public to access this information and to have a say in the planning process.
Waste Framework Directive (Directive 2008/98/EC on Waste)	This Directive sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It explains when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria), and how to distinguish between waste and by-products. The Directive lays down some basic waste management principles: it requires that waste be managed without endangering human health and harming the environment, and in particular without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest. Waste legislation and policy of the EU Member States shall apply as a priority order the following waste management hierarchy: prevention, preparing for re-use, recycling, recovery, disposal. The Directive introduces the "polluter pays principle" and the "extended producer responsibility". It incorporates provisions on hazardous waste and waste oils and includes sets recycling and recovery targets.

5 ENVIRONMENTAL BASELINE

5.1 Assumptions and limitations

The current level of project documentation and status of the design (Preliminary Design, IPSA 2018) has limited the possibility to define certain impacts and mitigation measures (e.g. the position of noise barriers and detailed geotechnical survey - Mission G21 will be determined during Main Design phase). However, data has been sourced from various sources to identify baseline conditions within the project corridor and supplemented with site surveys where possible in order to assess potential impact from the works and determine appropriate mitigation measures.

Table 12: Assumptions and limitations

Issue	*Brief description*
Project documentation	The level of project documentation (Preliminary Design, IPSA 2018) may be considered as a limitation factor with regard to some environmental and social aspect (e.g. the position of noise barriers and detailed geotechnical survey - Mission G21 will be determined during Main Design phase).
Existance of UXOs and mine fields	UXOs and mine fields are located in the southern part of the investigated area. The biodiversity survey was performed from the safe distance and by observing the area with binoculars from the local road.
Access to private properties	Access to private properties was restricted by fences (e.g. settlement Laksevine and Ortijes). The access was also restricted at other locations, such as active quarries and Mostar International Airport zone.
Deadlines for submission of this report	Deadlines for submission of this report restricted the biodiversity surveys to summer season only (June 2020). The spring-flowering species could not be found on site in this part of the year as well as autumnalis species. Consequently, additional biodiversity surveys are required as elaborated in Biodiversity Management Plan.
Assumptions and limitations related to investigation of invertebrates	Although the rapid field survey results provided a good representation of the habitat richness of the area, these surveys are preliminary findings that may serve as the baseline data for further studies of the area. As already mentioned, desktop survey was used to provide basic information on the biodiversity and presence/abundance of the species of conservation concern in the assessment area. Further surveys are needed, particularly for saproxylic beetle and freshwater invertebrates.
Assumptions and limitations related to investigation of fish	During undertaking the desk research, available literature has been used however no recent research has been undertaken in the envisaged area.
Assumptions and limitations related to investigation of ornithofauna	Although the survey covered the nesting aspect of birds in most of the researched polygons, the survey was limited in terms of time and migration of species during early spring. Since the survey did not cover all ornithological aspects, and due to the lack of bibliographic data of the researched area, therefore additional researches in spring would need to take place from March to April to cover early spring migrations with regard to Falconiformes species, Charadriformes and Anseriformes species, as well as to sensitive species Short-toed Lark (*Calandrella brachydactyla*) and Calandra lark (*Melanocorypha calandra*).
Assumptions and limitations related to investigation of large mamals	The Consultant assumed no assumptions or limitations except the scarce data available for the project area.
Limitations related to baseline water quality	The baseline survey of water quality in Buna and Bunica provided unreliable data for the chemical oxygen demand due to use of inadequate laboratory method. Dissolved oxygen and

Issue	*Brief description*
monitoring data	ammonia parameters are missing, both being necessary to be able to make appropriate conclusions about water quality. Baseline surveys need to be repeated with additional parameters measured an analyzed before works commence.
Limitations related to baseline air quality monitoring data	The monitoring station operated by the Cantonal Institute of Public Health is not functioning and the latest data are available for the period 2000-2007, while the monitoring station operated by the University of Mostar never made their data publicly available. Therefore, there was a lack of historical data about air quality in Mostar that would provide better insight in the baseline situation.

Figure 30: Restricted to the surveyed area

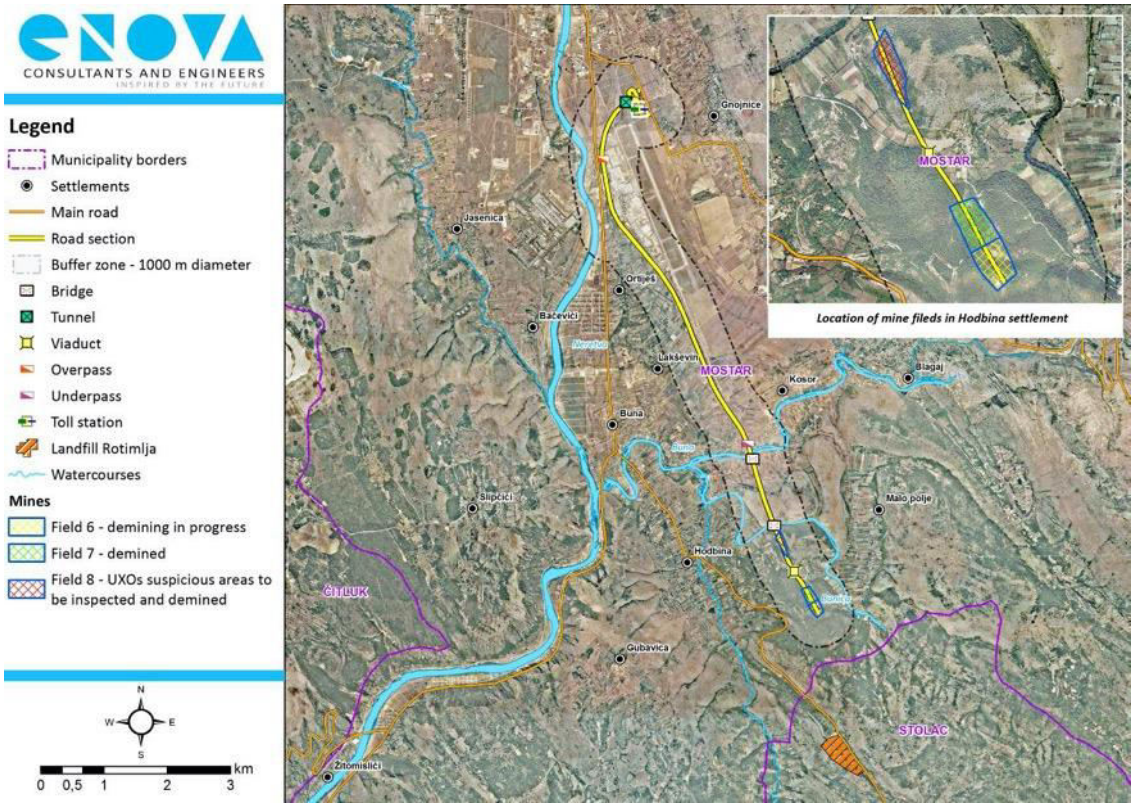


Figure 31: Mine fields in Hodbina Hill and Kajgin Kicin Hill

5.2 Flora and fauna

5.2.1 Background information

The detailed information on habitats, flora and invasive plant species, as well as fauna species of the project area are comprised in the Technical Annexes to the final Environmental and Social Assessment Report:

- Annex A: Habitats, vegetation and invasive species
- Annex B: Invertebrates
- Annex C: Vertebrates
    - Annex C-1: Fish (desk study)
    - Annex C-2: Herpetology (amphibians and reptiles)
    - Annex C-3: Ornithology
    - Annex C-4: Mammals – Bats
    - Annex C-5: Mammals – Large mammals (desk study).

The stand-alone reports on each category of biodiversity contain survey background, survey methodology, project team, locations of field surveys with regard to the motorway route, review of literature data, maps photographs and references, whereas for the purpose of this Chapter 5.2, only the most relevant information is provided.

The Critical Habitat Assessment (CH) is given as Annex D: Critical Habitat Assessment and the Chapter 5.2.5 contain the main conclusions of the CHA report.

5.2.2 Habitats

No previous studies have been done with regard to habitats of the project area, while in the southernmost part of the motorway route, data on habitats of preliminary Natura 2000 site Buna-Bunica were presented as part of the project *Support to the Implementation of the Birds and Habitats Directive in BiH* (Federal Ministry of Environment and Tourism, October, 2012-2014):

- 3270 Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation
- 62A0 Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)
- 8140 Eastern Mediterranean screes
- 8210 Calcareous rocky slopes with chasmophytic vegetation
- 8310 Caves not open to the public
- 9250 Quercus trojana woods.

None of the mentioned habitats were confirmed during field surveys conducted as part of this assignment.

The field survey with regard to habitats has been undertaken on 3-5 June 2020 on 32 sample points (Figure 32). For each sample point, GPS coordinates were recorded by NAVIGON mobile application, where present plant species and the type of vegetation were identified. The species were identified in the field, or, if that was not possible, specimens were collected and/or photographed in detail, to be identified later using the relevant botanical literature.

The aerial imagery (ESRI DigitalGlobe) was used for development of basic maps showing polygons of different habitat types. These maps were then taken into the field for ground truthing. Following the field surveys, the

habitat maps were refined, based on the information gathered at the sample points, and other general visual observations. EUNIS system was used for habitat mapping, and GIS computer programme has been used for digitalisation of identified habitats of the project footprint zone and the buffer of 1000 m diameter that has been set as the preliminary area of influence. The 500 m buffer zone at each side of the road route has been confirmed as sufficient with regard to the habitats that could be under impact of planned works on flora and vegetation, as most natural habitats are already degraded, whereas potential habitats and ecologically appropriate area of assessment of fauna species are considered separately in sections below. The habitats of the project footprint have been separately analysed from the remaining potential area of influence of buffer zone as given below.

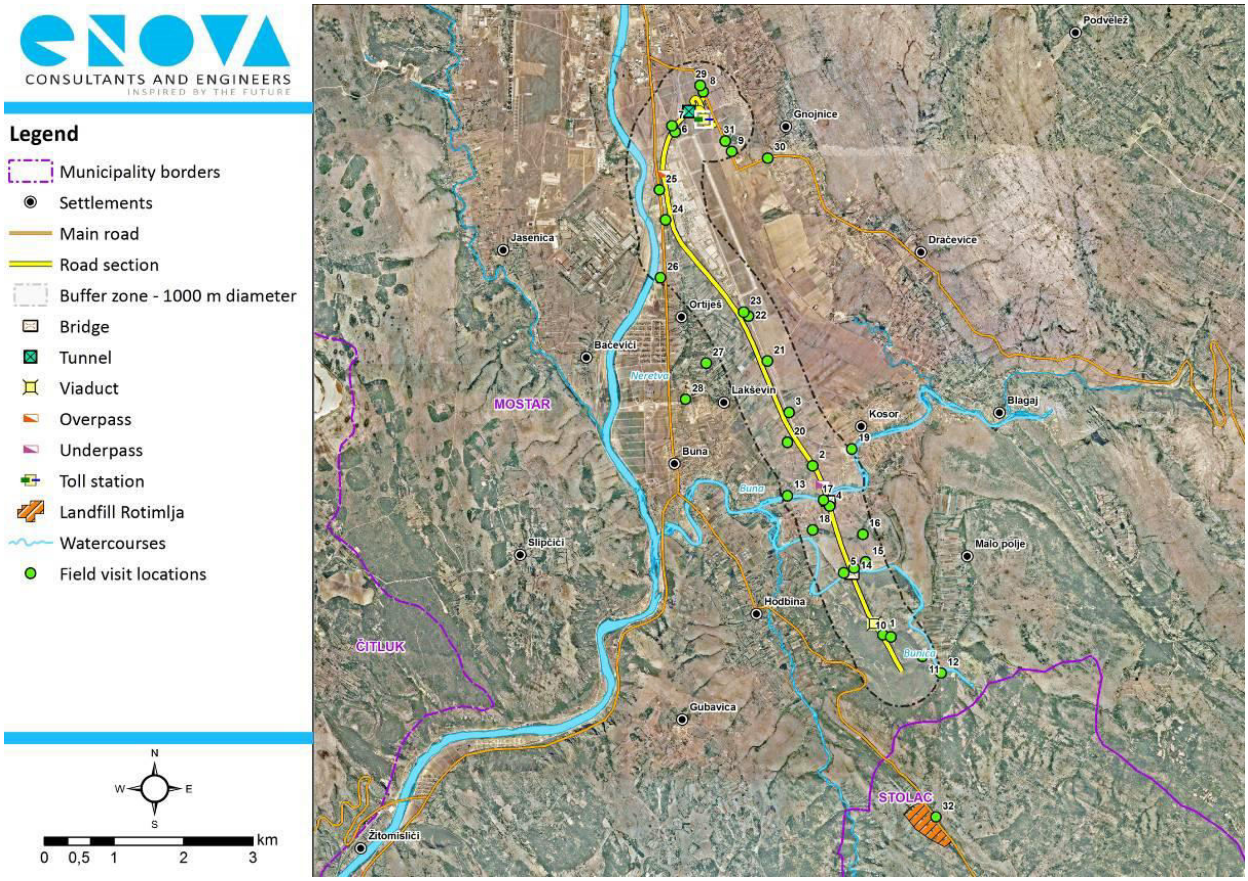


Figure 32: The map of flora and habitats surveyed sample points

Natural vegetation of the surveyed area consists of thermophilous deciduous oak and oriental hornbeam (Querco pubescentis - Carpinetum orientalis) and oak and hop hornbeam (Querco - Ostryetum carpinifoliae) woodlands, shrubs and garrigue, developed under arid climate with and dry summers. In most part of the area, the forest vegetation is degraded, so that terrain is covered with low shrubs and dry grasslands. The alluvial area around Neretva, Buna and Bunica streams is overgrown with soft leaf trees, poplars and willows. The hills in the surveyed area are mostly covered in different brushwood formations of *Paliurus spina-christi* and *Punica granatum* with *Juniperus oxycedrus* and *Cupressus sempervirens*, typical for rocky terrains of the Sub-Mediterranean region. The slopes of the hills in the surveyed area are characterized by dry rocky grasslands, developed under local climatic conditions and anthropogenic influence. The unmanaged parts of the grasslands are partially overgrown with shrubby vegetation. During the survey, the following habitat types were identified in line with EUNIS classification of habitats (Table 13):

Table 13: Habitat types identified in the surveyed area

EUNIS code	*Description*
C2	Surface running waters
C3	Littoral zone of inland surface waterbodies
E1	Dry grasslands
E1.6	Subnitrophilous annual grassland
E2	Mesic grasslands
F6.37	Illyrian [*Paliurus spina-christi*] garrigues
FB	Shrub plantations
FB.31	Shrub and low-stem tree orchards
FB.42	Intensive vineyards
G1	Broadleaved deciduous woodland
G1.1	Riparian and gallery woodland, with dominant [Alnus], [Betula], [Populus] or [Salix]
G1.7C	Mixed thermophilous woodland
J1.2	Residential buildings of villages and urban peripheries
J1.4	Urban and suburban industrial and commercial sites still in active use
J2	Low density buildings
J3	Extractive industrial sites
J4	Transport networks and other constructed hard-surfaced areas
J4.2	Road networks
J4.4	Airport runways and aprons
J4.7	Constructed parts of cemeteries
J6.2	Household waste and landfill sites
X07	Intensively-farmed crops interspersed with strips of semi-natural vegetation
X25	Domestic gardens of villages and urban peripheries

The spatial distribution of habitats is presented on map below (Figure 33, Figure 34). As given in Table 14, the project footprint zone covers the area of 55.32 ha, most of which (27.45 ha) is under EUNIS habitat type X07 (intensively-farmed crops interspersed with strips of semi-natural vegetation), followed by J3 (Extractive industrial sites) - 9.50 ha and F6.37 (Illyrian *Paliurus spina-christi* garrigues) - 9.15 ha. The most valuable natural habitat type in the surveyed area, the mixed thermophilous woodland (G1.7C) and natural dry grasslands (E1) will remain well-preserved, as only 1.45 ha and 0.016 ha respectively will be directly affected by the construction of the motorway. An additional area of 1071.32 ha could be indirectly affected if mitigation measures are not applied and possibly prone to the invasion of alien plant species as a consequence of the disturbance caused by construction works and later use of the motorway, which will require specific mitigation measures.

Table 14: Area under specific habitat types directly and indirectly affected by the project

EUNIS code	*Project footprint*	*Potential impact (area of influence*	*Total*
C2	0.25	27.96	28.21
C3	0	2.85	2.85
E1	0.02	16.31	16.33
E1.6	2.10	98.21	100.31
E2	0	17.70	17.7
F6.37	9.15	119.72	128.87
FB	0.09	15.35	15.44
FB 3.1	0.05	5.06	5.12
FB 4.2	0.14	81.64	81.78
G1	0	4.91	4.91
G1.1	0.12	16.21	16.33
G1.7c	1.45	63.07	64.52
J1.2	0	21.77	21.77
J1.4	0.18	26.40	26.59
J2	0	3.29	3.29
J3	9.50	28.86	38.36

EUNIS code	*Project footprint*	*Potential impact (area of influence*	*Total*
J4.2	0.77	12.13	12.9
J4.4	2.12	91.61	93.73
J4.7	0	1.27	1.27
J6.2	1.94	1.15	3.09
X07	27.45	412.90	440.36
X25	0	2.9	2.9
TOTAL	**55.32**	**1071.32**	**1126.63**

The Construction Landfill Rotimlja will directly affect additional 18.15 ha of natural habitats, most of which (13.17 ha) is covered with the garrigue (F6.37) and already existing landfill (2.68 ha).

Table 15: Area under specific habitat types directly and indirectly affected by the project

EUNIS code	*Project footprint*
E1.6	1.5
F6.37	13.17
G1.7c	0.53
J4.2	0.27
J6.2	2.68
TOTAL	**18.15**

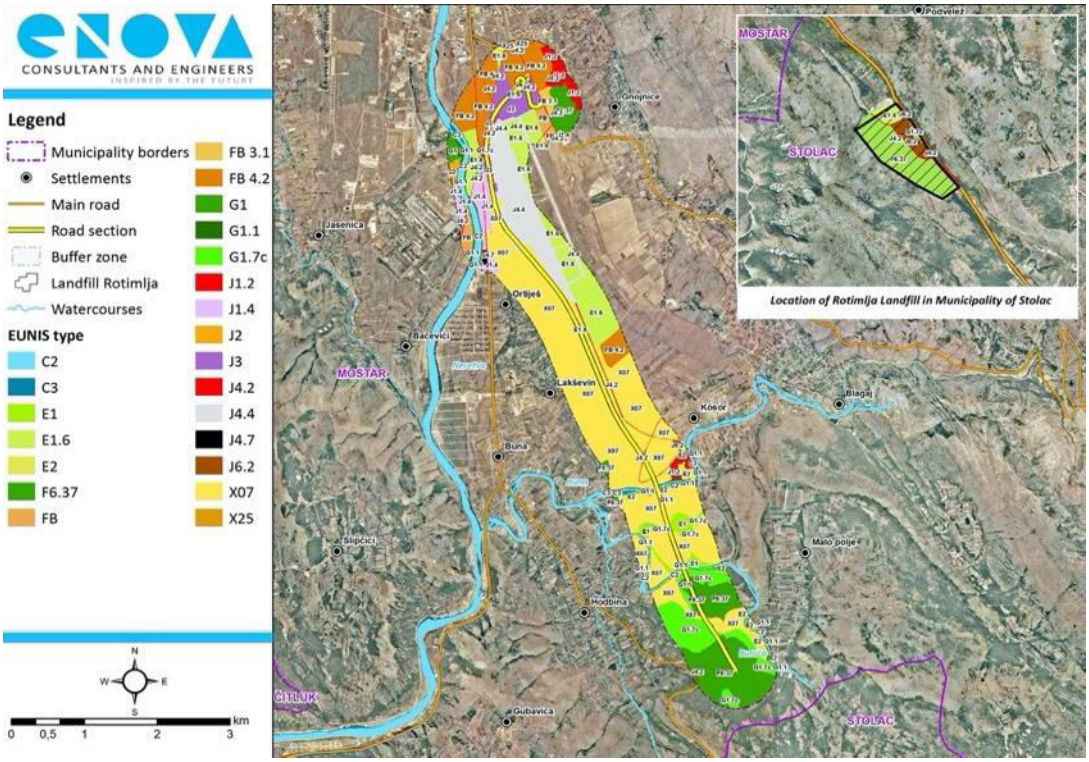


Figure 33: Map of EUNIS habitat types in the surveyed area (a)

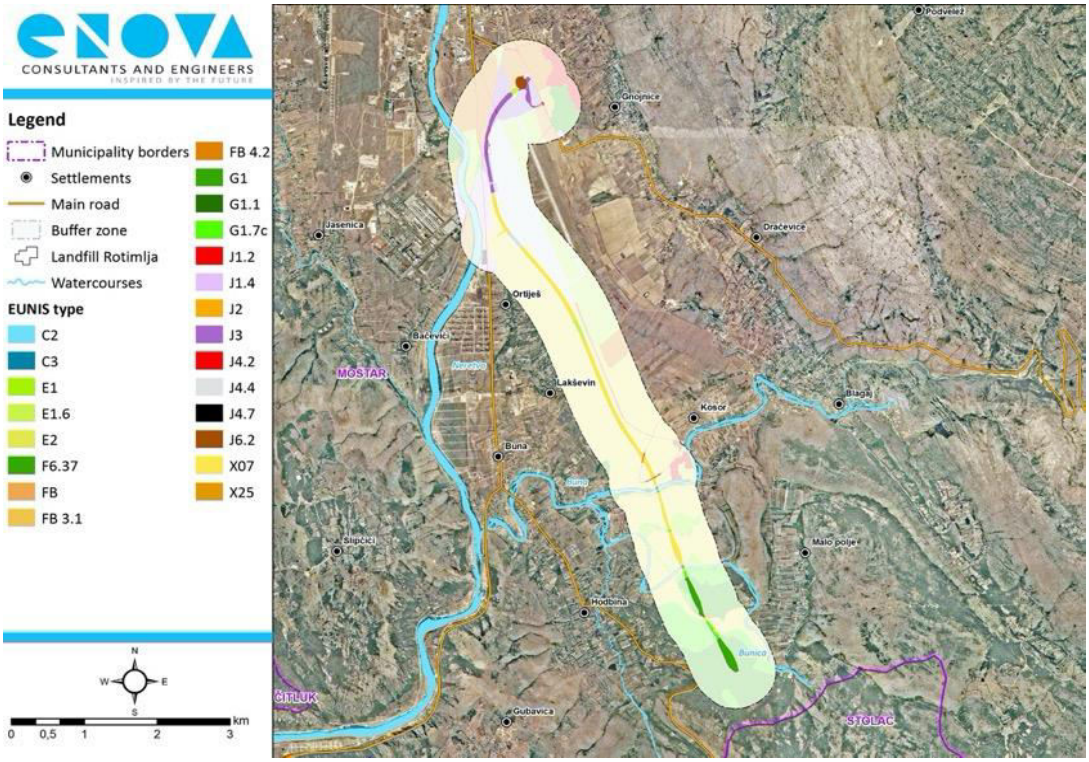


Figure 34: Map of EUNIS habitat types in the project footprint zone (b)

During the survey, **no sensitive or Annex I habitats from Habitat Directive or *priority habitats from Habitat Directive were found.** Having in mind that the southernmost part of the motorway passes through potential Natura 2000 site Buna-Bunica, the findings from the previous projects have been reviewed and included in this report. As already mentioned, according to the results of the Support to implementation of the Birds and Habitats directives in Bosnia and Herzegovina project, the following habitat types may be found in area of preliminary Natura 2000 site Buna-Bunica:

- 3270 Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation
- 62A0 Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)
- 8140 Eastern Mediterranean screes
- 8210 Calcareous rocky slopes with chasmophytic vegetation
- 8310 Caves not open to the public
- 9250 Quercus trojana woods.

Of these, **only dry grasslands were observed, but without the diagnostic species *Scorzonera villosa*.** Also, the calcareous rocky slopes with chasmophytic vegetation were observed from the distance with binoculars as part of the field work, but not sufficiently studied due to the presence of land mines. It is possible that those habitats are present in the southern part of the surveyed area at Hodbina Hill, but it is necessary to undertake more detailed surveys for final confirmation, after completion of demining activities in these areas.

5.2.3 Flora

During the flora survey, a total of 230 plant species were recorded. The results of the flora survey, with list of species registered at every observation point are given in the Annex A - Annex per each sample points.

The area under the surface running waters (C2) of Neretva, Buna and Bunica and their littoral zones (C3) is characterized by floating and waterside vegetation, dominated by reed canary grass (*Phalaris arundinacea*),

common reed (*Phragmites australis*) and water mint (*Mentha aquatica*). The presence of white water lily (*Nymphaea alba*) was recorded in a slow-flowing part of Bunica stream.

Figure 35: Riverine habitats in the surveyed area (Buna Stream)

Along the riversides, the riparian woodlands (G1.1.) of white willow (*Salix alba*), purple willow (*S. purpurea*) and black poplar (*Populus nigra*) are developed. With increasing distance from the water bodies, those woodlands are replaced by smaller patches of broadleaved deciduous woodland (G1), consisting mostly of field maple (*Acer campestre*) and European hop-hornbeam (*Ostrya carpinifolia*).

The mixed thermophilous woodland (G1.7C) developed in the lower alttitudes of Hodbina Hill and Kajgin Kicin Hill are dominated by Oriental hornbeam (*Carpinus orientalis*), manna ash (*Fraxinus ornus*), downy oak (*Quercus pubescens*) and European hop-hornbeam (*Ostrya carpinifolia*) with smoke tree (*Cotinus coggygria*), prickly juniper (*Juniperus oxycedrus*), European nettle tree (*Celtis australis*), Dalmatian Laburnum (*Petteria ramentacea*), and scorpion senna (*Coronilla emerus*) in shrub layer and black bindweed (*Dioscorea communis*), wild asparagus (*Asparagus acutifolius*) and butcher's-broom (*Ruscus aculeatus*) in the understory.

Figure 36: Thermophilous forest and garrigue at Hodbina Hill

The higher elevations of hills in the surveyed area are covered in garrigues (F6.37) of Jerusalem thorn (*Paliurus spina-christi*), with Mediterranean cypress (*Cupressus sempervirens*) and pomegranate (*Punica granatum*).

Mesic grasslands (E2) developed near the waterbodies are characterized by presence of false oat-grass (*Arrhenatherum elatius*), orchard grass (*Dactylis glomerata*), meadow soft grass (*Holcus lanatus*), creeping bentgrass (*Agrostis alba*), red clover (*Trifolium pratense*) and Erect brome (*Bromus erectus*). The sloped rocky terrain is covered with dry grasslands (E1), goldbeard grass (*Chrysopogon gryllus*), meadow brome (*Bromus commutatus*), mosquito grass (*Dasypyrum villosum*), love-in-a-mist (*Nigella damascena*), three-awn goat grass (*Aegilops neglecta*), thoroughwax (*Bupleurum veronense*), great quaking grass (*Briza maxima*), goldmoss stonecrop (*Sedum acre*), felty germander (*Teucrium polium*), erect brome (*Bromus erectus*), hairy melic (*Melica ciliata*), rough dog's-tail (*Cynosurus echinatus*), European stonecrop (*Sedum ochroleucum*) and hair grass (*Koeleria splendens*).

Figure 37: Dry grasslands with xerophilous species developed on sloped terrain

The subnitrophilous annual grassland (E1.6) developed around the runway of the Mostar International Airport (J4.4) and other airport hard-surfaced areas (J4) that could not be surveyed because of restricted access, is dominated by common wild oat (*Avena fatua*), three-awn goat grass (*Aegilops neglecta*), white laceflower (Orlaya grandiflora), barren brome (*Bromus sterilis*), small burnet (*Sanguisorba minor*), proliferous pink (*Petrorhagia prolifera*), felty germander (*Teucrium polium*) and star clover (*Trifolium stellatum*). Similar composition was observed around the constructed parts of cemeteries (J4.7). The access to the extractive industrial sites (J3) was restricted, but it was observed that nitrophilous dry vegetation was developed there.

The habitat types of the major part of the surveyed area include the mosaics of intensively-farmed crops interspersed with strips of semi-natural vegetation (X07) and domestic gardens of villages and urban peripheries (X25). The crops in these areas include cherries, pomegranates, grapevines, potatoes, raspberries, immortelle, Armenian plums, watermelons, onions, surrounded by remnants of thermophilous woodland (with wild pomegranate *Punica granatum*, downy oak *Quercus pubescens*, field maple *Acer campestre*, Jerusalem thorn *Paliurus spina-christi*). The common agricultural weeds and nitrophilous plants greater burdock (*Arctium lappa*), red poppy (*Papaver rhoeas*), annual meadow grass (*Poa annua*), stinging nettle (*Urtica dioica*), Yellow bristle-grass (*Setaria pumila*), wormwood (*Artemisia absinthium*), and annual fleabane (*Erigeron annuus*), are present.

Figure 38: Mosaic of agricultural and seminatural habitats

The area around the urban and suburban industrial and commercial sites still in active use (J1.4) is dominated by nitrophilous vegetation associated with frequent disturbance (wormwood - *Artemisia absinthium*, rat's-tail fescue - *Vulpia ciliata*, black nightshade - *Solanum nigrum*, prickly lettuce - *Lactuca serriola*, yellow bristle-grass - *Setaria pumila*, couch grass - *Elymus repens*, greater plantain - *Plantago major*, creeping cinquefoil - *Potentilla reptans*) with a number of alien invasive plants: tree of heaven (*Ailanthus altissima*), paper mulberry (*Broussonetia papyrifera*), Canadian horseweed (*Conyza canadensis*), annual fleabane (*Erigeron annuus*), common ragweed (*Ambrosia artemisiifolia*), Johnson grass (*Sorghum halepense*). These associations were also observed around the habitat J2 - low density buildings (i.e. gas stations). The access to the residential buildings of villages and urban peripheries (J1.2) was restricted, but a number of ornamental and lawn plants were observed near the fences: silver wattle (*Acacia dealbata*), catalpa (*Catalpa bignonioides*), perennial ryegrass (*Lolium perenne*) and black medick (*Medicago lupulina*).

The area along roads (J4.2.) is dominated by nitrophilous ruderal vegetation, consisting of a number of "weedy" plants - red poppy (*Papaver rhoeas*), wild mignonette (*Reseda lutea*), European dewberry (*Rubus caesius*), mayweed (*Anthemis arvensis*).

There are several illegal landfills (J6.2) in the surveyed area. Their vegetation is nitrophilous, similar to the one observed along the roadsides, but with more mesophilous species: pliant lettuce (*Lactuca viminea*), Ribwort plantain (*Plantago lanceolata*), Common mallow (Malva sylvestris), Perennial ryegrass (*Lolium perenne*). Invasive alien plant species tree of heaven (*Ailanthus altissima*) and Johnson grass (*Sorghum halepense*) were also observed at these locations.

Figure 39: Illegal landfills with nitrophilous vegetation

The shrub plantations (FB) of rosemary (*Rosmarinus officinalis*) and lavender (*Lavandula angustifolia*), low-stem tree orchards (FB.31) of cherry (*Prunus avium*) and vineyards (FB.42) are intensively managed and have no natural vegetation preserved in the understory.

With regard to literature data on flora of the project area, the most detailed work on the flora of this area, with focus on the urban flora, was done by Maslo (2014) who listed 965 taxa (species and subspecies). However that survey included railway station and private gardens, where numerous ornamental and short-life adventive species were present. Maslo (2014) provides the list of 27 endemic taxa, three of which (*Edraianthus tenuifolius, Petteria ramentacea* and *Tanacetum cinerariifolium*) were found during this survey.

The Environmental impact study for the Corridor Vc motorway Mostar North – South border, done by Civil engineering institute of Croatia (2006) mentions the possible presence of Balkan subendemic species at area of Neretva River: *Sedum orientale* in Neretva river canyon and *Seseli globiferum*, *Asplenium csikii* and *Sedum clusianum* in Buna canyon, as well as endangered *Dianthus liburnicus* (in karst forests), *D. sanguineus* (dry meadows and rocky pastures), *Silene reichenbachii* (karst rocks and rocky pastures), *Helleborus hercegovinus* (karst areas of the Mediterranean), *Cardamine maritima* (rock cracks in degraded forests and shrubs of the Oriental Oak), *Matthiola fruticulosa* (rocks of the Neretva Valley), *Rhamnus orbiculatus* (dry meadows and rocky pastures of the Mediterranean), *Astragalus illyricus* (dry meadows, rocky pastures), *Genista dalmatica* (limestone and dolomite rocks and pastures), *Portenschlagiella ramosissima* (limestone rock cracks), *Moltkia petraea* (limestone rock cracks), *Onosma stellulata* (rock cracks and rocks), *Teucrium arduinii* (rock cracks), *Micromeria croatica* (bottom of canyons and rocks), *Prospero elisae* (dry meadows), *Hyacinthella dalmatica* (rocky parts), *Galanthus nivalis* (along the Neretva River in the Oriental Oak zone), *Gladiolus illyricus* (rocky pastures), *Orchis tridentata* (limestone rock parts along the forest edges), and *Anacamptys pyramidalis* (pastures, light forests, shrubs). The mentioned species have not been found during field surveys implemented as part of this assignment, therefore additional surveys will need to be undertaken preferably during the spring period, with special attention to rock crevices and rock cracks.

During the survey, *Ruscus aculeatus* (VU) and *Petteria ramentacea* (NT) according to the Red List of Flora in FBiH (Official Gazette FBiH, No. 7/14), were found in the thermophilous oriental hornbeam and manna ash woodland in the southern part of the surveyed area. *Ruscus aculeatus* is also listed on Annex V of the Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora), as the species whose taking from the wild can be restricted by European law.

The Balkan endemic species *Edraianthus tenuifolius* (LC) was also found during the field survey.

According to the Environmental impact study for the corridor Vc motorway Mostar North – South border (2006), the sensitive species *Celtis tournefortii*, *Cyclamen neapolitanum*, *Cyclamen repandum*, *Acanthus spinossisimus*, *Galanthus nivalis*, *Orchis simia* and *Orchis spitzelii* can be found in the area of proposed motorway route. Those can possibly be found in the surveyed area as well, so it is necessary to undertake the surveys before the beginning of the construction phase, after the area in the southern part of the surveyed area has been cleared from landmines.

Figure 40-41-42: Butcher's-broom (Ruscus aculeatus), Dalmatian Laburnum (Petteria ramentacea) and Grassy bells (Edraianthus tenuifolius) recorded in the surveyed area

Invasive species have been observed at many locations of the project footprint area and surrounding potential area of influence, where only location without invasive species was Hodbina Hill due to the current natural condition of the ecosystems.

During the survey, the following invasive plant species (according to Maslo, 2016) were found:

- *Ailanthus altissima* (Tree of heaven)
- *Robinia pseudoacacia* (Black locust)
- *Broussonetia papyrifera* (Paper mulberry)
- *Ambrosia artemisiifolia* (Common ragweed)
- *Conyza canadensis* (Canadian horseweed)
- *Erigeron annuus* (Annual fleabane)
- *Sorghum halepense* (Johnson grass).

The above listed invasive species were mostly observed on waste and other disturbed sites, along roadsides, where they form relatively large stands. *Ailanthus altissima* was recorded to be most frequent invasive species and observed at neglected dry grasslands, along the existing local roads edges of degraded natural forest and waterside vegetation (e.g. in the vicinity of the Revigrad quarry).

Figure 43-44: Tree of heaven (Ailanthus altissima) and Paper mulberry (Broussonetia papyrifera) invading the area around the Revigrad quarry and parts of degraded thermophilous forest

5.2.4 Fauna

5.2.4.1 Invertebrates

Both literature review and filed surveys were undertaken with regard to invertebrates. The invertebrate survey was conducted at 10 survey locations along the motorway section as shown on Figure 45, whereas the coordinates of the surveyed points, information on location and general observations (e.g. habitat type or state) are given in Table 16. The research included only the species of conservation concern

For some species, material was sampled for identification in the laboratory. Desk research was undertaken to fill the information gaps and supplement and/or verify the data collected through the field surveys. Consultations with local experts and expert organizations have also been undertaken where appropriate. The project area of influence corresponds to the buffer of 500 m on each side of the motorway and is considered as sufficient for invertebrate fauna. The exception to this are Buna and Bunica streams where special attention should be given to avoiding possible pollution and disposal of material downstream from the construction site and where the area of influence may stretch to much wider and include lower course of Neretva River, if mitigation measures are not implemented.

The detailed results of the invertebrates field survey and literature data are given in Table 2: Field survey results of Annex B: Invertebrates report and below the summary of the main findings is presented

Table 16: The coordinates, location name, general observations regarding sampling points along the Vc corridor

Coordinates		*Sampling point name*	*Toponym*	*General observations regarding sampling points in buffer and motorway zone*
Lon.	Lat.			
17.84446	43.29476	T1 Aerodrom (Mostar Airport)	Aerodrom Mostar	Garrigue with *Paliurus spina christi*
17.83753	43.29928	T2 Vinograd (Vineyard)	Carski vinograd	Vineyard
17.83481	43.28801	T3 Kamenolom (Quarry)	Kadijevici	Abandoned limestone quarry
17.83451	43.27802	T4 Neretva River	Ortijes	Willow, alder and poplar forests along the rivers
17.87374	43.22796	T5 prema Bunici (Towards Bunica Stream)	Malo Polje	Forests and thickets of hornbeam and oak
17.86147	43.25045	T6 Polje	Leke	maintained gardens
17.86389	43.24581	T7 Laks	Kosor	Willow, alder and poplar forests along the rivers
17.85617	43.25408	T8 Laksevine	Laksevine	Garrigue with *Paliurus spina christi*
17.86346	43.23849	T9 Kamenjara	Gorica	Warm meadows on limestone Garrigue with *Paliurus spina christi*
17.86809	43.23674	T10 Bunica Stream	Hadzialica Kicin	Willow, alder and poplar forests along the rivers

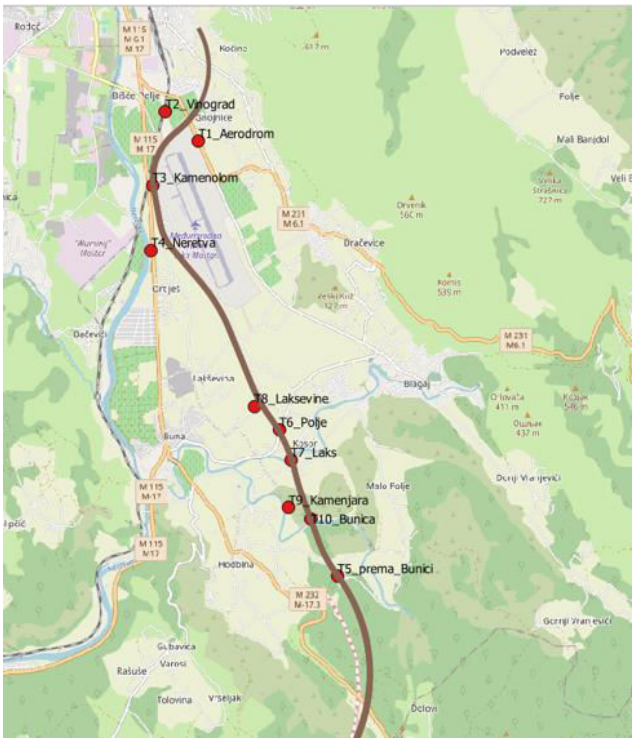


Figure 45: Distribution of invertebrate and herpetofauna survey locations along the motorway route

In total, the data on the presence of 16 species of national and/or international conservation concern in the project area were gathered, one of which was found during the field survey (*Austropotamobius pallipes*), while additional two were previously found by the author[58] near the buffer zone (*Zerynthia polyxena* and *Euplagia quadripunctaria*). In addition, suitable habitats for 2 other species (*Lucanus cervus* and *Cerambyx cerdo*) that have some level of national and/or international protection were also found, but due to time restricted field research these habitats could not be surveyed in more details to confirm species presence. This number is probably higher, but the survey needs to include more time and additional seasons. Suitable habitats for species *Z. cerisy, Z. polyxaena* and *L. dispar* have been found during field surveys, represented by wet meadows and grasslands along Buna and Bunica streams. Based on the data collected thorugh habitat mapping, the spatial distribution of grassland habitats and wet meadows is determined, as shown on Figure 46 below.

Among the species found or previously known for the area, *Austropotamobius pallipes, Lucanus cervus, Cerambyx cerdo, Lycaena dispar* and *Euplagia quadripunctaria* are the species of the Annex II of the Habitats Directive and important for the establishment of Natura 2000 Network. The motorway is planned on the territory of one of proposed Natura 2000 sites - „Buna-Bunica“ site, as shown on Figure 59. In addition to Large Copper (*Lycaena dispar*), already mentioned in Natura 2000 documents for this site, White-clawed Crayfish (*Austropotamobius pallipes*) is found to be present in both streams Buna and Bunica, while potential habitats for several other Natura 2000 species were found during this study, including European stag beetle (*Lucanus cervus*), Cerambyx Longhorn (*Cerambyx cerdo*) and Jersey tiger (*Euplagia quadripunctaria*).

It means that further research, as well as special measures and activities for the conservation of identified Natura 2000 species and their habitats are needed.

[58] Refers to the individual previous surveys of the project area conducted by the engaged invertebrate expert Dejan Kulijer

White-clawed Crayfish (*Austropotamobius pallipes*), as well as other nationally rare and threatened species, that inhabit Buna and Bunica streams, are among the most sensitive species. It is important that habitats of these species are preserved and that possible negative influences on the construction sites or downstream parts of the watercourses, e.g. substrate deposition, water pollution or other water disturbances, are mitigated.

Other valuable habitats with regard to invertebrates include woodlands and rocky grasslands in the southern hilly part of the impact area (between Buna and Bunica streams and especially south of Bunica up to the Kvanj tunnel). Particularly slopes south of Bunica Stream with preserved woodland habitats that are important for saproxylic species, e.g. saproxylic beetles *Lucanus cervus* or *Cerambyx cerdo* that inhabit the wider area, but could not be confirmed during this short survey in the project impact zone.

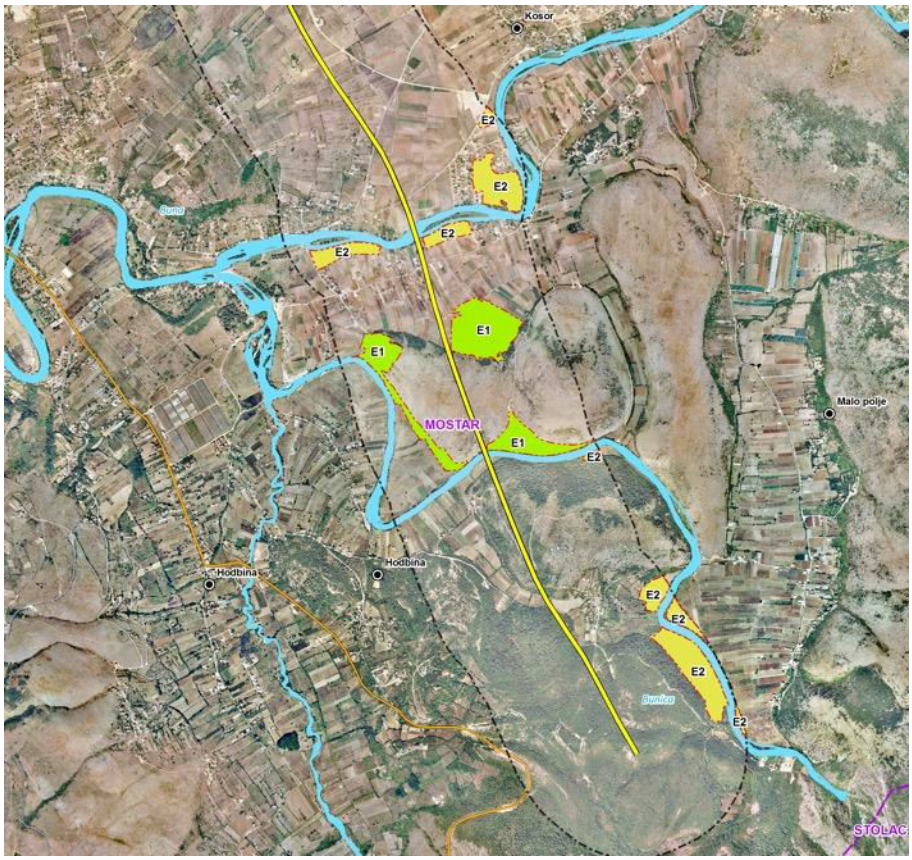


Figure 46: Spatial distribution of appropriate habitat of Z. cerisy, Z. polyxaena and L. dispar to be avoided during construction

5.2.4.2 Fish

Regarding the fish species of the project area, *desk research* was undertaken to analyze the relevant literature (e.g. previous and ongoing assessments, papers and reports) and has been reviewed with regard to presence of ichthyofauna species of conservation concern in the project area, as well as the ecological conditions of the project area and area of influence.

Having in mind the motorway route crosses Buna and Bunica streams over two planned bridges, project area of influence and potential impacts with regard to ichthyofauna may stretch downstream of both streams even to the Neretva River, if mitigation measures are not implemented. Special attention should be given to avoiding potential pollution (e.g. spillages of hazardous substances), avoiding disturbance of riverbed and

disposal of material downstream from the construction site, as well as maintaining the same conditions of physical-chemical parameters of watercourses.

The Neretva river basin is distinguished by a very large number of endemic fish species. Ichthyofauna of this river is very diverse, with large number of autochthonous and endemic species. Numerous fish species which live in this area have a very narrow and limited area of distribution, and therefore they are classified endangered on the IUCN Red List. Considering the very rich fish fauna, the Neretva river basin, together with four other areas in the Mediterranean Sea basin, represent centers of endemism in the Mediterranean and Europe. These centers of endemism are distinguished by the largest number of endangered freshwater fish.

Fish are very sensitive to changes in their aquatic habitats. For these reasons, the structure and composition of fish populations have been for a long time used as indicator of the water quality.

Table 1: Desk survey results of the Annex C-1: Fish (Osteichthyes) report provides the detailed list of fish species identified by previous surveys and literature data, whereas below the summary on main findings is presented.The results of comprehensive literature review which has included all relevant and reliable data sources indicate that in the investigated area lives 21 fish species from nine families: Cyprinidae (9), Salmonidae (5), Cottidae (1), Anguillidae (1), Gasterosteidae (1), Centrarchidae (1), Clupeidae (1), Poeciliidae (1), and Mugilidae (1).

Potential Natura 2000 site Buna – Bunica (BA 8200008) is found within the investigated area with an area of 7.95 km^2. Based on the findings collected during this initiative, important fish species are present in the Buna, Bunica and Neretva River: *Salmo marmoratus* (Marble trout), *Salmothymus obtusirostris oxyrhinchus* (Softmouth trout, Adriatic trout), and *Squalius svallize* (Adriatic dace).

The results of the fish desk study indicate the presence of species enlisted in the Red List of FBiH as given in Table 17. The largest number belongs to the LC category; however, 3 species are classified as CR, 2 as endangered and 1 VU species.

With regard to IUCN Red List, one species is classified as CR, 1 species is classified as EN, 2 species are classified VU and 1 species is classified as NT. Considering the conservation status in line with the Habitat Directive, 3 species are listed on Annex II: *Salmo marmoratus* - Marble trout, *Rhodeus sericeus amarus* - European bitterling, *Cottus gobio* – Bullhead.

Table 17: Fish species in the IUCN Red List categories

The IUCN category	*IUCN RL*	*FBiH RL*
Critically endangered (CR)	**1 species:** ▪ *Anguilla anguilla* - European eel	**3 species:** ▪ *Anguilla anguilla* - European eel ▪ *Salmo marmoratus* - Marble trout ▪ *Salmothymus obtusirostris oxyrhinchus* - Softmouth trout
Endangered (EN)	**1 species:** ▪ *Salmothymus obtusirostris oxyrhinchus* - Softmouth trout, Adriatic trout	**2 species:** ▪ *Chondrostoma knerii* - Dalmatian Nase ▪ *Gasterosteus aculeatus* – Burnstickle
Vulnerable (VU)	**2 species:** ▪ *Squalius svallize* - Adriatic dace ▪ *Chondrostoma knerii* - Dalmatian Nase	**1 species:** ▪ *Squalius svallize* - Adriatic dace
Near threatened (NT)	**1 species:** ▪ *Samarutilus rubilio* - South European roach	-
Least Concern	13	10

(LC)		

The term guild indicates species which play a similar role in the community. Grouping of fishes in ecological guilds[59] has significantly improved our understanding of the potential human impacts on fishes and their respective communities. In fact, these groupings represent a solid basis for biological assessment based on the living communities. Comprehensive analyses of preferences of fish communities for tolerance, habitats, reproduction, nutrition and migration have been carried out in order to evaluate potential negative impacts of the construction of the motorway on the fish communities (as given in Table 3 of the Annex C-1: Fish (Osteichthyes) report).

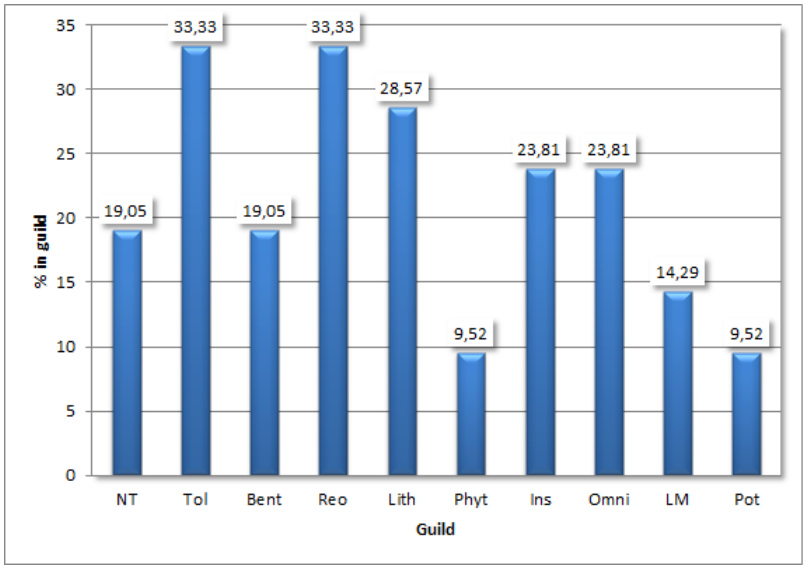


Figure 47: Ecological groups – guilds of fish[60]

Certain fish species and fish communities depend on the ecological characteristics of their aquatic habitats which support their biological functions.

Capacity of tolerance

Assessment of the level of tolerance of species on human pressure related to the physical-chemical water degradation is very often used in ecological assessments. Intolerant species will be present in suitable conditions, but absent in the case of disturbances, when tolerant species will dominate/survive.

Intolerant species in the research area are: Bullhead - *Cottus gobio*; Brown trout - *Salmo trutta m. fario*; European bitterling - *Rhodeus sericeus amarus*, and grayling - *Thymallus thymallus*. In the group of tolerant species belong 33% of all fish species in the research area. Those species are: Carp - *Cyprinus carpio*; Pumpkinseed - *Lepomis gibbosus;* Bleak - *Alburnus alburnus*; European eel - *Anguilla anguilla*; Three-spined stickleback - *Gasterosteus aculeatus;* Mosquitofish - *Gambusia affinis* and Prussian carp - *Carassius gibelio*.

Habitat guilds

[59] Term guild indicates species which play similar role in the community.

[60] **Legend**: NT – intolerant; Tol – tolerant; Bent – benthic; Rheo – rheophilic; Lito – lithophilic; Phyto – phytophilic; Ins – insectivorous; Omni – omnivorous; LM – long migration; Pot – potamodromous

Every fish species has optimal habitat conditions, which results in the changes in the structure along longitudinal profile in watercourse. Size, vitality, and spatial distribution of species depend on both quantity and quality of their respective habitats. Structure of this guild is based on only three groups:

- rheophylic (all life stages are in running waters),
- eurytopic (all life stages could be either in running or standing waters), and
- limnophilic (all life stages in standing waters).

The results of the analyses indicates that in the investigated area live **rheophilic species,** with regard to habitat type: Eurasian minnow - *Phoxinus phoxinus*; Bullhead - *Cottus gobio*; Brown trout - *Salmo trutta m. fario*; Rainbow trout - *Oncorhynchus mykiss*; Bleak - *Squalius cephalus albus*; Twaite shad - *Alosa fallax nilotica*, and Grayling - *Thymallus thymallus*.

Trophical guilds

Insectivorous species in the investigated area are: Bullhead - *Cottus gobio*; Brown trout - *Salmo trutta m. fario*; Pumpkinseed - *Lepomis gibbosus*; Adriatic dace - *Leuciscus svallize*, and Grayling - *Thymallus thymallus*.
Omnivorous species are: Carp - *Cyprinus carpio*; Bleak - *Alburnus alburnus*; European chub - *Squalius cephalus albus*; Burnstickle - *Gasterosteus aculeatus*, and Prussian carp - *Carassius gibelio*.

Reproductive guilds

Fish species express various form of reproduction. Reproductive guilds are used for assessment of changes in the structure of fish communities, which is connected with changes in availability of various habitat types. Lithophyle guild (spawning on the gravel) and phytophyle guild (spawning on the plants) are used as a measure of the reproductive structure of fish communities, because availability and suitability of specific ecological niches or spawning substratum decreases with the level of degradation. This could have significant indirect impacts on the reproduction of species which have specific demands for spawning. Therefore, loss or compression of gravel results in the reduction of lithophyle species in the community. **Lithophilic species** in this area are: Eurasian minnow - *Phoxinus phoxinus*; Bullhead - *Cottus gobio*; Brown trout - *Salmo trutta m. fario*; Rainbow trout - *Oncorhynchus mykiss*; European chub - *Squalius cephalus albus*, and Grayling - *Thymallus thymallus*. Phytophilic species are: Carp - *Cyprinus carpio*, and Prussian carp - *Carassius gibelio*.

Life strategies: migration guilds

Ecological guilds for migration are important since absence of migratory species, from locations where they used to live, indicates bottleneck at one or at all stages of their life cycle, probably caused either by the environmental changes or by presence of obstacles on migratory routes. Migratory species, therefore, could serve for the assessment of both longitudinal and lateral connectivity in the river system which is necessary for normal functioning of fish communities. Migratory behaviour of fish species in watercourses could be divided into two main types: potamodromous (in the river system of continental waters) and diadromous (freshwater – sea). The results of the assessment indicate that in the research area live two potamodromous species: Softhmouth trout - *Oncorhynchus mykiss* and European chub - *Squalius cephalus*. Variations in the abundance of their populations could be recorded depending on the season, since in the spawning season these species could migrate towards mouths of the tributaries and into tributaries itself.

Ecological guilds and metrics

The results of the analyses of ecological guilds have shown that in the research area dominant role play tolerant species (33.33%), which are less sensitive to the physical and chemical degradation of water, unlike intolerant species, which have demands for higher oxygen supply and preference to the rheophilic conditions. Significant part (33.33%) of all recorded species spends all life stages in the running waters (rheophilic species).

Considering feeding habits, here dominant role plays insectivorous (23.81%) and omnivorous species (23.81%). **Significant part of fish species (14.29%) belong to the group of long migratory species.**

5.2.4.3 Herpetofauna

The field survey of the area from the Mostar South interchange near Mostar Airport to Hodbina Hill has been undertaken during 08-11 June 2020 with regard to presence of herpetofauna. Field work was based on the methodology of active data collecting, the presence of species has been recorded and the frequency of findings for groups of amphibians and reptiles. The herpetofauna survey was conducted during the same time as invertebrate survey, at 10 survey locations along the motorway section as shown on Figure 45. The coordinates of the surveyed points, information on location and general observations (e.g. habitat type or state) are given in Table 16.

At each sampling point, a 400-meter transect perpendicular to the corridor line was made and individuals were actively searched 2.5 meters wide on each side.

The detailed results of the herpetofauna field survey and literature data are given in Table 2 and Table 3 of Annex C-2: Herpetofauna (Amphibians and Reptiles) report and below the summary of the main findings is presented.

During the field research, and according to the literature data, no critically endangered or endangered species of amphibians and reptiles were recorded. During the field survey conducted as part of this assignment, five species from the Habitat Directive and strictly protected species listed in Annex IV were recorded on site. In addition to these findings, ten species of amphibians and reptiles that are listed in Annexes II-IV of the Habitat Directive have been recorded in previous studies, as highlighted in Table 2 and Table 3 of Annex C-2: Herpetofauna (Amphibians and Reptiles) report. During field survey, the presence of two species of frogs, (*Bufo bufo* and *Pelophylax ridibundus*), was confirmed at Bunica Stream.

Regarding the reptiles, the field observation confirmed that the area of the planned motorway includes rocky habitats with vegetation of garrigue that are suitable for the following reptiles: viper (*Vipera amodytes*), spike (*Platyceps najadum*), and lizards, of which the sharp-headed lizard (*Dalmatolacerta oxycephala*), the Dalmatian wall lizard (*Podarcis melisellensis*) and the brown lizard (*Algyroides nigropunctatus*) are endemic to the Western Balkans, as well as the Hermanns Tortoise (*Testudo hermanii*).

The presence of *Vipera amodytes, Platyceps najadum, Dalmatolacerta oxycephala* and *Algyroides nigropunctatu*s species along the motorway route is expected, but so far these species have not been found through field survey conducted as part of this Project. The habitats of the aforementioned reptile species are widely represented along the investigated route. The mentioned e species are not steno-endemic, so that the eventual loss of individuals is compensable by the subsequent colonization.

All species of reptiles found in the field survey or identified in previous studies are fast moving organisms (able to run away from danger), except The Hermann's Tortoise which is the common species in the wider area of the planned project.

5.2.4.4 Ornithofauna

The ornithofauna field survey of the project area and preliminary determined buffer of 1000 m diameter of the planned motorway on the section Mostar South – Tunnel Kvanj were undertaken during two days, on June 4 and 6, 2020. This period covered the nesting aspect, while only a smaller number of birds have been observed on migration or vagrant. The field surveys were conducted in the early morning, 4-11 am, as well as from 4-8 pm, and they coincided with the maximum activity period of birds, which facilitated the detection of species, and justifies the relevance of the data.

The field survey has been undertaken by the transect method over the project footprint area and surrounding area considered as preliminary buffer, as well as counting birds on the surface from the census point (Gregory, et al., 2004). The counting has been undertaken by a Minox spyglass, magnification 20x45, and Vortex Crossfire 10x50 and Vortex Crossfire 8x50 binoculars. Photographs were taken with Nikon p900 camera and optical zoom 83x was used. Data recording was done with the NaturaList application which enables precise georeferencing of filed survey findings. For the assessment of the size of the nesting population of single species in Bosnia and Herzegovina, and for the valorisation of the given area, the internal data base of the Ornithological Society "Nase ptice" was used, previously conducted for the European Breeding Birds Atlas 2 during the period 2013-2017. For identification of species, Collins Bird Guide, 2nd edition has been used, while for bird songs the online data base www.xseno-canto.org has been used.

The field survey area has been divided into 6 segments and 13 micro-locations, as showed on the Figure 48 and in Table 18 below:

Table 18: Observed ornithofauna locations with coordinates

No.	*Location*	*Latitude*	*Longitude*
1	Gnojnice Donje	43°17'58.05"N	17°50'28.77"E
2	Aerodrom	43°17'34.99"N	17°50'13.55"E
3	Neretva River 1	43°17'18.45"N	17°49'58.66"E
4	Neretva River 2	43°16'40.43"N	17°50'2.52"E
5	Ortijes	43°16'16.17"N	17°50'50.09"E
6	Laksevine	43°15'57.53"N	17°51'8.81"E
7	Kosor	43°15'10.73"N	17°51'45.33"E
8	Buna Stream	43°14'40.87"N	17°51'51.62"E
9	Malo Polje	43°13'25.27"N	17°53'1.63"E
10	Hadzajlica Kicin	43°14'20.71"N	17°52'11.42"E
11	Bunica Stream	43°14'11.58"N	17°52'5.33"E
12	Kajgin Kicin	43°13'41.08"N	17°52'29.94"E
13	Hodbina	43°13'13.12"N	17°52'43.70"E

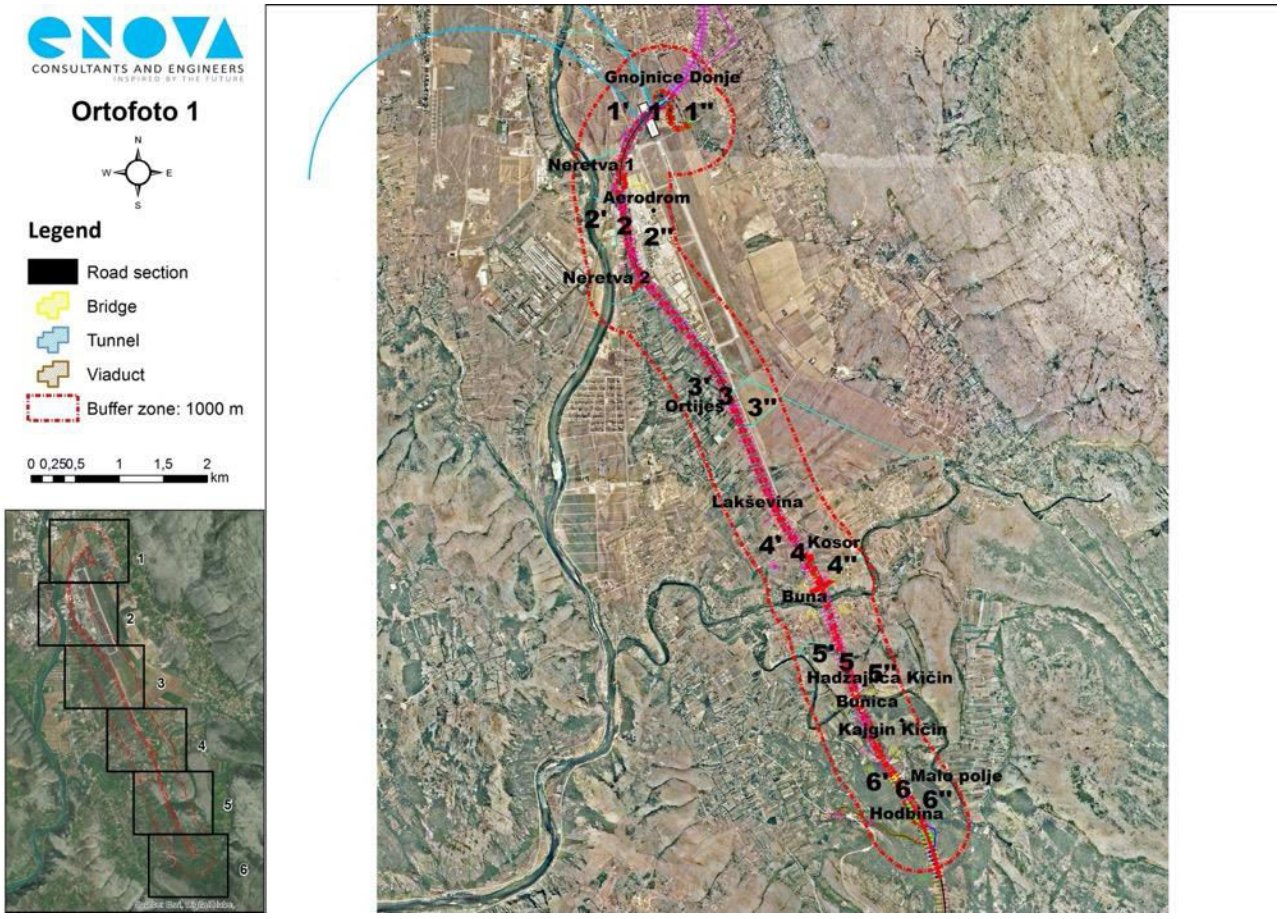


Figure 48: Spatial distribution of surveyed locations along the motorway route and project area of influence

As previously stated, during undertaking the ornithofauna field surveys the Consultant experienced several assumptions and limitations as elaborated in Chapter 5.1. However, in spite of the limiting factors, a satisfactory coverage of terrain was achieved in different parts of the surveyed area and different habitat types have been covered. The data on the species composition, sizes of populations, their distribution, and endangering factors for the nesting population have been collected.

With regard to the project area of influence for bird species, the appropriate area of assessment of the impact to bird populations is to be expanded in line with the findings during the survey. In settlement Ortijes, 750-800 m from the planned motorway route three big colonies of Sand Martins (*Riparia riparia*) of 5.000-6.000 pairs have been observed, and around 180-200 pairs of Bee-eaters (*Merops apiaster*), while another 1.500-2.000 pairs of sand martins nest in four colonies in settlement Kocine (Figure 49), which is more than a half of the total nesting population of this species in Bosnia and Herzegovina. Preliminary findings of this survey show that the main feeding areas of sand martins are the rivers Neretva and Buna and Bunica streams, and open grasslands from Ortijes to Kosor. This species feeds on insects while flying, often low above the ground, therefore collision with speeding cars is rather certain and will require specific mitigation – i.e. protective bird panels to avoid collision. By placing protective panels along the motorway, birds that feed low above the ground will rise to a higher height, thus avoiding fatal side collisions with cars.

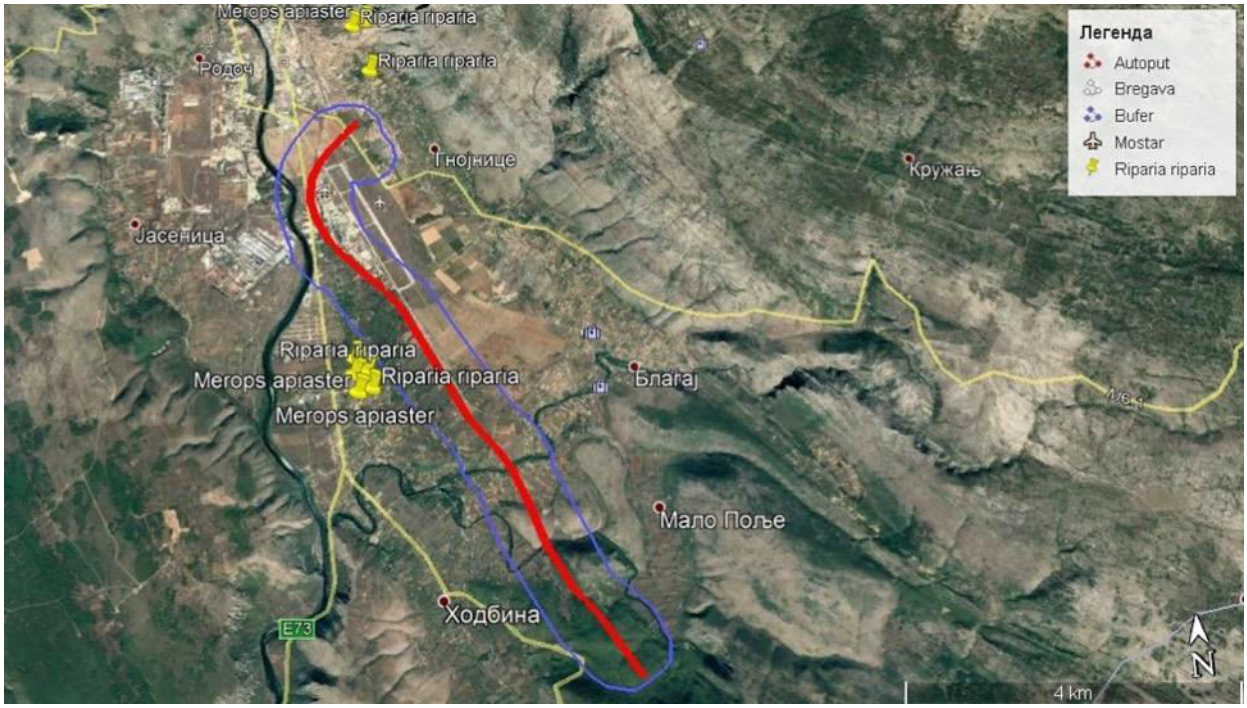


Figure 49: Colonies of sand martin and bee-eater observed in Ortijes and Kocine settlements

According to the previous environmental impact assessment studies, the ornithofauna of the researched area consists of 163 bird species, without indicating authors, list of species, or bibliography on the basis of which the mentioned number of species was established. The review of the relevant ornithological literature for the given area showed significant deviations in the number of registered species in the comparison with the field survey. Furthermore, the studies list shoals, sandbars, reeds, and water surfaces as the main bird habitats, which have not been observed.

Upon the review of all types of habitats on the researched area, water surfaces were not evidenced on site, with the exception of small parts of waterways of the streams Buna and Bunica where Bridge Buna and Bridge Bunica are planned to be constructed. As highlighted in previous studies, nesting of the endangered species of the bittern (*Botaurus stellaris*) and Ferruginous Duck (*Aythya nyroca*) were highlighted as the most important species. Great bittern nests only in large reed complexes, and white-eyed pochard inhabits larger lakes and wetlands under the open water surfaces deeper than 1 meter. Since on the given area neither these types of habitats nor the habitats of the highlighted species were registered, it was concluded that the previous study holders did not conduct field ornithological researches, so these data can be scoped out.

The scarce available literature overview of the bird species of Blagaj and its surroundings was developed during the researches on birds in the 1980s (Bem, 1990). After analysis of project documentation and literature review, short field researches were organized, with the intention of confirming the bibliographic data on ornithofauna of the given area, confirming the nesting ornithofauna, mapping the nesting territories of all species along the planned route of the motorway as well as the buffer zone, and assessing the impact on the ornithofauna of the project area.

Table 2 of Annex C-3 provides the overview of ornithofauna in tabular format and assesses the presence of species from previous studies as well. **The total of 6,345 bird individuals within 78 bird species have been found on site** during the two-day field survey of ornithofauna along the motorway route as well as in the

buffer zone. **31 more species have been registered in the literature.** No species listed as CR and EN on the global IUCN Red List ware registered.

Out of the total of 109 species registered both in literature and during field surveys, Pygmy Cormorant (*Phalacrocorax pygmaeus*) and Fieldfare (*Turdus pilaris*) are listed as CR on FBiH Red List. Pygmy Cormorant is nesting species of Hutovo Blato wetlands and uses streams Buna and Bunica and Neretva River for food and rest, and this species will require protection measures to be applied with regard to water quality of the rivers and preservation of riverine habitats. The presence of Fieldfare is confirmed only during the winter, while in the given project area it does not form nests.

Out of the 7 species listed as EN in FBiH Red List whose presence has been determined based on the literature, only Pallid Swift (*Apus pallidus*) is registered during the field survey. The Pallid Swift nests on cliffs and higher buildings that may be found outside the area of influence since this species is feeding with high-flying insects. Hence, the construction works and motorway itself would not reflect on the population of this species, therefore no specific mitigation is needed for this species.

Out of the total number of registered species, 21 listed are on European Birds Directive Annex I. Out of these, 6 species are nesting within the buffer zone and only one species, Red-backed Shrike, is found to be nesting on the motorway route. However, Red-backed Shrike is very common in all open and mosaic habitats throughout BiH. As a mitigation measure, the works should be carried out outside the nesting season, which for this species it is from May to the end of June).

Habitats along the future motorway were formed under the significant influence of anthropogenic factors. There are very few natural habitats, which also affects the composition of the species per visited locations. Most of the recorded nesting bird species in the surveyed area are common and numerous in the territory of Bosnia and Herzegovina.

The most important species in the study area found during the field surveys is Short-toed Lark (*Calandrella brachydactyla*) (Figure 52). There are not more than 50-200 breeding pairs of the Short-toed Lark in whole BiH (according to the estimates of the Ornithological Society „Nase ptice“/ "Our Birds“) out of which 24 territories have been registered (i.e. around 50% of the breeding population of BiH) in the buffer zone in settlement Laksevine (Figure 50), 50-500 m away from the motorway route. Since the abovementioned location is one out of the two breeding sites of the Short-toed Lark in BiH, the species will be endangered by the construction of the motorway, unless general mitigation related to construction site organisation is applied. Specific mitigation measures will need to be applied for this species, e.g. **to preserve the existing grassland habitats in a given locality** as shown in the Figure 51. The species nests in the grass habitat on the ground. During courtship, territorial males rise high in the sky with a constant song and descend near the nest. The species does not have a wide range of daily activities, so no collision with cars in traffic is expected but bird protective panels that are required for Bee-eater and Sand martin may also act as noise barriers for Short-toe lark, although the species of this particular site seem to be **noise resilient** since significant noise levels are already emitted due to airplane traffic (this could be considered as the local adaptation).

The species Short-toed Lark is usually found in deserts and requires open sandy or earth substrate with rare grass patches, so BiH is sub-optimal habitat. BiH is considered to be the most north-western border of the areal of this species. During field surveys as part of this assignment (surveying e.g. 2 km x 1 km of surface), the whole area on the left of the project area have been assessed as an appropriate habitat, outside of the 500 m that corresponds the grass habitats towards the Blagaj village.

Second finding of the Short-toed Lark population, collected during implementation of the project European Breeding Bird Atlas (2013-2017), is approx. 60 km south from the project area (Popovo polje karst field between Zavala and Trebinje Town).

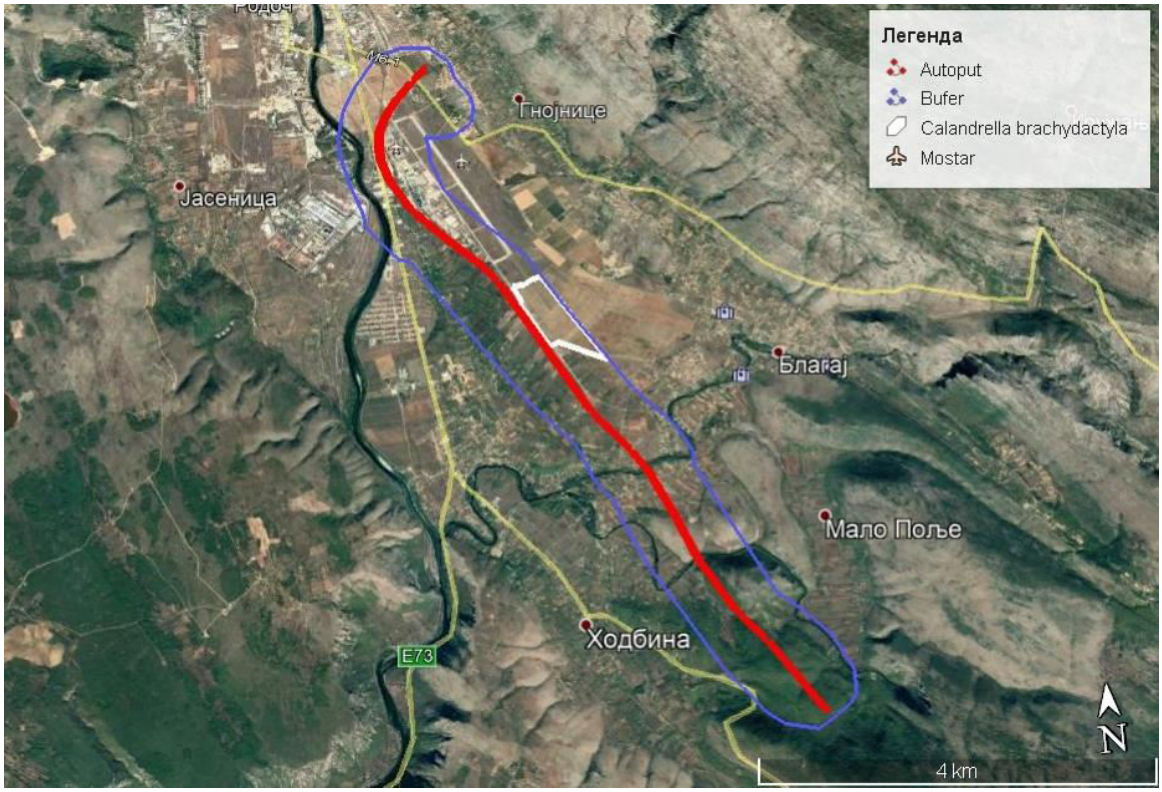


Figure 50: Spatial distribution of found nesting territories of the Short-toed Lark (Calandrella brachydactyla) in the surrounding area of the motorway route in settlement Laksevine

Figure 51: Spatial distribution of appropriate habitat of Short-toed Lark to be avoided during construction

Figure 52: Short-toed Lark (Calandrella brachydactyla) (nesting territories observed at segment 3'' 50-70 m away from the motorway route in settlement Laksevine)

In addition to the Short-toed Lark, Sand Martin (*Riparia riparia*) will require specific mitigation in order to avoid potential significant impact of the motorway. Five largest colonies of this species in BiH (Fig. 4) with the total of 6.000- 8.000 breeding pairs, are located 800-1,050 m from the motorway route (Figure 53). Sand Martin feeds in flocks, in large numbers, catching insects often low above the ground as a result of which birds may be killed or injured in a collision with motor vehicles. Six individuals of the Sand Martin were found roadkilled on the existing military runway in the segment 3" (Figure 54) even though this road is rarely used and 10 more individuals of the same species were found dead on the main road M17 during this field survey. It can be assumed that the number of roadkilled sand martins could be even bigger due to the planned motorway section. Therefore, specific mitigation measures (e.g. protective bird panels shall be constructed on both sides of the motorway) in this area.

Figure 53: Spatial distribution of Sand Martin (Riparia riparia) colonies in settlement Ortijes, 800-1050 m from the motorway route

Figure 54: Example of Sand Martin (Riparia riparia) individuals killed by traffic on existing roads

5.2.4.5 Bats

Site investigations with regard to presence of bat surveys have been carried out for two consecutive nights (10th and 11th of June 2020). The two-day observations during late spring season is not a referent for the scientific conclusion, but these data may be used as reference to avoid potential important bat sites and to minimize the future damage to bat populations at the early stage of project planning. The used recording time is not approved by EUROBATS or any other scientific criteria. This recording was conducted at the level of preliminary survey of the area to obtain necessary data for the project and inputs for much needed further bat species monitoring. **N**o capturing of bats by using mist nets has been undertaken. Survey time did not allow any mist net positioning because special research permission from the Federal Ministry of environment and tourism is needed for these activities.

Although the whole area has been mostly mine - cleaned, there are still areas at risk of mines and UXOs, especially in southern part of the project near Hodbina hills.

Records of bats echolocation signals have been collected at ground level, using a DODOTRONIC ULTRAMIC 250K connected to a TOSHIBA SATELLITE l750-1XV laptop. For recording and real-time analyses, the software: SeaWave - Sound Emission Analyser Wave edition developed by CIBRA and AEST has been used. Identification was based on Walters et al 2012, plus additional literature specific for social calls. Because of site morphology, instead of a classical linear transect approach it was opted for selecting a finite number of observation areas ("Point counts" method based on Barataud 2015) covering different ranges of habitat conditions across the investigated site and in a buffer zone up to about 1 km around the site chosen by the expert (Rodrigues et al., 2014).. Spatial distribution of recording points is provided in Figure 55, while for coordinates and description references are given in Table 19.

Figure 55: Observation points (T1 - T7) – Source: Google Earth

Table 19: Coordinates and short description of bat-detector monitoring point

Location	*N*	*E*	*Description*
T1	43°17'46.52"	17°50'41.08"	The most northern point of the project area and it is situated on the frequent road (M-6.1 Mostar - Nevesinje) near the settlement of Gorica.
T2	43°17'11.57"	17°50'12.78"	Kadijevici settlement near the Mostar Airport entrance. The whole site was modified by anthropogenic activities.
T3	43°15'50.57"	17°51'11.97"	Agricultural area of Bisce Polje. The area is cultivated mostly with wine yards and orchards.
T4	43°14'50.10"	17°51'42.64"	Near Kosor settlement and Buna stream. The area is mostly consisted out of grassland with some tree vegetation near Buna stream.
T5	43°14'43.41"	17°51'27.05"	Located between Buna and Bunica streams. It is mostly covered with orchards and other agricultural land, with exclusion of some tree vegetation near both Buna and Bunica streams.
T6	43°13'41.41"	17°52'29.06"	Near settlement of Brijeg. The dominant vegetation is orchards and scrubland mixed with trees.
T7	43°14'2.72"	17°52'46.68"	Located near Bunica stream and near the cave Velika pecina with mostly agricultural and scrubland area. Mixed habitat represented partially with hills, fields and river.

Table 20 provides an overview of the exact time after sunset for each measurement and the average time for each location. Total recording time per point was app 20 minutes. In total, per day it was recorded 2h 30min. of material. Site for the recording was chosen based upon few following criteria:

- at least 1 site in settlement or near settlement;
- at least 1 site on frequent road;

- at least 2 sites on river coastline;
- at least 2 sites in agricultural areas;
- at least 1 site at forest or scrubland habitats.

In total 7 sites were chosen (Figure 55) encompassing the motorway route and motorway corridor (1000 meters) from the motorway borders in both directions) and decision by the bat species expert on site.

Table 20: Recording time delay from sunset (h:mm format)

Point	*Day*	
	1	**2**
T1	0:30	2:30
T2	0:50	2:10
T3	1:10	1:50
T4	1:30	1:30
T5	1:50	1:10
T6	2:10	0:50
T7	2:30	0:30

Roost sites inspection: Based on the surveyor's previous experience, already known roost sites and potential roost sites have been investigated in order to assess their importance. Field inspection was aimed to record the presence of bats or other indirect signs such has bat's guano or bones, to estimate the population and the use of the site (e.g. hibernation, maternity etc.). These activities have been performed by visual identification supported by photographic documentation. Only one site, the cave Velika pecina has been inspected for roosts and no bat species were found or any other bat traces.

Figure 56: Entrance to Velika pecina cave – view from the local road (Photo: Admir Aladzuz)

Monitoring of bats by ultrasound detectors have been performed from 10.06.2020 until 11.06.2020. Seven recording points (Figure 55) were investigated all in different habitat conditions.

During survey with ultrasound detector, at least 5 genera have been detected: *Myotis* Kaup, 1829*, Pipistrellus* Kaup, 1829*, Eptesicus* Rafinesque, 1820*, Nyctalus* Bowdich, 1825 and *Tadarida* Rafinesque, 1814.

With regards to species, the presence of 9 taxon can be confirmed: *Pipistrellus nathusii* (Keyserling & Blasius, 1839)*, Pipistrellus kuhlii* Kuhl, 1817*, Myotis mystacinus* (Kuhl, 1817)*, Myotis blythii* Tomes, 1857*, Myotis dasycneme* (Boie, 1825)*, Eptesicus serotinus* (Schreber, 1774)*, Nyctalus noctula* (Schreber, 1774)*, Nyctalus leisleri* (Kuhl, 1817)*, Tadarida teniotis* (Rafinesque, 1814).

Most active observation points with regard to the presence of bats were points T4, T5 and T6. Moderate active point was point T7 while the points with less activity were points T1, T2 and T3. This was expected with regard to the habitats and also confirmed by the recordings. Bat species probably use Buna and Bunica Streams as important hunting ground. To clearly confirm this, more record data is needed in the future during pre-construction surveys.

With regards to habitats relevant for bats, the dominant habitats are agricultural fields and orchards on north part of the motorway and mixed forest and scrubland vegetation on south part. In its middle part, the motorway cross two streams (Buna and Bunica) with their coast vegetation and partly distributes swamp – like water vegetation. A significance of habitats for bats species in relation with their ecological role is given in Table 21 (from Paunovic et al. 2011).

Bats use different types of roosts, often moving and changing roost depending on the period of the year (summer or winter roosts) and availability of roosts. Typical roosts include underground sites (caves or artificial objects), hollow trees and buildings (especially old).

Based on the field research, there is only **one cave** in the potential area of influence zone of the planned motorway route – the "Velika pecina" in the settlement of Malo polje near Blagaj, **e.g. 700-800 m of air distance east-north-east from the motorway route, therefore this location is unlikely to be impacted by the motorway route.** During field work it was noted that the cave is not deep, and it did not contain any visible bat species or their waste (guano). By the information collected from the local population, some bat species use the cave during the winter period (they can be found in the cracks of the cave). According to the available literature data (Mulaomerovic et al, 2015), the cave was inhabited only by two bird species: *Hirundo daurica* (Laxmann, 1769) and *Sitta neumayer* Michahelles, 1830 which was confirmed by the project team.

The motorway is planned over local settlements and villages which can provide additional potential roost sites. Woodland is mainly present by scrubland, but the region near Buna and Bunica streams and hills near Hodbina and Malo Polje settlements contain the mature woodland, which can be very important for the bat species. In these areas trees as roosting sites are probably playing a great role in mentioned areas, as given in Table 21. More research is needed to prove this scientifically and they should be finished before commencement of construction activities.

Table 21: Habitat significance for bats in relations with different ecological use

	Forest	*Shrubland*	*Grassland*	*Wetlands (inland)*	*Rocky Areas*	*Caves and Subterranean*	*Artificial*
Roosts	High	No	No	High	Moderate	High	High
Hunting areas	High	High	Moderate	High	Moderate	No	High
Flight paths	High	High	Moderate	High	No	No	High
Migration routes	High	Small	?	High	?	No	Small

?) potentially significant but not enough data for assessment (from Paunovic et al. 2011)

There is no official long-term monitoring programme of bat population implemented or supported by BiH or FBiH government bodies or public institutions. Consequently, there is no official public database where information about bat species distribution and population could be retrieved. The only available data on the distribution and status of bats typically are collected by volunteers who are involved in the NGO sector (mostly speleological/caving groups). Among past and ongoing projects, it should be highlighted that in 2013 a large project financed by CEPF (Critical Ecosystem Partnership Fund) was assigned to CKS (Center for Karst and Speleology), an NGO based in Sarajevo. Among other activities, this project collected new field data on bats presence and roost sites in the region of the Neretva river catchment area including the area of Mostar region (Mulaomerovic et al. 2015).

Based on the recent data, 31 species of bats are recorded in BiH (Karapandza et al 2014; Pasic and Mulaomerovic 2016, Babic et al 2018). Although none of these 31 species can be fully excluded, because of the site morphology and habitat distribution, species that are usually strongly associated with water are: *Myotis capaccinii* Bonaparte, 1837, *Myotis dasycneme* (Boie, 1825) and *Myotis daubentonii* (Kuhl, 1817) should be of much more interest for the research area due to the vicinity of the Buna and Bunica streams.

Based on scarce literature data (Presetnik et al. 2014a, Presetnik et al. 2014b, Mulaomerovic et al. 2015, Hodzic et al. 2017 and Rnjak et al. 2017), in the wider of including Velez Mountain, so far 19 species were recorded which belong to the 11 genera known in BiH. Other species may be also present in the region.

The detailed results of the bats field survey and literature data are given in Table 6 and Table 7 of Annex C-4: Mammals - Bats report and below the summary of the main findings is presented.

Based on the data presented in Table 6 and Table 7 of Annex C-4, at least 2 NT species on global IUCN red List assessment and two EN and two VU species from the Red List of FB&H inhabit this area so adequate mitigation measures are needed to avoid any potential long-term negative impacts. The bat species found in the project are also listed on Annex II and/or IV of the Habitat Directive.

Possible adverse impact of motorway on bat populations is expected in whole project area, but the highest is expected on the areas of the motorway route and areas near the route. The southern project area, due to its habitat composition and possible foraging site is the area with potential high risk for bat species, while for other areas the potential impacts is lower.

Considering that similar habitats are not widely available in the surrounding area (especially southern part of the project), disturbance is considered to have a moderate to possible high impact to bats population in the area, especially to their potential roosting sites and migration corridors. Therefore, **an adequate 1-year monitoring on key different habitats** should be undertaken and bat migration corridors, roosting sites and foraging areas should be referenced on maps using GIS software and afterwards, the definitive route changes shall be proposed if found to be required. This is a crucial step for planning of future bat conservation in the project area, that will allow additional mitigation measures to be included during Main Design phase (e.g. micro-alignments of the route), as well as in revised BMP (if required) to avoid any impacts to potential roosting sites and migration corridors of bats. The updated BMP is to be agreed with the EBRD to ensure all requirements of PR 6 will be implemented.

5.2.4.6 Large mammals

Desk research was undertaken to analyse the relevant literature (e.g. previous and ongoing assessments, papers and reports) and has been reviewed with regard to presence of large mammals' species of conservation concern in the project area, as well as the ecological conditions of the project area and area of influence.

The research has sought to collect and analyse all information available in print documents or published on the internet regarding the biodiversity of the area comprising the motorway sections of the Corridor route Vc and hunting areas that are located in the Project area. The hunting organization that manages the hunting area in the area of influence of the future motorway is the Hunting Association "Jarebica" Mostar which has been contacted for additional data on large mammals.

During undertaking the desk research, the Consultant assumed no assumptions or limitations except the scarce data of the project area regarding the large mammals.

Large mammals usually have wide areal which may stretch to e.g. 50 km or larger for some species, but having in mind the present conditions of the habitats in the project area and existing fragmentation of habitats due to the local roads, settlements and other infrastructure, it is considered that the project area has no potential to sustain large mammals as most natural habitats are already degraded and due to traffic noise of urban and semi-urban areas. Large mammals usually have wide areal which may stretch to e.g. 50 km or larger for some species, but having in mind the present conditions of the habitats in the project area and existing fragmentation of habitats due to the local roads, settlements and other infrastructure, it is considered that the project area has no potential to sustain large mammals as most natural habitats are already degraded and due to traffic noise of urban and semi-urban areas.

The Project area passes through settlements Gnojnice donje, Ortijes, Malo Polje, Laksevine, Hodbina and Blagaj, formation of settlements and placement of other infrastructure such as the main road, railway, local roads, electrical infrastructure, etc.

The detailed results of the large mammal's desk study are given in the Table 1 of Annex C-5: Large mammals report and below the summary of the main findings is presented. The evaluation is based on the research of threatened species/habitats of the species of large mammals at the selected localities.

Based on the desk research results presented in Table 1 of Annex C-5, 17 species of large and medium-sized mammals have been found in the previous studies, however for only few of them the habitat has been assessed as suitable to sustain the species This is due to the state of the habitats, which are modified and semi-modified by human activity over the years. Other infrastructure is also present in the settlements, such as: main, road, railway road and electrical infrastructure. In the wider area of the construction of concerned motorway section, a number of habitats are represented, of which aqueous habitats are very significant, as well as forests, meadows, rocks and other habitats.

Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), and Eurasian otter (*Lutra lutra)* are among the most sensitive species identified as part of the desk study, since the species are classified as vulnerable or endangered, respectively, on the Red list of FBiH. Eurasian otter is also classified as neat threatened IUCN Red list. Other species of large mammals identified in literature review as part of this report are not on the IUCN Red list of critically endangered, endangered and vulnerable species.

The three mentioned species are listed on Annex II of the Habitat Directive, while brown bear and wolf are also being classified as priority species. Annex II of the Habitats Directive requires the establishment of a consistent network of special areas of conservation; the sites should be managed in accordance with the ecological requirements of the species. For species and subspecies of community interest listed in Annex IV a strict protection regime must be applied. Based on the existing conditions of the habitats, the area has no potential to sustain brown bear and wolf, whereas the presence of Eurasian otter cannot be excluded due to the Buna and Bunica streams. It has been considered that mitigation measures for preservation of aquatic habitats, such as sustaining the good state of water quality and avoiding any training of both streams will indirectly serve as mitigation measures for this species.

During the desk study conducted as part of this assignment, in addition to these findings, three species from the Habitat Directive i.e. strictly protected species listed in Annex IV have been recorded in previous studies, as given in Annex C-5. However, based on the existing conditions of the habitats, the area has no potential to sustain wolf and wildcat species, whereas for Eurasian otter mitigation has been proposed.

5.2.5 Critical Habitat Assessment

A Critical Habitat Assessment (CHA) was undertaken as part of this assignment and is available as Annex D: Critical Habitat Assessment report. Based on the presented survey findings (habitats, flora and invasive species, invertebrates, herpetofauna, ornithofauna and mammals-bats) and the desk search studies (fish and large mammals), total of 81 terrestrial or aquatic species have been brought forward for further assessment. No habitats have been brought forward for further assessment as none are considered to be of conservation concern.

In line with the methodology for CHA given in EBRD Guidance Note 6[61], the main conclusions of the CHA are included below:

- The project is considered to trigger critical habitat considerations for aquatic ecology of Buna and Bunica Streams based on the following criteria:
  - **habitats of significant importance to endangered or critically endangered species** (CR European eel, EN Softmouth trout and EN White-clawed crayfish). Due to the limited time, fish survey could not be undertaken and CR and EN fish species could not be verified on project site therefore the presence of these species is based on the reviewed literature data for fish, while the presence of White-clawed crayfish has been confirmed during field surveys. Following the precautionary principle, the area of aquatic habitats of Buna and Bunica streams is considered in this report to be critical habitat for aquatic fish species and aquatic invertebrate species
  - **habitats of significant importance to endemic or geographically restricted species** (four endemic fish species have been identified as well as five aquatic invertebrate species based on the literature data, therefore due to the precautionary principle and taking into account some fish species are also considered to be EN or VU, CH is triggered for this criterion.
  - **habitats supporting globally significant migratory or congregatory species –** three migratory fish species use Buna and Bunica streams as well as some migratory bird species use the streams occasionally for feeding and resting as part of the Adriatic Flyway.
- No terrestrial critical habitats have been identified within terrestrial area of the CHSA.
- Regarding the criteria determining the priority biodiversity features (PBFs):
  - no threatened habitats have been identified.
  - KBA River Neretva and its tributaries (includes Buna and Bunica streams) has been identified to be present in the project area and corresponding to the areas of the two bridges, again referring only to the aquatic habitats that are not to be disturbed. No IBA or Ramsar sites are located within the project area or the area of 10 km radius.
  - Vulnerable species and species requiring protection (VU, Annex II and IV as well as Annex I BD species) have been identified.

Based on the requirement of the PR 6 paragraph 16, critical habitat must not be further fragmented, converted or degraded to the extent that its ecological integrity or biodiversity importance is compromised. No net loss of **aquatic habitats and species** that triggered CH may only be achieved through specific and

[61] EBRD (2016). Guidance Note: EBRD Performance Requirement 6. European Bank for Reconstruction and Development

targeted mitigation in line with mitigation hierarchy of avoiding the negative impact to aquatic habitats and species. Mitigation will require preservation of same conditions of the two watercourses Buna and Bunica without any disturbance, preservation of the riverine vegetation and preservation of the flow regime same as the current conditions downstream of the affected area. Consequently, and due to the fact that this can not be achieved without the changes to the design of the project and avoiding of any impacts to aquatic ecosystems, the changes to the Preliminary Design have been proposed in ESAP PR 6, ESIA and BMP.

Mitigation measures for **terrestrial** species of conservation concern can be implemented effectively for terrestrial ecology, as given in BMP and this ESIA.

5.2.6 Protected areas

The current percentage of territory under protection in BiH is low at 2.28%.[62] According to the Law on Nature Protection of FBiH[63] the system of protection of natural areas foresees the establishment of protected areas of different categories in line with IUCN categorization. There are no officially designated protected areas (PAs) in the project area, as shown in Figure 57.

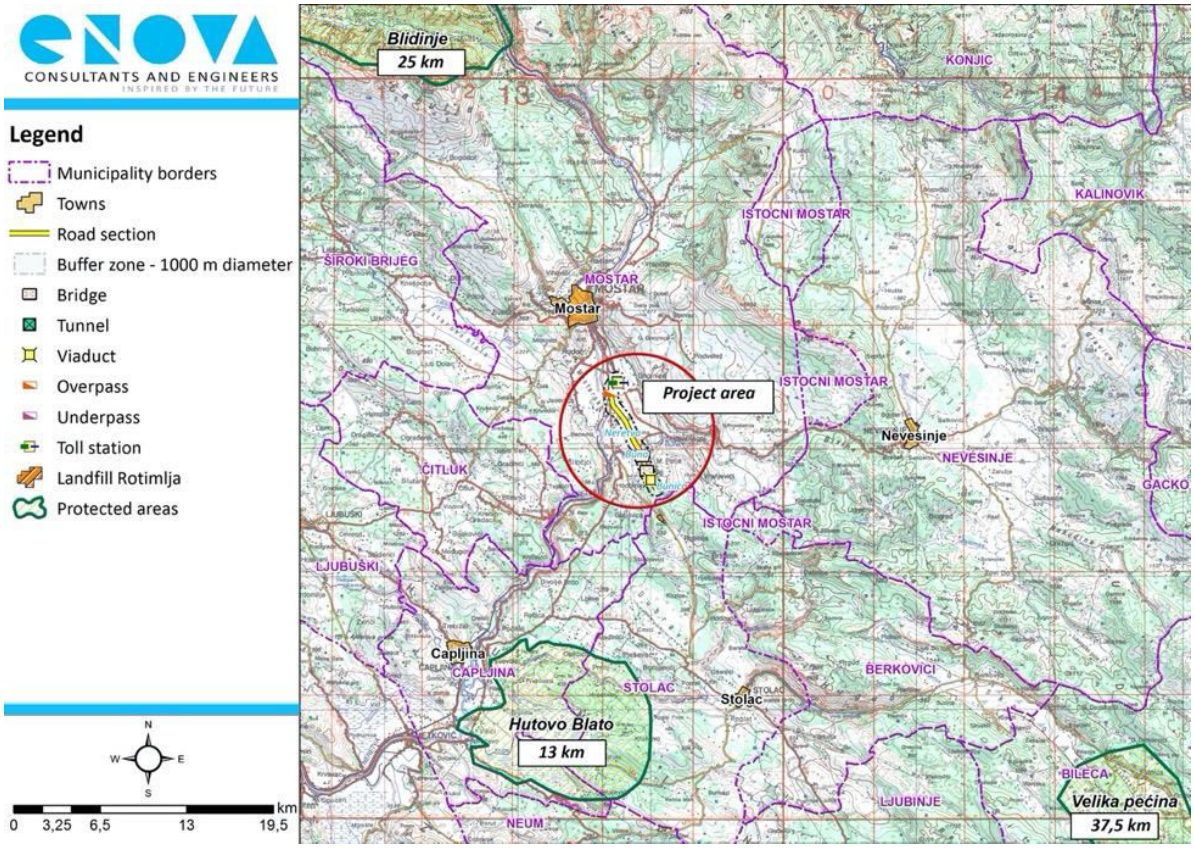


Figure 57: Spatial distribution of existing PAs in relation to the project area

IBA[64] and Ramsar sites[65] are not envisaged by the planned project either. The nearest existing PAs with regard to the project area are: Nature Park Hutovo Blato in FBiH (also Ramsar Site) (13 km of air distance south of the

[62] United Nations Development Programme, Sixth National Report to UN Convention on Biological Diversity, 2019
[63] Official Gazette of FBiH, No. 66/13
[64] IBA is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations.

project area), Nature Park Blidinje in FBiH (25 km of air distance north-northwest) and Velika pecina Cave in Municipality of Bileca, RS (37.5 km of air distance southeast).[66]

NBSAP BiH (2015-2020)[67] aimed to map and protect BiH's specific biodiversity by 2020 in accordance with the current spatial documentation (legislation on nature protection determines that protected areas are established on the basis of spatial plans). According to the Sixth national report to UNCBD and based on the analysis of available spatial plans it can be concluded that BiH strives to protect 17% of its territory. Proposal of the Spatial Plan of the FBiH (2008-2028), which is still in the process of adoption, envisages the establishment of 14 new protected areas with a total spatial coverage of 18.5% of the area of the FBiH. Table 22 shows planned PAs in FBiH. All of the planned PAs in FBiH are out of the project area as well. The closest two planned protected areas at level of FBiH are: (i) Igman – Bjelasnica – Treskavica – Visocica – Rakitnica River Canyon and (ii) Prenj – Cabulja – Cvrsnica – Vran, both situated outside of the radius of 15 km of air distance or more from the project area.

Table 22: Planned PAs in FBiH[68]

No.	*Name of protected area*	*Surface (ha)*
1.	Igman – Bjelasnica – Treskavica – Visocica – Rakitnica River Canyon	95,032.4
2.	Prenj – Cabulja – Cvrsnica - Vran	101,744.3
3.	Mt. Vranica	25,078.1
4.	Mt. Grmec	78,939.8
5.	Radusa – Stozer - Crni Vrh	42,415.5
6.	Mt. Sator	29,736.3
7.	Dinara	26,314.9
8.	Mt. Pljesevica	5,094.7
9.	Livanjsko Field	19,833.8
10.	Mt. Vlasic	12,382.9
11.	Popovo Field - Vjetrenica	3,572.5
12.	Canyons of Neretva, Doljanka, Ribnica and Drezanka	7,357.3
13.	Pliva Lakes	633.9
14.	Una River Basin	34,685.8

In addition to these plans, Global Environment Facility is funding the ongoing project Achieving Biodiversity Conservation through Creation and Effective Management of Protected Areas and Capacity Building for Protection of Nature in BiH, implemented by United Nations Environment Programme in BiH[69] with the aim to officially protect five areas:

1. Botanical and floral reserve Mediteranetum in Municipality of Neum (Herzegovina-Neretva Canton)
2. Cave system Vjetrenica (Herzegovina-Neretva Canton)
3. Livanjsko Field (Canton 10)
4. Bjelasnica– Visocica– Treskavica–Rakitnica River Canyon (Herzegovina-Neretva Canton and Sarajevo Canton)
5. Mt. Zvijezda, Municipality of Vares, Zenica-Doboj Canton).

[65] Wetlands protected by national governments to fulfil their obligations under the Convention on Wetlands of International Importance (the Ramsar Convention).
[66] The distances were measured from the closest point of existing protected area/ areas planned for protection to location of the project area by using GIS computer programme
[67] Council of Ministers, Strategy and Action Plan for the Protection of Biological Diversity of Bosnia and Herzegovina for the period 2015-2020, 2017 (available at: http://www.vijeceministara.gov.ba/akti/prijedlozi_zakona/default.aspx?id=25304&langTag=hr-HR)
[68] Proposal of the Spatial Plan of the FBiH (2008-2028)
[69] Available at: https://www.thegef.org/project/achieving-biodiversity-conservation-through-creation-effective-management-and-spatial

All five ongoing initiatives regarding designation of mentioned areas are located outside of City of Mostar region.

The Consultant has analysed the spatial-planning documentation at the level at Herzegovina-Neretva Canton, i.e. the Draft Spatial Plan of Herzegovina-Neretva Canton 2012 – 2022[70]. The Draft Spatial Plan recognizes the areas of:

Bunica Spring with Lake and the confluence with Neretva River, Municipality of Mostar (4 ha) as the area of (i) most valuable natural heritage of BiH in the area of Herzegovina-Neretva Canton, as well as the (ii) geomorphological natural monument
Buna Spring in Blagaj near Mostar as the area of reserves of natural landscapes.

It is important to mention that the given classifications of the planned protection of these areas are not in compliance with categories of protection in accordance with the Law on Nature Protection of FBiH. Both areas (i) *Bunica Spring with Lake and the confluence with Neretva River* and (ii) *Buna Spring in Blagaj near Mostar* are not envisaged by the project area and are located 900 m and 3.5 km of air distance east-northeast and southeast, respectively.

[70] Ministry of Construction and Spatial Planning of Herzegovina-Neretva Canton; Institute for Spatial Planning and Environmental Protection, 2016

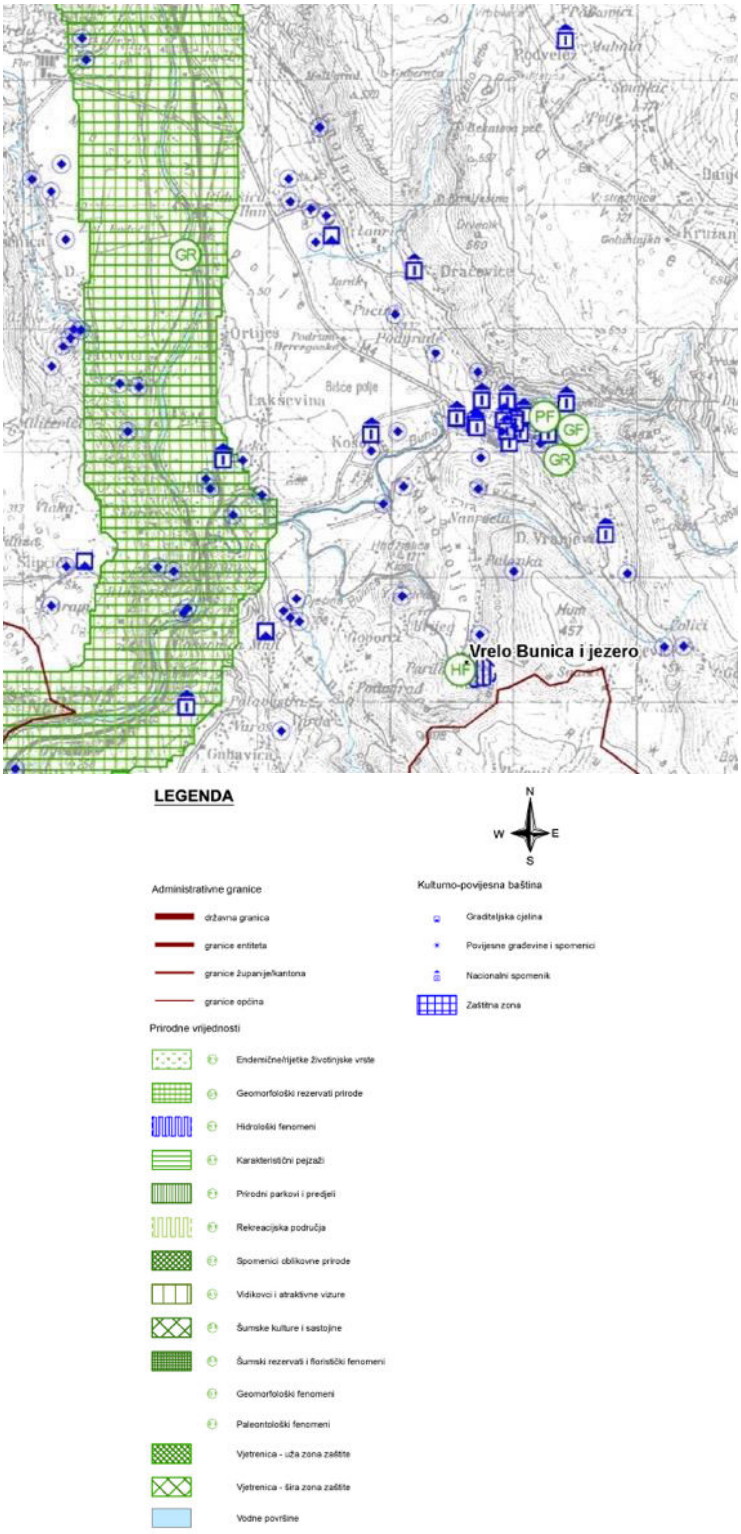


Figure 58: Spatial distribution of planned PAs according to the Draft Spatial Plan of Herzegovina-Neretva Canton 2012 – 2022[71]

[71] Ministry of Construction and Spatial Planning of Herzegovina-Neretva Canton; Institute for Spatial Planning and Environmental Protection, 2016

5.2.7 Potential Natura 2000 sites

The Government of FBiH adopted the *Decree on the Natura 2000 Program – Protected Areas in Europe* (O.G. of FBiH, No. 41/11), in order to establish the ecological network of protected natural habitat types and species in the FBiH and to include certain sites into international network of protected natural habitats and species. This *Decree* includes objectives for preservation of Natura 2000 sites and necessary measures for preservation or for favourable state of population of wild plants and animal species in the nature, their respective habitats and habitat types. This *Decree* passes a part of EU Habitat directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) with its Annexes and a part of the Bird directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009) on the conservation of wild birds with its Annexes. Potential Natura 2000 site Buna – Bunica (BA 8200008) is within the investigated area with an area of 7.95 km^2 (Table 23), that refer to the wider area compared to the planned project. Out of the mentioned biodiversity features for the area of Buna – Bunica (BA 8200008), no listed Natura 2000 habitats were confirmed in the project area. Regarding aquatic species, both fish and aquatic invertebrates have been confirmed in this ESIA report for which specific mitigation measures to avoid any impacts to the streams Buna and Bunica is required by ESAP and BMP, developed as part of this assignment. Regarding terrestrial species, specific mitigation measures have been suggested as part of BMP. Regarding the bats, additional monitoring has been required for inspection of possible roosts, migration corridors etc. and the requirement for micro-aligning of the motorway to avoid any impact for roosts that may be found during monitoring in pre-construction phase. By implementing all mitigation and monitoring measures suggested in ESAP and BMP, possible impact to these features will be fully mitigated.

The *Law on Nature Protection of FBiH*[72] recognizes Natura 2000 sites and states that certain areas may be designated for the European program Natura 2000 to be engaged in the international ecological network, conservation of natural habitats and habitats of species by a regulation of the Government of FBiH.

Considering the fact BiH is not part of the EU, and Natura 2000 sites are still not mandatory for protection. In line with the Article 58 of the Law on Nature Protection, the Government of FBiH will establish a separate European ecological network protected areas called Natura 2000, however currently no areas have been officially proclaimed in FBiH. Management plan has not been adopted for potential Natura 2000 site Buna-Bunica. No subsidiary legislation on Natura 2000 has been adopted in FBiH either.

Table 23: Potential Natura 2000 site Buna-Bunica

Code	*Name*					*Type*	*Area (km^2)*
BA8200008	**Buna-Bunica**					**B**	**7.95**
BD Species	**HD Species**						
Birds	**Habitats**	**Plants**	**Invertebrates**	**Fish**	**Amphibians**	**Reptiles**	**Mammals**
None	3270 Rivers with muddy banks with *Chenopodion rubri* p.p. and Bidention p.p. vegetation	None	*Lycaena dispar* (Large copper)	*Salmo marmoratus* (Marble trout)	*Bombina variegata* (Yellow-bellied toad)	*Testudo hermanni* (Hermann's tortoise)	*Miniopterus schreibersi* (Schreibers's Long-fingered Bat)
	62A0 Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)			*Salmothymus obtusirostris* (Softmouth trout, Adriatic trout)		*Zamenis situla* (Crvenkrpica)	*Myotis blythii* (Lesser mouse-eared bat)

[72] Official Gazette of FBiH, No. 66/13

Code	*Name*					*Type*	*Area (km²)*
BA8200008	**Buna-Bunica**					**B**	**7.95**
BD Species	**HD Species**						
Birds	**Habitats**	**Plants**	**Invertebrates**	**Fish**	**Amphibians**	**Reptiles**	**Mammals**
	8140 Eastern Mediterranean screes (*Drypidetalia spinosae*)			*Squalius svallize* (Adriatic dace)			*Myotis emarginatus* (Geoffroy's bat)
	8210 Calcareous rocky slopes with chasmophytic vegetation						*Rhinolophus blasii* (Blasius's horseshoe bat)
	8310 Caves not open to the public						*Rhinolophus euryale* (Mediterranean horseshoe bat)
	9250 *Quercus trojana* woods						*Rhinolophus ferrumequinum* (Greater horseshoe bat)
							Rhinolophus hipposideros (Lesser horseshoe bat)

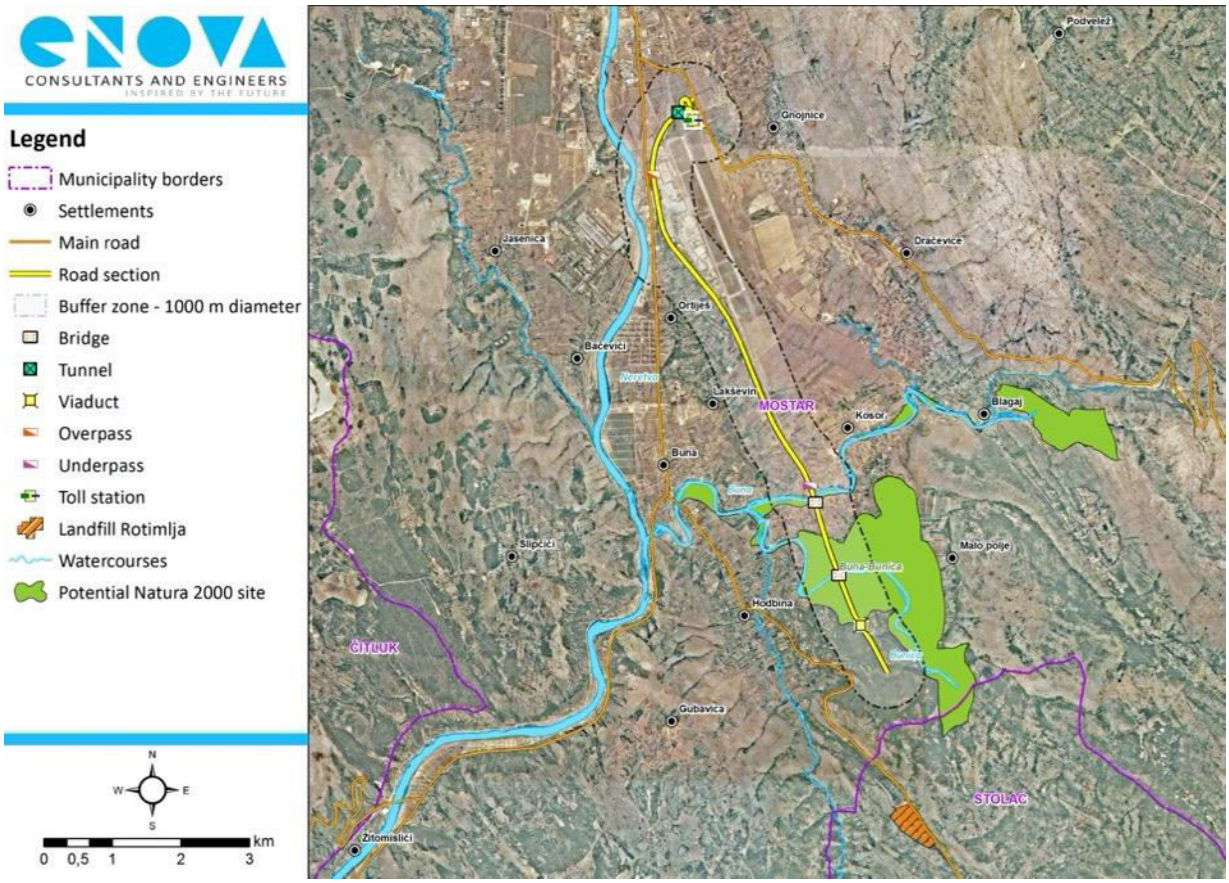


Figure 59: Spatial distribution of potential Natura 2000 site Buna-Bunica in relation to the project area

5.2.8 Ecosystem services

This analysis presents an assessment of the potential impacts of the project and dependencies on ecosystem services.

According to the information presented in LALRP[73], total of 572 land plots are affected by the project, of 106 are used as agricultural land:

- 41 used as cultivated land,
- 32 used as orchards,
- 21 used as vineyards,
- 7 used for growing crops,
- 2 used as orchards (cherry and hazel trees),
- 2 used as vineyards and orchards combined,
- 1 used as cultivated land and orchards combined.

The changes described in the physical and biotic environment will have profound consequences for the Project area and potentially in the project area of influence, including the 6 settlements Gnojnice Donje, Ortijes, Blagaj, Kosor, Malo Polje and Hodbina that are in the Project area. The identified ecosystem services related to project footprint and the buffer zone are listed in Table 24.

Table 24: Ecosystem services identified in the project area

Ecosystem services	*Identified ecosystem services*	
	Project footprint	*Buffer zone*
Provisioning services Food resources, raw materials, water, medicinal and vitamin plants	24.3285 ha of farmland will be converted in construction land. 27.9453 ha of orchards, pastures, meadows, vineyards, forests, forests and farmlands will be converted in construction land. Most common cultivated crops: wheat, cabbage, pepper, tomato, potato, beans, various agricultural crops, onion, and immortelle. Most common crops in orchards: cherry trees, hazelnut trees, pear and plum trees, pomegranate, walnut trees, fig trees, vineyards, strawberries, watermelon, clover, blackberries, almond trees, meddler trees and grapevine. On the north side of Kajgin Kicin there are multiple agricultural lands. Minimum 50% of harvest is used for food. The following species are the most relevant medicinal species raised by the communities: lavender, everlasting flowers and rosemary. Rosemary crops, lavender and vineyards are found near the main road M6.1 to Nevesinje	All benefits from this ecosystem service will remain the same as there will be no significant impact on this ecosystem service in the buffer zone except for potential impact caused by activities in Project footprint.

[73] ENOVA Sarajevo, Land Acquisition and Livelihood Restoration Framework (LALRP), March 2020

Ecosystem services	*Identified ecosystem services*	
	Project footprint	*Buffer zone*
	and Gnojnice. Under the Buna Bridge there are cultivated crops of cherry, grapevines and strawberries. Forest fruits and wild plants are common in this Project area. Some of them are raspberry, blackberry and fig tree. Many invasive species have been observed during the site visits, especially near the main road M17 and KES quarry such as: black locust, annual ragweed and tree of heaven. Ruderal species have also been found since the land near the main road is degraded. In the Project footprint there is 1 greenhouse in the settlement Malo Polje used for cultivation and nutrition. There are 7 water wells, 6 in Kosor and 1 in Malo Polje, which local population use for water supply.	
Regulating services Climate regulation, carbon storage, prevention and mitigation of natural disasters, soil erosion control, wastewater treatment, pest and disease regulation	The mixed thermophilous forests developed in the lower altitudes of Hodbina Hill and Kajgin Kicin Hill that regulate climate and store carbon There is no evidence that suggests that the ecosystems or any particular species within the vicinity of the Project Area plays a significant role in pest control. ▪	The maintenance of natural carbon capture and storage processes is important for the beneficiaries, since, given their proximity to emission sources such as vehicles there is a greater risk of developing health effects for settlements in the buffer zone. Vegetation, various marine organisms and river banks play a role in the interception, filtration, decomposition, and detoxification of pollutants and wastes but they are not within the scope of the Project area and buffer.
***Cultural* services** Tourism, recreation, mental and psychical health, spiritual enrichment, aesthetic value landscape diversity, cultural diversity, art and design	There are no touristic or recreational enjoyments in the Project footprint except for properties on private land plots.	There are several camping sites and accommodations in the buffer zone such as: Auto Camping EKO in Kosor. Autocamp Kolo-M near Stream Buna, Apartment Azra on the border of the area of influence, Farm Ranch in settlement Laksevine, Motel Kolo, Villa Harmoni, Fig Country and Hotel Nar in Kosor. Outside the buffer zone there are 3 protected areas that are in the range of 40 km from the Project area – Hutovo Blato Nature Park, Blidinje Nature Park and Velika Pecina. There are several potential Natura 2000 sites in the buffer zone and near the Project area.
Supporting services	Soil quality is important for human health, landowners, flora, and fauna. Healthy soil also plays an important role in flood regulation through the capacity for water absorption. As stated in previous ecosystem services construction activities will cause modifications, soil conversion and erosion.	Increase in concentration of contaminants could exceed the capacity of soils to regulate quality through accidental leaks and spills and deposition of dust and atmospheric pollutants generated during construction activities. ▪

5.3 Water

5.3.1 Hydrology

All watercourses of the City of Mostar belong to the Adriatic Sea basin. The largest and richest river is the Neretva River, which enters the territory of the City in the area of Aleksin Han and leaves the territory near Zitomislici. The catchment area of the Neretva River is not fully defined due to the karst characteristics of the terrain. It is assumed that the Neretva basin covers an approximate area of about 8,200 km. It is divided into upper, middle and lower course. The part of the Neretva River that flows through the City of Mostar represents the middle part of the flow. Within the city territory, the length of the river Neretva flows is 67.5 km. The surface of the basin coincides with the surface of the City of Mostar and amounts to 1,175 km^2. Neretva enters a wide valley in the area of Bijelo polje. The valley narrows in Mostar and Neretva slows down. It then crosses the Mostar plain where its valley extends all the way to the confluence of the Buna, and then enters a smaller gorge, in the south part of the study area.

Beside the Neretva River that is flowing close to the north section of the road, the Buna Stream, the left tributary of Neretva, and its tributary Bunica are important from the aspect of road construction as they will be bridged by road constructions at the southern edge of the Mostar field (Figure 60). The most sensitive area from the aspect of potential water pollution during construction and operation phase is the area in-between streams Buna and Bunica that serves for irrigation of high-quality agricultural land and for livestock watering. They all are considered to be recipients of possible pollution from the road structure during construction and operation/maintenance.

According to the Water Management Plan for the Water Catchment of the Adriatic Sea in Federation of BiH (2016 - 2021) Buna and Bunica are classified as small to medium valley streams with the characteristics given in the table below.

Table 25: Classification of Buna and Bunica

Type	*Subtype*		*Abiotic parameters*				*Watercourse*
			Size of catchment area (km^2)	*Altitude (m a.s.l)*	*Lithological surface*	*Flow (m^3/s)*	
12. Small and medium valley streams	12a	Small and medium valley streams on carbonate bed	10-100	<200	C	2-20	Bunica
			100-1000	<200	C	>20	Buna

The catchment area of Buna and Bunica, which covers an area of more than 1,100 km^2, is located East of the Mostarsko polje and covers the entire basin of Nevesinje field including streams Zalomka, Zavidovska and Koljeska to the highest peaks of Snijeznica in the south and Gatacka Bjelasnica in the east. A number of water colouring investigations performed on underground streams Zlatac, Zdrijelo, Zalomski ponori, estavelles Zdrijebnik and boreholes in Zljebovi and Zdrijebnik prove the strong underground connection of these locations/streams with the Buna spring (Qmin = 3.5 m^3/s - Qmax = 150 m^3/s. The underground streams Biograci and Krupac have connection with the spring of Bunica Qmin = 2 m^3/s. Given the karstification of the

carbonate aquifer and the slope gradient, the average mean flow velocity of 4 cm/s for is realistic and expected. The route of the motorway is located downstream from the main springs of this basin[74].

The project area is not prone to floods[75].

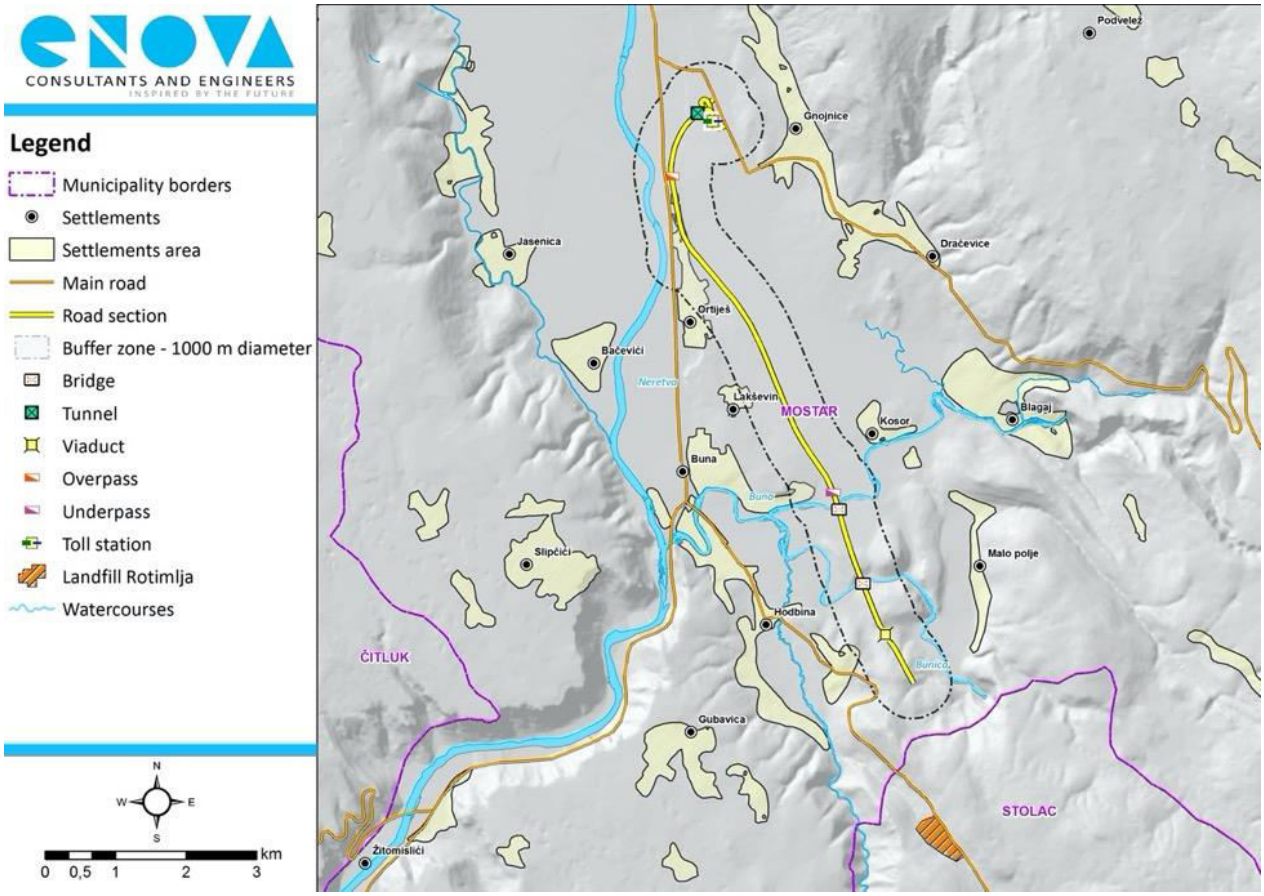


Figure 60: Water courses in the project area

5.3.2 Hydrogeology

The area of the Mostar City is mostly made of permeable carbonate rocks (predominately limestone). Some areas are made of dolomites, the rocks of medium water permeability that presented localised and relative barriers to groundwater movement.

Eocene flysch deposits (waterproof according to their properties) have the function of a complete or suspended hydrogeological barrier. The alluvial deposits have been found in the Neretva valley which may have the hydrogeological function of alluvial aquifers. Quaternary clastic sediments of low permeability were also represented. All rocks in this area can be classified into four groups:

- well-permeable rocks,
- medium to low permeability carbonate rocks,
- poorly permeable rocks and

[74] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[75] Hydro-Engineering Institute Sarajevo, Study on Preliminary Flood Risk Assessment for FBiH, April/May 2013

- watertight rocks.

The road section is situated in the Mostar valley that is built of a Quaternary hydrogeological complex represented by formations of dominant intergranular porosity within which interlayers of weakly bound conglomerates (crack porosity) appear.

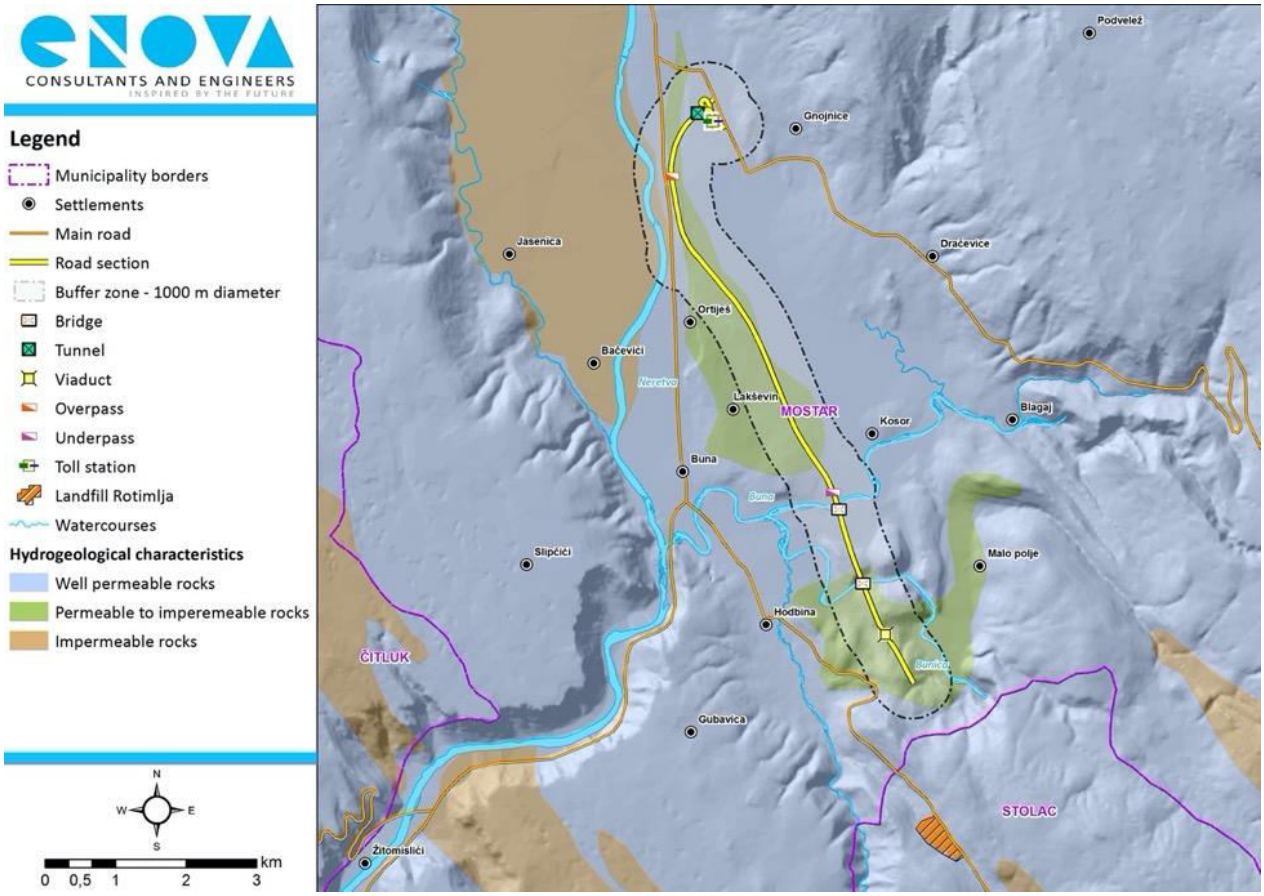


Figure 61: Hydrogeological characteristics of the project area

The foundation of this Quaternary complex are Miocene marls. The groundwater level is directly related to the water level in the Neretva River, i.e. depending on the position in relation to its left tributaries Buna and Bunica.

The formed aquifer with the free level is influenced by fluctuations in the water level of the local water network and under the influence of climatic factors. The wider area itself is built mostly of carbonate rocks from Cretaceous and Eocene age. Carbonate rocks belong to well-permeable rocks with crack porosity, which means that their permeability primarily depends on the fracture and erosion of the rock mass, which in turn is a consequence of tectonic activity.

Carbonate rocks have the property of maximum surface water infiltration, which means that all water that falls or overflows will infiltrate underground without delay and will reach the zone of horizontal groundwater circulation. Due to the karst, and often cavernous porosity, this environment has minimal or no ability to purify polluted wastewater, and especially not mineral oils and fats, which are the basic constituents of wastewater from the motorway. In parts of the route where the land cover is significant - or where the land cover is continuously spread, the possibility of wastewater infiltration into the karst limestones is significantly reduced.

Given the granulometric composition of red and dark red clays, the soil has intergranular porosity, and its water permeability directly depends on the granulometric properties. Accordingly, the soil is low permeable to impermeable medium. In general, the red clay can be considered as a watertight environment in those localities where its thickness exceeds a few meters. This is also valid for the clay cover deposits in the Miocene marl series.

Within the wider area, marl deposits and flysch-like Eocene formations play the role of a hydrogeological lateral barrier. Within these deposits, the layers with moderately developed crack porosity are frequently found, which also have limited collector characteristics. Groundwater from these series is locally discharged from less abundant sources[76].

5.3.3 Water quality

The water quality in streams Buna and Bunica is analysed in May 2020 for the purpose of determining the baseline condition in the pre-construction phase[77]. The sampling was performed in the immediate vicinity of the planned bridges, upstream and downstream from the bridge on Buna and bridge on Bunica.

The results for Buna stream are given in Table 26 and Table 27. The results indicate that the electro-conductivity, biological oxygen demand BOD_5 and the content of the total phosphorus are elevated comparing to the limits prescribed in the Rulebook on Characterization of the Surface and Ground Waters, Reference Conditions and Parameters for Water Assessment and Monitoring[78]. The concentration of total ammonia is moderately elevated while the other parameters show good ecological status.

Table 26: Measurements results for Buna, upstream from the future bridge

No.	*Parameter*	*Result ± measurement variation*	*Assessment of physical-chemical parameters*		
			High	*Good*	*Moderate*
1.	Temperature	10,0	-	-	-
2.	pH	8,15	7,4-8,5	7,4-7,0 8,5-9,0	<7,0 >9,0
3.	Suspended solids	1	-	-	-
4.	Turbidity	<1	-	-	-
5.	Electro conductivity	318	<500	500-600	>600
6.	Biological oxygen demand BOD_5	1,4	<2,0	2,0-3,0	>3,0
7.	Chemical oxygen demand	<6,0	<4,0	4,0-5,5	>5,5
8.	Ammonia content	1,84	<0,10	0,10-0,25	>0,25
9.	Total ammonia	2,06	<1,5	1,5-3,0	>3,0
10.	Total phosphorus	0,027	<0,10	0,10-0,25	>0,25
11.	Iron	45,0	-	-	-
12.	Manganese	25,0	-	-	-
13.	Lead	<0,1	-	-	-
14.	Oil and grease	<2,7	-	-	-

Table 27: Measurements results for Buna, downstream from the future bridge

No.	*Parameter*	*Result ± measurement*	*Assessment of physical-chemical parameters*

[76] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[77] IG Banja Luka, Report on Quality of Surface and Ground Waters, May 2020
[78] Official Gazette of FBiH, No. 1/14

		variation	*High*	*Good*	*Moderate*
1.	Temperature	10,0	-	-	-
2.	pH	8,12	7,4-8,5	7,4-7,0 8,5-9,0	<7,0 >9,0
3.	Suspended solids	2	-	-	-
4.	Turbidity	<1	-	-	-
5.	Electro-conductivity	300	<500	500-600	>600
6.	Biological oxygen demand BOD_5	1,5	<2,0	2,0-3,0	>3,0
7.	Chemical oxygen demand	<6,0	<4,0	4,0-5,5	>5,5
8.	Ammonia content	2,182	<0,10	0,10-0,25	>0,25
9.	Total ammonia	2,392	<1,5	1,5-3,0	>3,0
10.	Total phosphorus	0,027	<0,10	0,10-0,25	>0,25
11.	Iron	45,0	-	-	-
12.	Manganese	20,0	-	-	-
13.	Lead	<0,1	-	-	-
14.	Oil and grease	<2,7	-	-	-

The results for Bunica stream are given in Table 28. The results show the identical ecological status as in the case of Buna stream.

Table 28: Measurements results for Bunica, upstream from the future bridge

No.	*Parameter*	*Result ± measurement variation*	*Assessment of physical-chemical parameters*		
			High	*Good*	*Medium*
1.	Temperature	12,0	-	-	-
2.	pH	7,86	7,4-8,5	7,4-7,0 8,5-9,0	<7,0 >9,0
3.	Suspended solids	1	-	-	-
4.	Turbidity	<1	-	-	-
5.	Electro conductivity	392	<500	500-600	>600
6.	Biological oxygen demand BOD_5	1,2	<2,0	2,0-3,0	>3,0
7.	Chemical oxygen demand	<6,0	<4,0	4,0-5,5	>5,5
8.	Ammonia content	1,632	<0,10	0,10-0,25	>0,25
9.	Total ammonia	1,850	<1,5	1,5-3,0	>3,0
10.	Total phosphorus	0,015	<0,10	0,10-0,25	>0,25
11.	Iron	22,0	-	-	-
12.	Manganese	20,0	-	-	-
13.	Lead	<0,1	-	-	-
14.	Oil and grease	<2,7	-	-	-

Table 29: Measurements results for Bunica, downstream from the future bridge

No.	*Parameter*	*Result ± measurement variation*	*Assessment of physical-chemical parameters*		
			High	*Good*	*Medium*
1.	Temperature	10,0	-	-	-
2.	pH	8,12	7,4-8,5	7,4-7,0 8,5-9,0	<7,0 >9,0
3.	Suspended solids	2	-	-	-
4.	Turbidity	<1	-	-	-
5.	Electro conductivity	300	<500	500-600	>600
6.	Biological oxygen demand BOD_5	1,5	<2,0	2,0-3,0	>3,0

7.	Chemical oxygen demand	<6,0	<4,0	4,0-5,5	>5,5
8.	Ammonia content	2,182	<0,10	0,10-0,25	>0,25
9.	Total ammonia	2,392	<1,5	1,5-3,0	>3,0
10.	Total phosphorus	0,027	<0,10	0,10-0,25	>0,25
11.	Iron	45,0	-	-	-
12.	Manganese	20,0	-	-	-
13.	Lead	<0,1	-	-	-
14.	Oil and grease	<2,7	-	-	-

The overall conclusion of the Report is that the both water streams have good ecological quality determined based on the main physical and chemical parameters, both upstream and downstream of the future location of the bridge. Unfortunately, the irregularities were found in the Reports on baseline conditions of surface waters monitoring (as explained in Chapter 5.1) thus the ESMP will recommend repeating the analysis before the start of the construction works, with proposed modifications.

5.4 Air quality

The air quality measurements in city of Mostar are performed on two monitoring stations, one operated by the by the Cantonal Institute of Public Health and one operated by the Faculty of Science, Mathematics and Education of University of Mostar (owned by the Federal Ministry of Environment and Tourism, operated by the City of Mostar who transferred the operation rights to the University of Mostar). Unfortunately, the monitoring station operated by the Cantonal Institute of Public Health is not in function and the latest data are available for the period 2000-2007[79], while the monitoring station operated by the University of Mostar never made their data publicly available[80].

Therefore, the only available data on the air quality in Mostar are belonging to the period 2000-2007 and are summarised in the table below.

Table 30: Status of air quality in the City of Mostar in the period 2000-2007

SO_2 *(measured from 2000 to 2007)*	*PM_{10}* *(measured from 2000 to 2005)*	*NO_X* *(measured in 2000 and in 2001)*
▪ Not recorded during the spring-summer and summer-autumn transitions. ▪ In the summer period, SO_2 maximum values are approximately constant in the range of 38-68 µg/m^3. ▪ During the winter, SO_2 maximum values fluctuate between 54 and 146 µg/m^3. ▪ It can be concluded that SO_2 concentrations does not exceed the limit values during the year.	▪ The recorded PM_{10} particles values hit the extreme maximum during the first three months in 2004 (209-414 µg/m^3). ▪ In the remaining measurement periods, the maximum values are also recorded during the winter months of January and February (18-148 µg/m^3). ▪ If observed on the annual level, it can be concluded that annual average concentrations of PM10 are not exceeded however the peaks during the winter months	▪ Nitrogen-oxides (NOX) had only been measured twice, in 2000 and 2001. ▪ During the summer, recorded maximum NO_2 values are constant and are within the range of 28-46 µg/m^3. ▪ During the winter, values fluctuate from 32-62 µg/m^3. ▪ It can be concluded that NO_X concentrations does not exceed the limit values during the year.

[79] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[80] Federal Hydrometeorological Institute, Annual air quality report for FBiH, 2019

SO_2 (measured from 2000 to 2007)	PM_{10} (measured from 2000 to 2005)	NO_X (measured in 2000 and in 2001)
	are observed.	

For the purpose of this baseline, one-time measurement of air quality was performed by IG Banja Luka on two locations along the Mostar South-Tunnel Kvanj sub-section (Figure 62 and Figure 63) in April 2020. The 2-hour measurements of concentrations of air pollutants in the ambient air including carbon monoxide (CO), sulphur dioxide (SO_2), ozone (O_3), nitrogen oxides (NO, NO_2, NO_X) and particulate matters (PM_{10}) were carried out. Measurements were made by a mobile air quality monitoring station. The details about performed measurements are available in the report prepared by IG Banja Luka[81]. The results are presented in Table 31 and Table 32.

Figure 62: Satellite image of the location MM1 43°17'11.16"N 17°50'5.69"E (Source: Google Earth)

[81] IG Banja Luka, Report on air quality measurements at the location of Corridor Vc, Mostar South- Tunnel Kvanj Sub-section, Report Number: 0716-20-EKO, April 2020

Figure 63: Satellite image of the location MM2 43°14'40.52"N 17°51'52.02"E (Source: Google Earth)

Table 31: Results of air quality measurement at MM1

Pollutant	*Sampling period*	*Test method*	*Measured value*	*Unit*	*Limits*	
CO	28.04.2020. (2h)	BAS EN 14626:2013 non-dispersive infrared spectroscopy *	0.26	(mg/m^3)	-	-
SO_2		BAS EN 14212:2013 ultraviolet fluorescence *	8.27	($\mu g/m^3$)	LV 350 $\mu g/m^3$	TL 365 $\mu g/m^3$
O_3		BAS EN 14212:2013 ultraviolet fluorescence *	79.02	($\mu g/m^3$)	TV 120	
NO		BAS EN 14625:2013 ultraviolet photometry *	10.93	($\mu g/m^3$)	-	
NO_2			24.15	($\mu g/m^3$)	LV 200 $\mu g/m^3$	TL 210 $\mu g/m^3$
NO_X			35.08	($\mu g/m^3$)	-	
PM_{10}		standard gravimetric method	37.42	($\mu g/m^3$)	-	

LV - limit value; TL - tolerance limit; TV - target value
*Standards marked with * are from the accredited field*

Table 32: Results of air quality measurement at MM2

Pollutant	*Sampling period*	*Test method*	*Measured value*	*Unit*	*Limits*	
CO	28.04.2020. (2h)	BAS EN 14626:2013 non-dispersive infrared spectroscopy *	0.17	(mg/m^3)	-	-

SO_2		BAS EN 14212:2013 ultraviolet fluorescence *	5.38	($\mu g/m^3$)	LV 350 $\mu g/m^3$	TL 365 $\mu g/m^3$
O_3		BAS EN 14212:2013 ultraviolet fluorescence *	51.36	($\mu g/m^3$)	TV 120	
NO		BAS EN 14625:2013 ultraviolet photometry *	7.10	($\mu g/m^3$)	-	
NO_2			15.70	($\mu g/m^3$)	LV 200 $\mu g/m^3$	TL 210 $\mu g/m^3$
NO_X			22.80	($\mu g/m^3$)	-	
PM_{10}		standard gravimetric method	18.21	(µg/m3)	-	

LV - limit value; TL - tolerance limit; TV - target value
*Standards marked with * are from the accredited field*

The recorded values do not exceed the limits prescribed by the Rulebook on the air quality monitoring method and definition of pollutant types, limit values and other air quality standards[82].

In general, it can be concluded that air quality in Mostar is satisfactory, the fluctuations in the parameters are observed during winter. The pollution sources are mainly traffic and heating. Except for alumina production located south of city of Mostar, heavy industrial activity is not present. The climatic conditions explained in chapter 5.6, especially the strong winds during winter help in dispersing pollutants and preserving air quality.

5.5 Land

5.5.1 Geomorphology

The location of the project can be described as intersection of North, West and East Herzegovina. The urban part of the City of Mostar is situated in three valleys, so called Mostar valley, that form the 18% of the city, while 88.2% is the hilly-mountainous terrain of which 60% is over 1,000 m a.s.l (Prenj, Cvrsnica, Cabulja and Velez mountains).

[82] Official Gazette of FBiH, No. 1/12 and 59/19

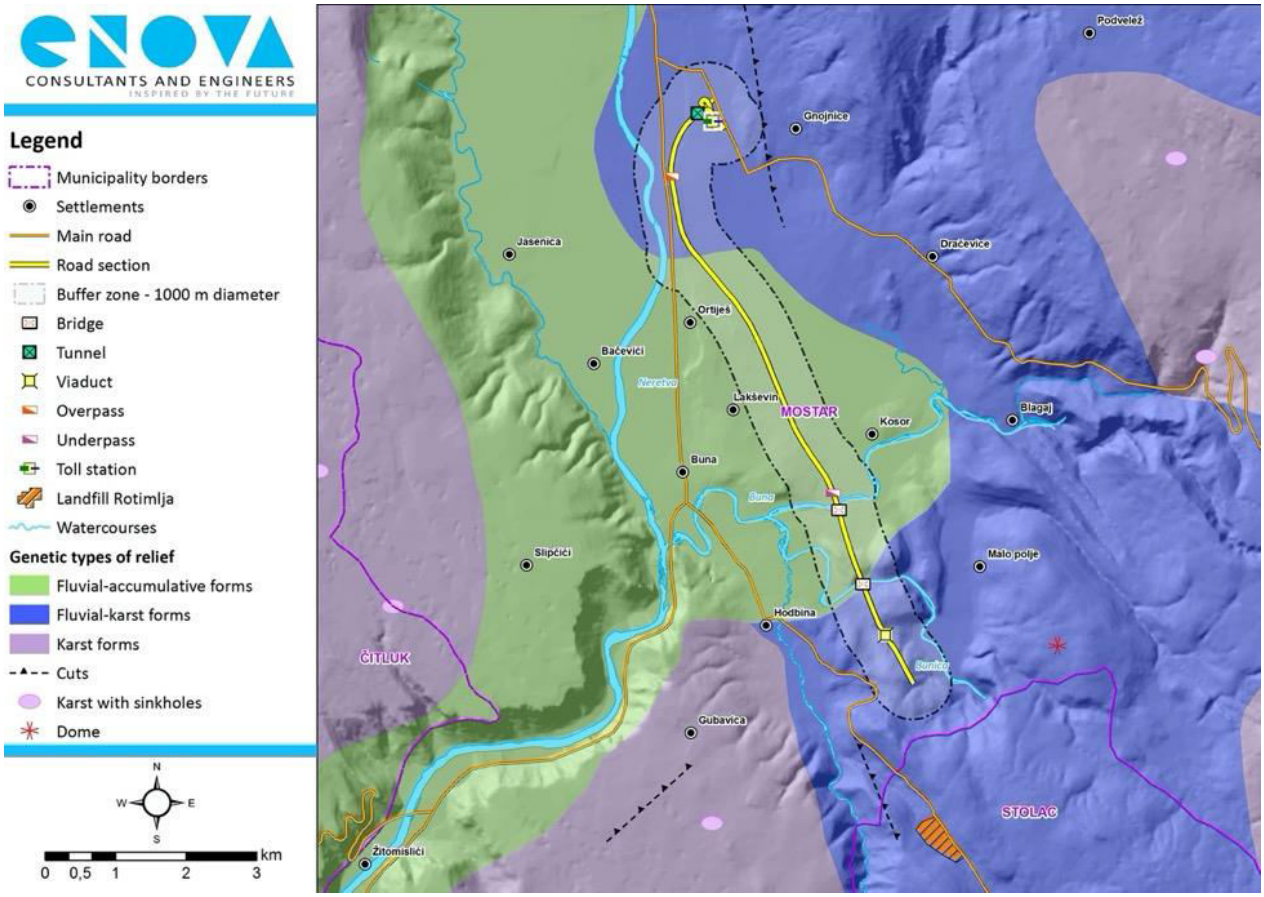


Figure 64: Genetic types of the terrain in the project area

The route of the sub-section Mostar South-Tunnel Kvanj mainly runs through flat terrain of Mostar field towards the Mountain Kvanj, crossing the streams Buna and Bunica, left tributaries to the River Neretva. From Interchange Mostar South, the route runs between the airport Mostar and the River Neretva, along its left bank[83]. The terrain is very rich in surface and ground water as the route passes along the left bank of the Neretva River and crosses its tributaries all the way to northern slopes of Kvanj (hilly area of Parila).

The project area belongs to Dinaric karst morphology. It is situated in the zone of high karst dominated by limestone and dolomites.

This sub-section runs for the most part along the Mostar field, with Quaternary structures dominated by limnoglacial and alluvial structures of the River Neretva and its tributaries Buna and Bunica, and with some diluvium Quaternary structures.

The cover of the Mostar field has stable thickness whether it is the cover over alluvial or diluvium structures of the cover over fluvial-glacial complex – the dusty and sandy clays mixed with gravel. The majority of the terrain is made of rudist limestones of the upper Cretaceous. In some parts there are foraminiferous limestones of lower and middle Eocene structures from middle and upper Eocene, and non-classified marls of middle and upper Miocene in the valley between Kvanj and Hum.

[83] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

Rock masses along the whole sub-section are represented by moderately to significantly karstified rocks, with extensive coverage. The cover is significantly developed also on slopes and northern side of Kvanj (hills Parilo). The clay is highly to moderately plastic, consistent and hard to knead, of the red-brown colour with various amount of small-grained debris.

5.5.2 Geology

The geology of the project area is determined based on the field works (engineering-geological mapping, exploratory drilling, and geo-electrical explorations) and on the results of laboratory tests of samples. The investigations are carried out in three sections (so called engineering blocks) and they revealed the presence of the following composition[84]:

No.	*Engineering blocks*	*Chainage*	*Lithostratigraphic characteristics*
1.	Block 1	km 0+000.00 m – km 6+937.80 m	Marls, marl limestones and in smaller amount conglomerates of middle and upper Miocene (M2,3), Alluvial structures – Quaternary (alQ), Diluvium structures – Quaternary (dlQ), Limnoglacial sediments – Quaternary (lglQ)
2.	Block 2	km 6+937.80 m – km 8+176.50 m	Limestones – upper Cretaceous – Turon – Senon (K22,3), Alluvial structures – Quaternary (alQ), DILUVIUM Structures – Quaternary (dlQ)
3.	Block 3	km 8+176.50 m – km 9+125.00 m	Marls, marl limestones and conglomerates M2,3 in smaller amount Diluvium structures – Quaternary (Q)

The illustration of the geological characteristics of the project area are given in the photographs below[85].

Figure 65: Broken and karstified rudist limestones

[84] IPSA Institute, Preliminary design – Book C 1040 Engineering-geology study for main alignment and facilities, March 2018
[85] Ibid.

Figure 66: Marls (marl limestones) of Ortijes-Mukos

Figure 67: Alluvium plateau of the Stream Bunica

Figure 68: Limnoglacial stratified layers of gravels and loosely bound conglomerates

Based on the performed engineering and geological mapping of the area the following conclusion relevant to the construction are given in the Preliminary design[86]:

- The sub-section Mostar South-Tunnel Kvanj may be divided into a stage 1 within the separate engineering block 1 that contains, besides marls as the main base rock, the Quaternary structures represented by limnoglacial complexes. Apart from these, diluvium and alluvial Quaternary structures are found near the Stream Buna. This complex is represented by sandy gravels, gravels, worn conglomerates and conglomerates to a lesser degree.
- Limnoglacial complex may be clearly separated based on the performed explorations and standard penetration test (SPT) into two horizons: the surface horizon of thickness of up to 2.5 m, moderately to fully compacted, and the lower horizon that is very compacted with more than 50 hits.
- Within the engineering block 1, the storm water drains quickly towards the erosion foundation found at the level of the River Neretva. The route itself runs through the area saturated with groundwater.

[86] IPSA Institute, Preliminary design – Book C 1040 Engineering-geology study for main alignment and facilities, March 2018

- Within the engineering block 2, the ground is mainly composed from carbonate sediments being rudist limestone of the upper Cretaceous with prominent cover. This area is under the strong influence of tectonics. Engineering geological mapping found several large faults along which wider areas of broken rocks are found that are several tens of meters, and more small faults with possible occurrence of narrow broken zones.
- Observing vertical composition, it is possible to differentiate the surface wearing zone (PZT) with limited vertical and horizontal reach, the upper wearing zone (GZT) with frequent gaping fissures in the upper part and the base rock mass (OS).
- Construction works in the section coinciding with the engineering block 2 will mainly be performed in the upper wearing belt (GP) and the base rock mass (OS), and in the upper wearing zone (GZT). In GP and GZT it is expected to find blocks of decimetre and occasionally meter dimensions, separated by 5 mm fissures filled with clay, while in the OS somewhat larger blocks are dominant, of meter dimensions, and even larger, separated by 1 mm fissures or even wider, empty or filled with calcite filling or covered by lining of compressed clay.
- In both belts the unstable blocks are to be expected due to the direction of layers, orientation of fissures and presence of wider fault zones.

5.5.3 Land categorisation

The land in Mostar area is classified according to three land categories:

- Agro-zone I – highly valuable agricultural land
- Agro-zone II – medium valuable agricultural land
- Agro-zone III – least valuable agricultural land

Land is according to its quality classified in one of the mentioned categories in the classes from I-VIII where:

- classes I - IV are suitable for agricultural production, they represent arable land with no restrictions or little restrictions for use. This category of land is classified as agricultural land;
- classes V an VI represent the land that can be cultivated if agro-technical measures are implemented. This type of land is used for agricultural production and rarely for the other purposes;
- classes VII i VIII are not suitable for cultivation due to high restrictions to use and high costs for agro-technical measures to enable cultivation. This type of land is used for purposes other than agriculture.

Table 33 presents the information about the land categorisation in the Mostar area, also graphically shown in Figure 69.

Table 33: Land categorisation in the Mostar area[87]

Agro-zone	*Land category*	*Area (km^2)*	*Location*
Agro-zone I	I, II, III, IVa i IVb	30	Uneven and sloped terrains of 5% slope in the valley of Neretva, Buna, Bunica and Trebizat, and the Mostarsko polje karst field. Areas around Buna, Zitomislici, Sretnica, Podgorja and Rastana, and around road Mostar-Blagaj.
Agro-zone II	V i VI	238,7	The Mostarsko polje karst field and the area around Bogdol, Bijelog Polje, Lisani, Humilisana, the Hansko polje field, valley above Potok, valley under east side of the Prenj and Velez mountains towards the Nevesinjsko polje field.

[87] IPSA Institute, Preliminary design – Book C 1040 Engineering-geology study for main alignment and facilities, March 2018

Agro-zone	*Land category*	*Area (km^2)*	*Location*
Agro-zone III	VII i VIII	322,3	Mountain area of the municipality, including Velez, Cabulja and Prenj.

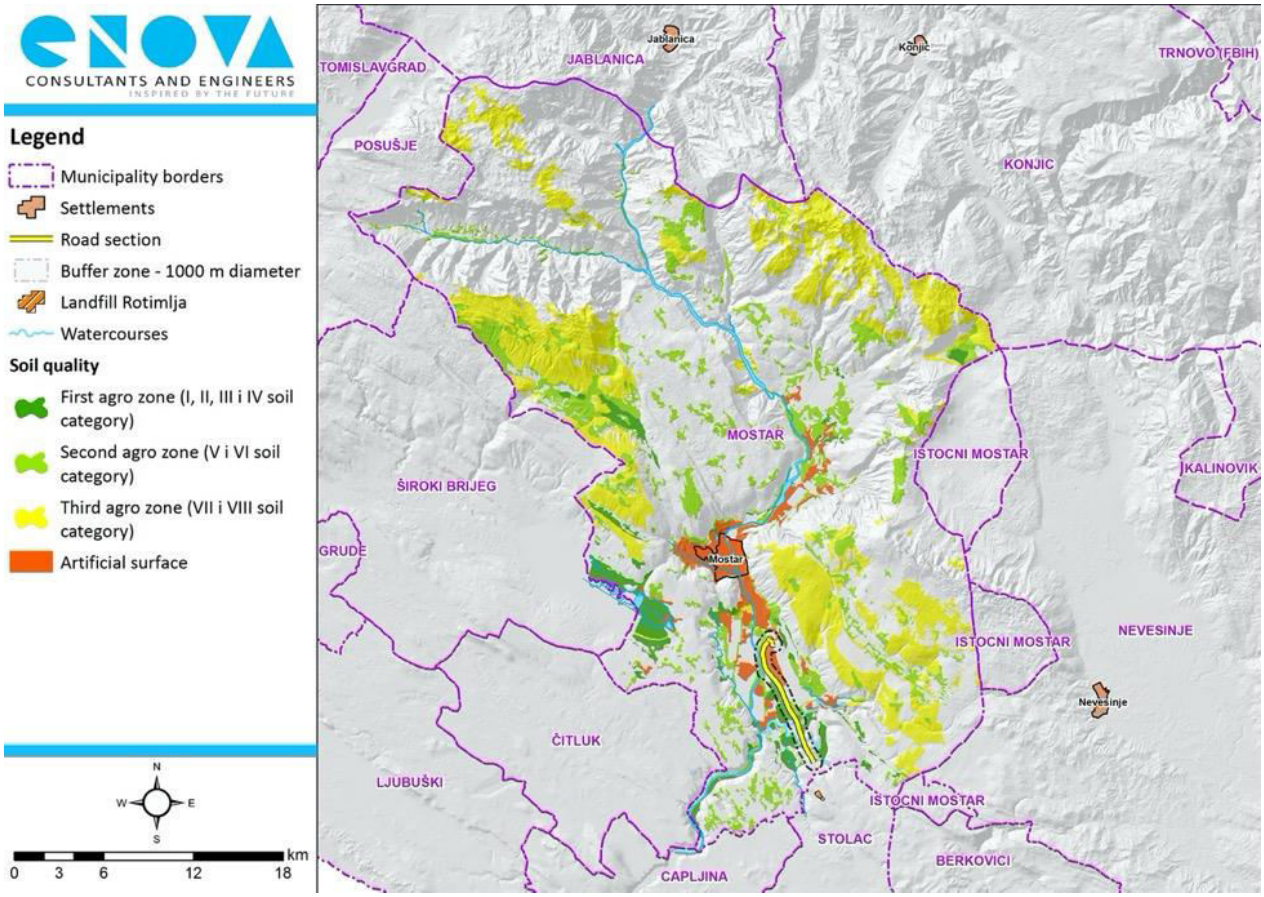


Figure 69: Land categorisation in the project area

5.5.4 Land use

Based on the information obtained from the 2012 Corina Land Cover for BiH the route passes through areas that are mainly used for cultivation and agriculture. The northern section is passing close to the industrial area including the airport, while southern section is situated in the natural environment (coniferous forest and grasslands) (Figure 70). Information on the current land use in the project area are given in Chapter 6.3.1. There is no baseline information on the soil quality in the project area.

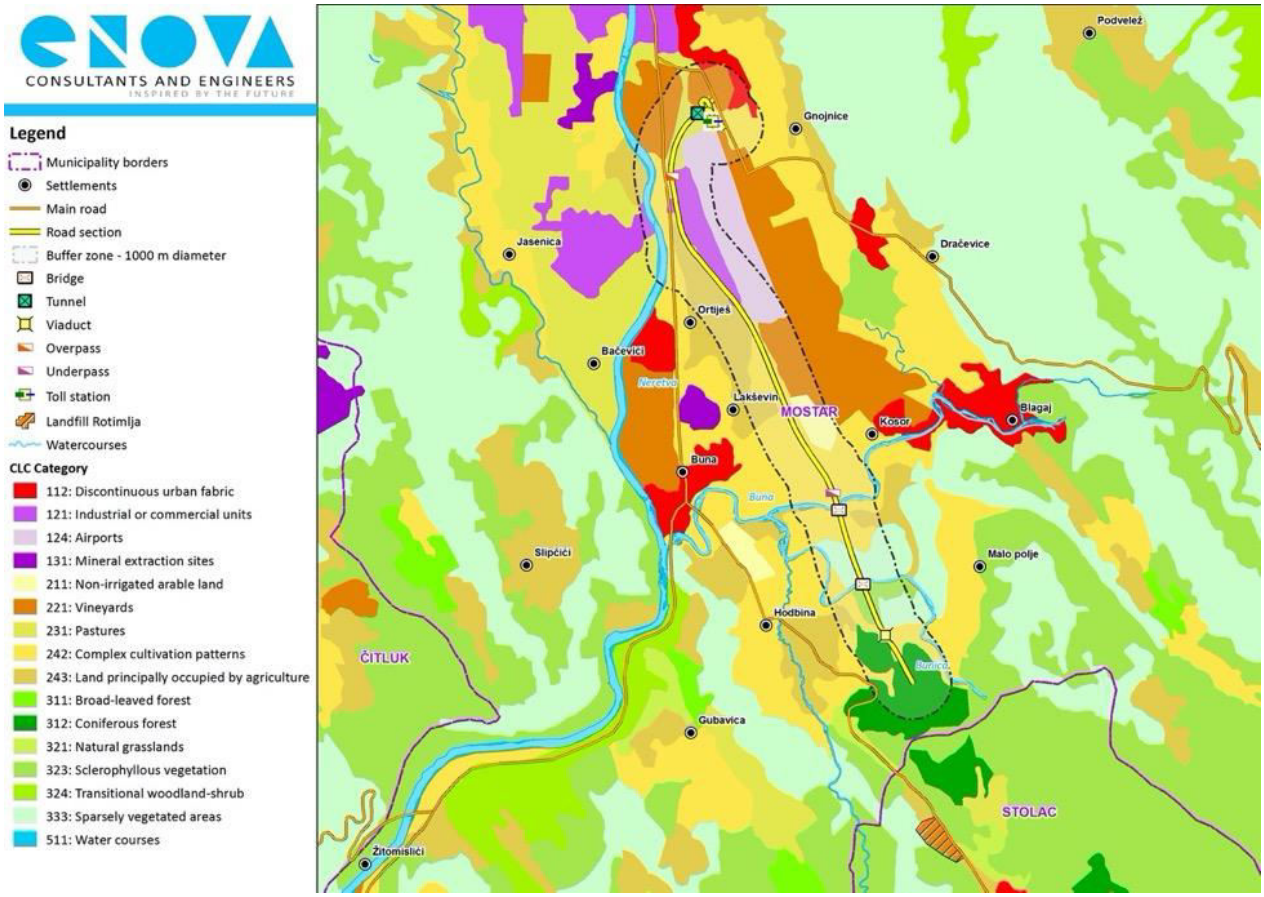


Figure 70: Land use in the project area

5.6 Climatic characteristics of the project area

5.6.1 Climatic factors

The City of Mostar is situated in the valley of Neretva River which extends to the Mediterranean coast and brings the Mediterranean climate into the area, slightly changed due to the position of the city. On the territory covered by the city, modified Mediterranean climate is predominantly present, while also Mediterranean, pre-Alpine, pre-Alpine moderate continental and Alpine climates are found in the surroundings (Figure 71). The road section is found on the territory with dominant modified Mediterranean and Mediterranean climate strongly under influence of climatic conditions from the Adriatic Sea that penetrate inland through the Neretva river valley.

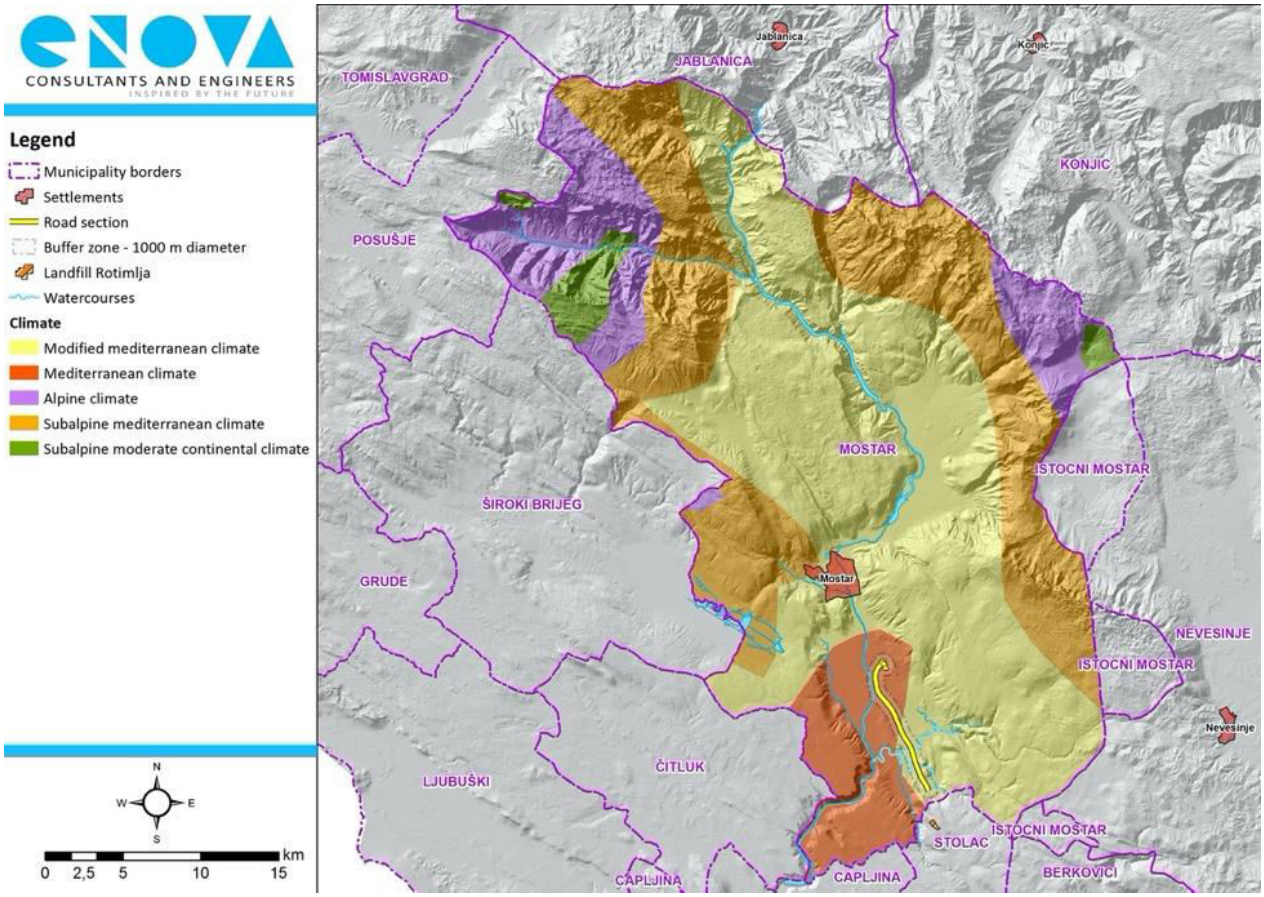


Figure 71: Climate zones on the territory of City of Mostar

The Mostar meteorological station is located in the settlement Bijeli Brijeg in the urban part of Mostar City (43°21' N i 17°48' E) at 99 m a.s.l in the Mediterranean climate zone. According to the climatological data, Mostar is the warmest city in Bosnia and Herzegovina with largest number of sunny hours per year (2,285 hr/y).

Figure 72: Monthly value of insolation in 2019 comparing to the average sum of insolation in 1961-1990[88]

Annual average temperature is around 14˚C. In the summer period, the temperatures are very high and can reach 45˚C in the shadow. Very often summer temperatures cause droughts and state of natural disasters. Due

[88] Federal Hydro-meteorological Institute, Annual Meteorological Report, 2019

to the proximity of Adriatic Sea, the winter temperatures are stable with average temperature being around 4˚C[89]. The Bora wind in the winter period can lower the temperature for additional 1-2˚C. In spring and autumn, the temperatures are in the range of 10-13˚C. Autumn is warmer than spring because of the Mediterranean warm air penetrates through the Neretva valley. Winters are very mild with temperatures rarely being below zero.

Table 34: Temperatures in the City of Mostar in 2019[90]

	Par	*I*	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*	*god*
Mostar	T_{avg}	4,1	8,8	12,6	15,1	15,4	25,7	26,5	27,7	21,8	16,8	13,6	8,5	16,4
	T_{min}	1,6	4,4	7,6	10,3	11,1	19,5	20,3	21,4	17,1	11,6	10,6	5,9	11,8
	T_{max}	7,2	13,9	18,3	20,5	20,6	32,2	33,1	35,2	29,0	24,6	17,2	11,5	21,9

where: T_{avg} – average monthly temperature (°C); T_{min} – minimum temperature (°C); T_{max} – maximum temperature (°C)

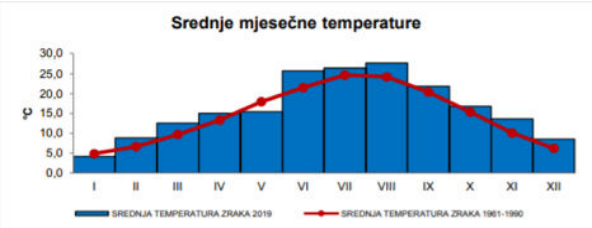


Figure 73: Average monthly temperatures in 2019

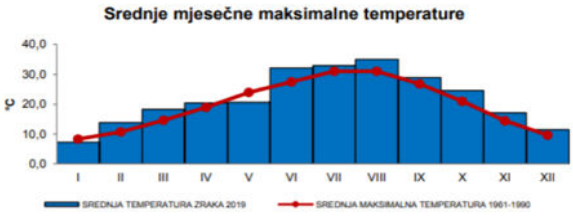


Figure 74: Average maximum temperatures in 2019

Figure 75: Average minimum temperatures in 2019

While summer months are in general dry, Mostar in spring and autumn months has significant number of rainy days with increased precipitation. The precipitation maximum is in November and December reaching up to 210 l/m^2. Snow in winter months is not so common.

[89] CETEOR Sarajevo, Environmental Impact Study for Motorway LOT 5, 6: Section Mostar North- Mostar South-Pocitelj; Mostar South-Buna, Updated Study, April 2017
[90] Federal Hydro-meteorological Institute, Annual Meteorological Report, 2019

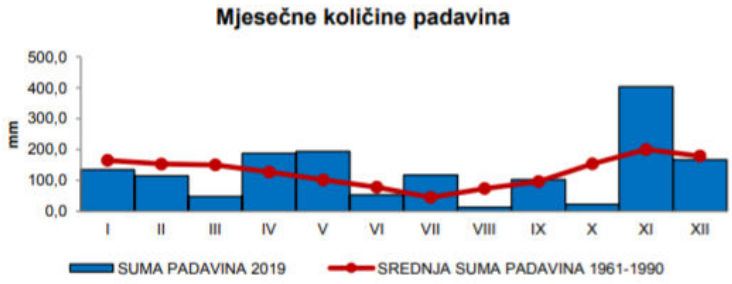


Figure 76: Monthly precipitation in 2019 comparing to the average precipitation in period 1961-1990

The most common winds in the Mostar are the North and North-East winds, also known as the Northern wind ("sjeverac") and Bora ("bura"). Bora is a phenomenon occurring on the east coast of the Adriatic Sea which penetrates the inland through Neretva valley. Bora is a very dry and cold wind blowing in the winter months. In spring and autumn another dominant wind is the Southern wind ("jugo") also penetrating from the Adriatic Sea. *Jugo* is a very humid wind and brings heavy rains.

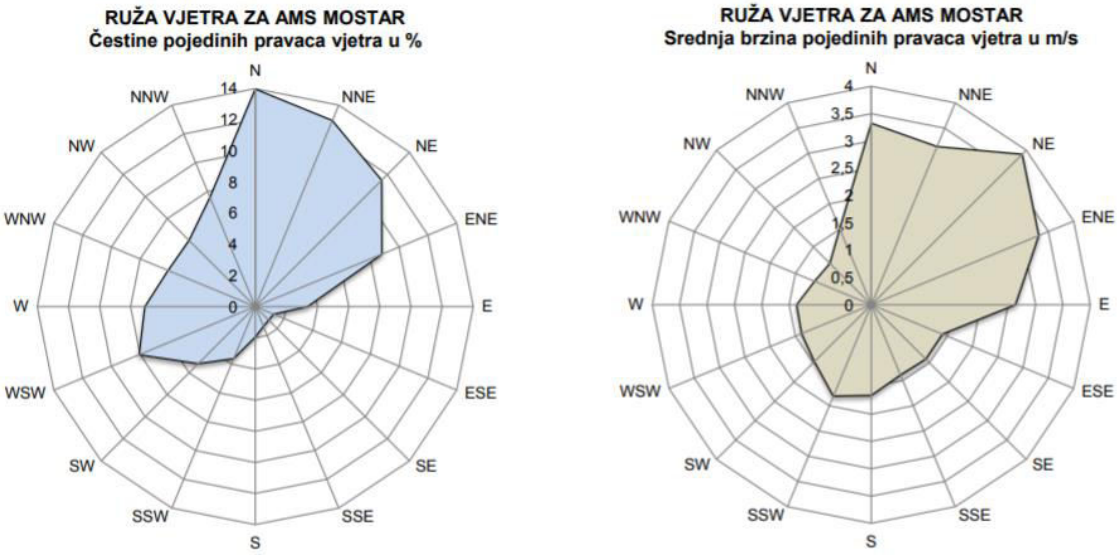


Figure 77: Wind rose (the frequency of the wind direction in % on the left and wind speed in m/s on the right)

5.6.2 Climate change

According to climate models for Bosnia and Herzegovina, the mean seasonal temperature changes for the period 2001-2030 are expected to range from +0.8°C to +1.0°C above previous average temperatures. Winters are predicted to become warmer (from 0.5°C to 0.8°C), while the biggest changes will be during the months of June, July and August, with predicted changes of +1.4°C in the north and +1.1°C in southern areas. Precipitation is predicted to decrease by 10% in the west of the country and increase by 5% in the east. The autumn and winter seasons are expected to have the highest reduction in precipitation. The climate models that have been applied to Bosnia and Herzegovina project further significant temperature increases during the

period 2031-2060, with a predicted average rise in temperature of between 1°C to 2°C in coastal areas, and 2°C to 3°C inland[91].

The negative consequences of climate change are already visible in Bosnia and Herzegovina even though the country contributes little to the causes of climate change. The per capita emissions are just over half of the EU average: 5.18 tons CO2 equivalent per capita per annum in 2008, compared to an EU average of 9.93 tons. But compared to relative wealth, Bosnia and Herzegovina's emissions are almost four times higher than those of the EU. Greenhouse gas emissions per unit of GDP were 1.59 kg CO_2 equivalent per EUR in 2008, while the EU average was 0.4 kg per EUR[92].

Bosnia and Herzegovina has low emissions of carbon dioxide from transport (25% below the global average and 77% below the Organisation for Economic Cooperation and Development [OECD]) average. Furthermore, the proportion of greenhouse gas emissions from the transport sector is lower than in EU countries: less than 7%[93] of total emissions compared to approximately 20% in the EU27[94]. Greenhouse gas emissions in this sector come mainly from road transport (more than 90% of total emissions). As road transport is the dominant means of transport – and is expected to remain so in the future – greenhouse gas emissions from transport are set to rise. Therefore, the transport is among the four sectors selected as priority sectors for the Low Emissions Development strategy.

The specific information related to climate changes and GHG emissions in the city of Mostar are not available. The baseline scenario relevant to the calculation of GHG impact of the motorway construction will be analysed in the impact assessment chapter.

5.7 Existing material assets including cultural-historical and archaeological heritage

Existing material assets in the project area are identified in Chapter 0.

The preliminary screening of presence of the cultural and historical heritage in the project area was done for the purpose of the 2009 Local EIA study for LOT 4[95]. Based on the information presented in this Study[96], the remains of a prehistoric fort and settlement from the Roman times are located on the Hadzajlica Kicin hill in Malo Polje. The remains are at the 500 m clearance distance from the road section Mostar South-Tunnel Kvanj, being on the edge of the project area of influence. The remains are not categorised as national monuments[97]. The same monument is found on the list of protected goods and cultural and historical heritage received from the Federal Institute for Protection of Monuments based on the JPAC's request for official opinion related to the construction of this road section. In June 2020 the Institute issued the list of 15 recorded and protected goods of cultural and historical heritage located near the road section[98] whose exact locations respective to the road alignment is not known. Therefore, the Institute prescribed the conditions under which the construction can take place, which will be elaborated in the impact assessment section.

[91] Results from running the EH50M model presented in Climate Change Adaptation and Low-Emission Development Strategy for Bosnia and Herzegovina (June 2013). This is detailed on p.16 of the Initial National Communication for Bosnia and Herzegovina under the UNFCCC, 2009.
[92] Climate Change Adaptation and Low-Emission Development Strategy for Bosnia and Herzegovina, June 2013
[93] Initial National Communication of Bosnia and Herzegovina under the UNFCCC, 2009.
[94] http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsdtr410&language=en
[95] IPSA Institute, Environmental Impact Assessment Study LOT 4, 2007.
[96] The information is obtained from the Institute for the Protection of Cultural-Historical Heritage of Herzegovina Neretva Canton.
[97] http://aplikacija.kons.gov.ba/kons/public/nacionalnispomenici
[98] Institute for protection of monuments in FBiH, Expert opinion related to the agreement on construction of the motorway Mostar South-Tunnel Kvanj, ref no. 07-36 -4-2328-1/120 from 1.6.2020

Table 35: List of protected goods of cultural and historical heritage

No.	*Location*	*Description*
1.	Kosorska cuprija, Kosor, Mostar	Roman bridge (damaged)
2.	Kosorska glavica, Kosor, Mostar	Prehistoric tumulus and remains of Roman settlement
3.	Varđa, Kosor, Mostar	Medieval judicial chair with Cyrilic scipture
4.	Kicin, Malo Polje, Mostar	Remains of prehistoric fortress and settlement from Roman period
5.	Gradina, Malo Polje, Mostar	Remains of prehistoric fortress and settlement from Roman period.
6.	Gorica, Malo Polje, Mostar	Prehistoric tumulus
7.	Negocine, Buna, Mostar	Remains of roman settlement and medieval necropolis
8.	Donje Gnojnice, Donje Gnojnice, Mostar	Remains of roman settlement and graveyard
9.	Gnojnice, Gnojnice, Mostar	Prehistoric tomb
10.	Gomila, Donje Gnojnice, Mostar	Prehistoric tumulus
11.	Gomile 2, Donje Gnojnice, Mostar	Prehistoric tumulus
12.	Markovac, Gnojnice, Mostar	Medieval necropolis
13.	Tuste, Donje Gnojnice, Mostar	Prehistoric tumulus
14.	Mukos, Mukos, Mostar	Remain of foundation of Roman building with columns, most probably belonging to a Roman temple.
15.	Gorica, Buna – Suho Polje, Mostar	Prehistoric tumulus and remains of roman buildings

In addition, the team of consultants engaged on development of LALRP for Mostar South-Tunnel Kvanj visited the location of Mostar South-Tunnel Kvanj section in November 2019 and identified three tombstones below the future Buna Bridge in Malo Polje.

5.8 Landscape

Each natural landscape contains three components: terrain, water and vegetation. The cultural landscape, in addition to natural components, also contains anthropogenic interventions in space. Of the natural elements of the landscape, the most dominant are the morphology and vegetation of the terrain.

Within the boundaries of the road alignment, the morphology of the terrain is slightly hilly with flat or slightly sloping terrains occupied with agricultural production.

The landscape imagery is completely open and vivid thanks to the rich floristic composition and significant ecological capacity of the landscape. There is also the presence of constructed urban segments however they fit into the ambient and form a harmonious landscape image.

Two dominant elements of the landscape are found in the project area: the natural system (rivers, forest) and the system created by human activity (agricultural land, settlements and infrastructure).

The settlement system is strongly connected with the transport system and, through that, with the natural morphology. The landscape looks like a continuation and makes a holistic picture with the existing natural environmental characteristics. Thus, this landscape is in a very delicate balance with its characteristic values (natural and human). The landscape of the observed area is additionally complemented by the streams Buna and Bunica.

The motorway is a linear structure, so the project route will change the existing landscape and the visual. During the construction, there will be a change in the way the land is used which will also have a temporary impact on the existing landscape.

5.9 Other specific elements relevant to the project

5.9.1 Noise and vibration

The current project area can be divided in three distinctive zones, industrial zone (airport and other commercial facilities), residential zone (settlements Kosor and Malo polje) and nature (forest). The terrain work indicated that motorway alignment is passing in close vicinity of residential houses, some of which are less that 50 m away from the route. Examples are given in figures below.

Figure 78: Houses in close proximity to the motorway in settlement Kosor (chainage 5+300 to 5+400)

Figure 79: Houses in close proximity to the motorway in settlement Kosor (chainage 5+700)

Figure 80: Houses in close proximity to the motorway in settlement Kosor (chainage 5+900, 6+100)

Figure 81: Houses in close proximity to the motorway in settlement Malo polje (chainage 6+400 to 6+700

In order to determine the baseline noise in the project area, the zero-state monitoring of noise is performed in April 2020[99]. The measurements are performed at 3 locations as described in the following table:

No.	*Measuring point*	*Description of location*	*Coordinates of measuring points*
1.	M1	At the existing quarry in the close vicinity of motorway alignment. Chainage framework: 1+400.	43°17'11.18"S 17°50'5.97"I

[99] IG Banja Luka, The Report on Expert Findings on External Noise Measurement - Zero State Monitoring, April 2020

No.	*Measuring point*	*Description of location*	*Coordinates of measuring points*
2.	M 2	Between the Mostar airport and railway, just along the planned alignment. Chainage framework: 0+450.	43°17'34.23"S 17°50'13.71"I
3.	M 3	Near a future bridge on the stream Buna. Chainage framework: 6+500.	43°14'40.64"S 17°51'51.90"I

The noise was measured during the COVID-19 outbreak when the Mostar Airport was closed. Therefore, the measured values do not include possible noise from the airport. The measurements are also not performed in settlement Kosor. The results are presented in Table 36.

Table 36: The results of outdoor baseline noise measurements

Acoustic area (zone) IV; Trading, business, housing and housing next to traffic corridors, storage without heavy transport				
Location	*Date of measurement*	*28.04.2020*		*Limit value for zone IV in dB(A)*
	Measurement interval	*Unit*	*Measured value dB(A)*	
M1	15 min	L_{eq}	53,3	60
		L_{10}	56,0	70
		L_1	63,3	75
M2	15 min	L_{eq}	46,9	60
		L_{10}	47,9	70
		L_1	58,3	75
M3	15 min	L_{eq}	52,2	60
		L_{10}	52,8	70
		L_1	60,6	75

Leq - equivalent noise level
L_{10} - sound pressure level exceeded for 10% of the measurement period
L_1 - sound pressure level exceeded for 1% of the measurement period

The values of the measured 15-minute equivalent outdoor noise level at measuring points located in open space along the border of expropriation towards residential facilities along the future construction site of Mostar South-Tunnel Kvanj motorway, motorway section in the Corridor Vc, do not exceed the limit values for the outdoor noise level defined for the acoustic zone IV defined by the Law on Noise Protection[100].

No information on baseline vibration is available.

5.9.2 Waste and materials management

During the construction and operation of the motorway, waste will be generated and classified according to the *Rulebook on categories of waste with lists*[101] by the characteristics and activities from which it generated. The type and scope of works on the construction of the motorway and ancillary facilities, which include

[100] Official Gazette of FBiH, no. 110/12
[101] Official Gazette of FBiH, No. 9/05

excavation, blasting, concreting, installation works, transport of materials and equipment, will govern the types and quantities of waste generated.

The main type of waste that will occur during the construction of the motorway is the construction waste, including:

- earth, sand, gravel, clay, loam, stone as a result of earthworks and excavation;
- bitumen (asphalt) or cement-bound material, sand, gravel, crushed stone as a result of construction of civil engineering structures;
- concrete, bricks, mortar, gypsum, aerated concrete, natural stone as a result of the construction of buildings;
- wood, plastic, paper, cardboard, metal, cables, paint, varnish and other mixed waste on the construction site as a result of other construction operations.

Indicative composition of construction waste is:

- excavation material 90%,
- demolition and construction waste 5%,
- asphalt and concrete 5%.

For the most part (95%) construction waste is inert waste (earth and stones from excavation, plaster, broken concrete, iron, steel, metals, wood, plastic, paper, etc.), and may be hazardous, for example, asphalt binder or waste containing asbestos, which requires special control and treatment. Other waste (5%) is mixed municipal waste produced by employees, oil waste and packaging waste (Table 37).

Table 37: Categorization of waste that will be generated during the construction of the motorway

Code	*Waste*
02 00 00	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing
08 00 00	Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), sealants and printing inks
13 00 00	Oil wastes and wastes of liquid fuels (except edible oils, 05 and 12)
15 00 00	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified
16 00 00	Wastes not otherwise specified in the list
17 00 00	Construction and demolition wastes (including excavated soil from contaminated sites)
20 00 00	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions

The clean-up and preparation works will include cutting shrubs and trees of all sizes, removing branches, cutting them to lengths suitable for transport, removing roots, etc. The total quantity of green waste from the removal is calculated per square meter of cleared overgrown area which takes up about 40% of the project footprint. These activities will be performed by the competent (local) forestry authority.

The motorway construction requires ground excavation and removal of extra quantities of excavated soil and removal of bad quality soil from the construction site (marly soil, soil containing high percent of biodegradable material). Granular materials – broken stone, crushed stone and sand are used for filling works and lining for road laying. Cement, concrete, steel and wood are materials that will be most frequently used in structure construction.

Total quantity of excavated materials resulting from the construction of the motorway will be as follows:

- excavation works on the route 1,939,734.55 m^3 (category III soil and stones, weakened substrate and sub-substrate) and
- tunnel excavation 48,336.00 m^3.

The excess land from excavation generated during construction activities will be disposed on the landfill Rotimlja, designed and opened for this purpose. The landfill site will be used for the construction of the whole section Mostar South – Buna and the two sub-sections including Mostar South-Tunnel Kvanj. The detailed description of the landfill site is given in Chapter 2.5 Associated facilities. Types and quantities of waste to be disposed on Rotimlja Landfill are given in table below.

Table 38: Types and quantities of construction waste that are planned to be disposed of at the location of the Rotimlja landfill from the sub-section Mostar South-Tunnel Kvanj

No.	*1[1]*	*2[1]*	*3[1]*	*Name of waste*	*Composition*	*Quantity m^3*
1.	17	01	01	Concrete	Waste large and small debris of concrete generated during the demolition of existing structures that were located on the site of the future route and the construction of the route and ancillary facilities of the motorway	240
2.	17	01	02	Bricks	Bricks resulting from the demolition of existing brick buildings	400
3.	17	01	03	Tiles and ceramics	Tiles and ceramics resulting from the demolition of existing structures	200
4.	17	05	04	Soil and stones other than those mentioned in 17 05 03*	Excavation materials such as: earth, stones, sand, limestone sand, gravel (surplus that will not be used as construction material during construction) - preliminary design	1,988,100.55
5.	17	05	06	Dredging spoil other than those mentioned in 17 05 05*	Dredge spoil, humus resulting from preparation works in a layer of thickness d= 20 cm (surplus that will not be used as construction material during construction)	31,600
6.	17	09	04	Mixed construction and demolition waste other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	Mixed construction waste generated due to the demolition of existing structures at the location of the future motorway route	200
7.	**Total construction waste to be disposed of at the location of the Rotimlja landfill**					**2,020,740.55**

1[1] - activity from which the waste originates, 2[1] - the process in which the waste was generated, 3[1] - the process from which the waste originates

During construction of the motorway, there might be a need to use additional construction materials such as soil, gravel, stone that will be used in the construction. The Contractor can obtain such materials from borrow pits or buy them on the market from licenced operators, which is the most common practice. Additional information on borrow pits are given in Chapter 2.5.4.

During the operation of the motorway, there will appear waste specific to road traffic, as well as waste resulting from inappropriate behaviour of road users, such as throwing garbage from cars while driving or especially in parking lots. This waste is of a sedimentary character. Waste from the ground, along the road, as well as waste from the parking lot should be taken away by the institutions responsible for motorway maintenance.

Small amounts of municipal waste might be generated during operation of the motorway. Waste will also be generated as a result of motorway facilities maintenance and in case of any traffic accidents. These include tires, metal waste, packaging contaminated with hazardous substances, greasy cloths, municipal waste and packaging waste, sludge from oil and grease separators, etc.

The types of waste that are expected during the operation of the motorway are given in the following table.

Table 39: Categorization of waste that will be generated during the exploitation of the motorway

Code	*Waste*
08 00 00	Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), sealants and printing inks
13 00 00	Oil wastes and wastes of liquid fuels (except edible oils, 05 and 12)
15 00 00	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified
19 00 00	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
20 00 00	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions

The management of waste generated on site is described in detail in the Waste Management Plan and Construction Waste Management Plan prepared for this motorway section. These plans are inseparable parts of this Study.

6 SOCIAL BASELINE

6.1 Settlements

The sub-section starts at the Mostar South interchange, in the settlement of Gnojnice. On the left side[102] of the interchange there are the first houses of this settlement located at a distance of approx. 150 m. Gnojnice is a rural settlement, with a total of 3,637 inhabitants as per Census 2013. The project area of Gnojnice is characterised by land plots belonging to one company for the production of wine and other alcoholic beverages, the airport restricted area and the existing railway Mostar-Capljina. Figure 82 below shows the area of project influence in Gnojnice.

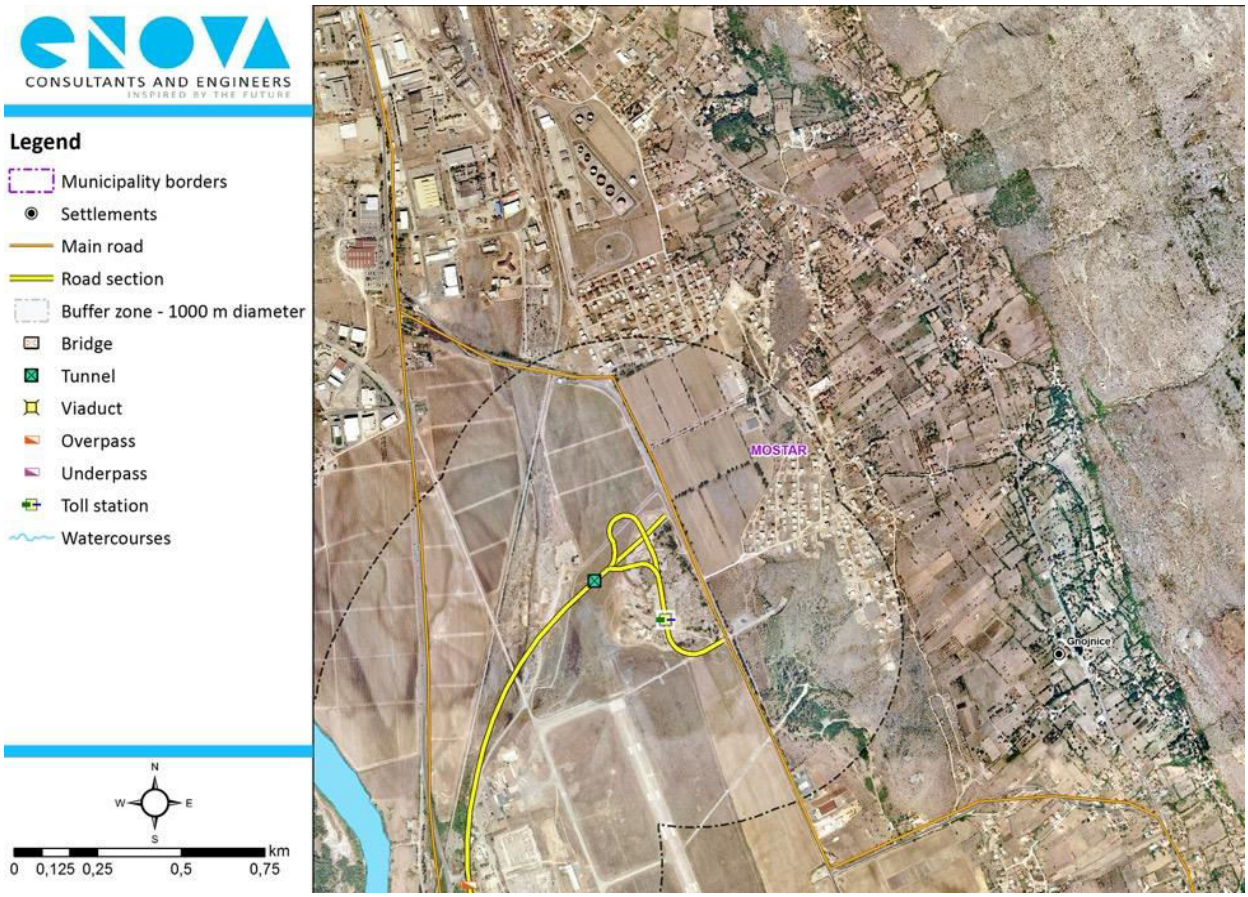


Figure 82: Area of Project influence in Gnojnice

The route passes parallel with the Mostar Airport runway towards Ortijes, Laksevine and Kosor settlements. These three settlements are also rural. As per Census 2013 the total population of Ortijes is 487, in Laksevine 1,432 and in Kosor 507 inhabitants. In Ortijes and Laksevine few sporadic houses are located on the left side[103] of the road section, at a distance between 100 m and 300 m. The settlement of Kosor is also characterised by agricultural land Two houses located in this settlement are affected by land acquisition and will be acquired.

[102] Direction from North to South
[103] Direction from North to South

Some houses are in the close proximity of the motorway route, some of which are less that 50 m away from the route (for figures please refer to Chapter 5.9.1).

Some land plots belonging to the settlement of Blagaj are located in the area near to the auxiliary airport runway. These land plots are not used for cultivation and no houses of the settlement of Blagaj are in the project area of influence (the nearest houses are at a distance of 1,250 m from the route section). The area of Project influence in Ortijes, Laksevina, Blagaj and Kosor is shown on Figure 83.

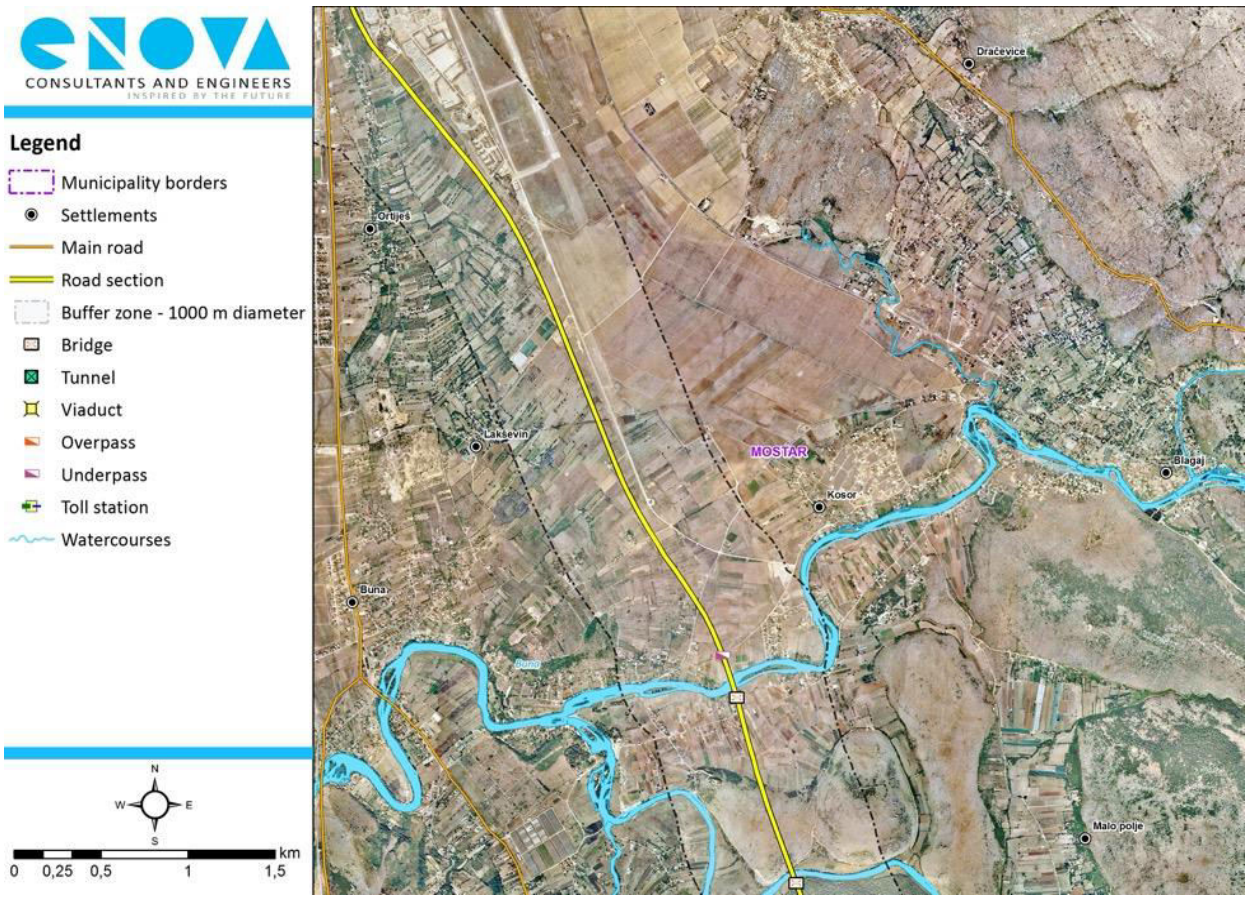


Figure 83: Area of Project influence in Ortijes, Laksevina, Blagaj and Kosor

After crossing the Buna Stream, the road section passes through agriculture areas of Malo Polje. Malo Polje is a small settlement with 469 inhabitants as for Census 2013. It is characterised by agricultural land and villas and apartments for renting during summer season. In this settlement two houses are affected by land acquisition as the motorway section passes over these two houses. The two houses will be acquired in line with land acquisition procedure described in LALRP, and the owners of affected houses will receive adequate compensation for their losses, in line with local legislation and EBRD PR 5. The other houses in Project affected area are in the close proximity of the motorway route, some of which are less that 50 m away from the route (for figures please refer to Chapter 5.9.1).

After passing the Bunica Stream, the road section passes through the territory of the settlement Hodbina via a viaduct which leads to the Hodbina Hill and further to the entrance of Tunnel Kvanj. The territory of Hodbina is mainly agricultural and with land plots covered with forests. Some sporadic houses are located on the left side of the motorway section (the nearest at a distance of 400 m aprox.), while a group of aprox. 5 houses are located on the right side of the viaduct, at a distance of 100 m aprox. None of the aforementioned houses are affected by land acquisition. This part of the section is shown on Figure 84.

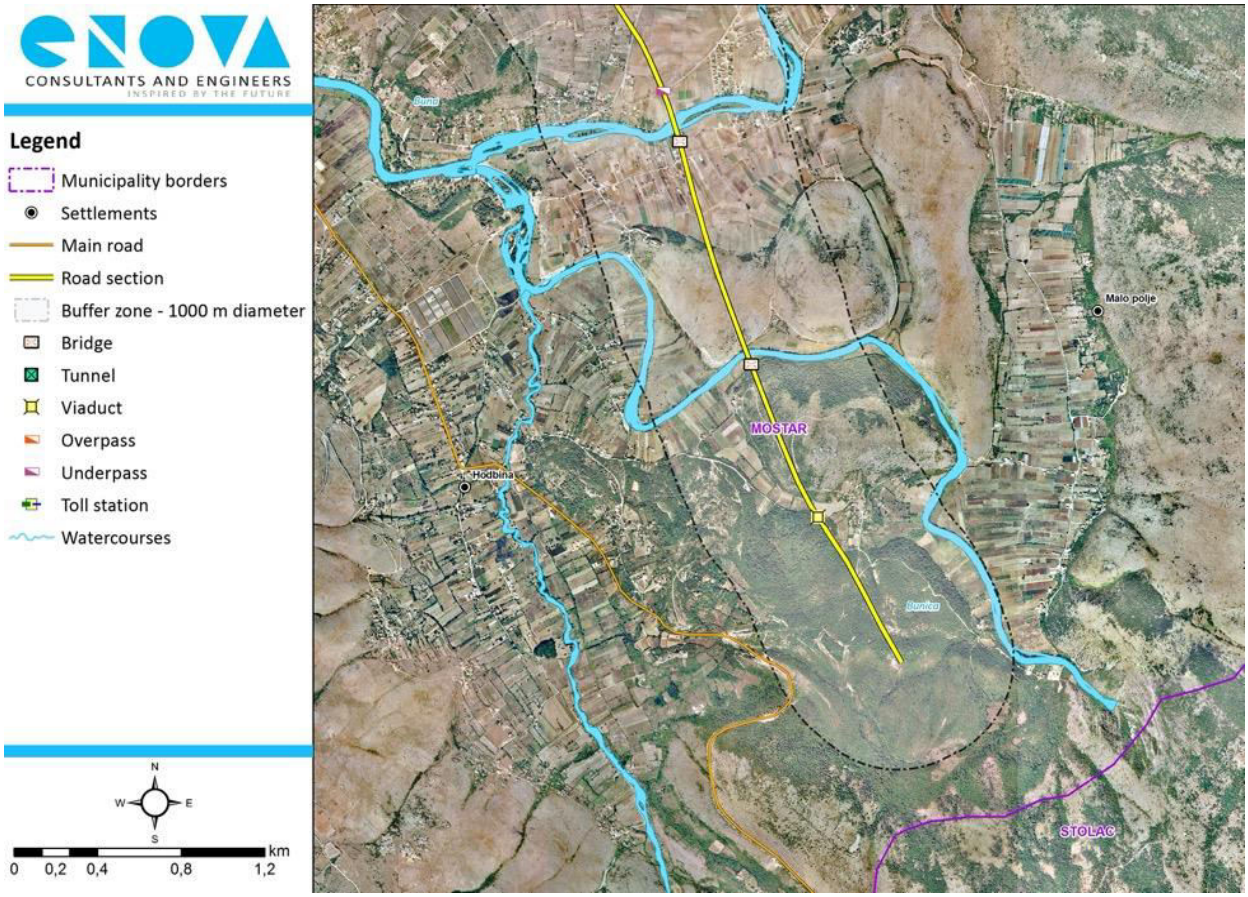


Figure 84: Area of Project influence in Malo Polje and Hodbina

6.2 Population and demographics

6.2.1 Population and demographics for the City of Mostar

According to the 2013 Census of population, households and apartments in Bosnia and Herzegovina, the territory of Mostar has 105,797 inhabitants. There are very significant differences in the distribution of population by regional units. The Neretva River valley and its tributaries represents the population's focal point of the territory. The population mainly settled on the fertile land of the central, southern and southwestern parts of the City. The mountainous areas in the northeast, northwest and west, which include the Cvrsnica, Cabulja, Prenj and Velez mountains are uninhabited due to adverse natural-geographical conditions. The city of Mostar is one of the middle-populated areas, with an average population density of 90 residents/km^2[104].

Natural movement of population

The natural movement of the population in the City of Mostar is negative, which means that more people die than are born. The difference between the number of births and deaths is shown in Table 40 below.

[104] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

Table 40: Natural movement of a population – City of Mostar 2013-2018[105]

Year	Live births	Died	Natural increase
2013	1,011	1,034	-23
2014	1,077	1,010	67
2015	965	1,164	-199
2016	1,025	1,068	-43
2017	974	1,105	-131
2018	1,003	1,114	-111

(Source: Statistical Yearbook of FBiH, Sarajevo 2019)

Natural increase is usually expressed as the rate, in relation to 1000 inhabitants (in ‰). Natural increase rates are very variable in time and space. Very high natural increase is expressed in rates higher than 20‰, high natural increase is 15-20‰, moderate natural increase 5-15‰, while rates lower than 5‰ are considered to be low natural increase. Movement of births and deaths may result in zero or negative natural increase (negative natural movement), i.e. the natural decrease.

According to 2013 data, the natality rate in the City of Mostar was 9.6‰. In the period 2013-2018, this rate was between 9.1-10.2‰.[106] According to the estimate for 2018, the natality rate is 9.5 ‰. Natality rate in the City of Mostar for the period 2013-2018 is shown in Table 41 below.

Table 41: Natality rate in the City of Mostar for the period 2013-2018[107]

Year	Mid-year No. of citizens	Live births	Natality rate (‰)
2013	105,797	1,011	9.6
2014	105,890	1,077	10.2
2015	105,871	965	9.1
2016	105,661	1,025	9.7
2017	105,417	974	9.2
2018	105,371	1,003	9.5

(Source: Statistical yearbook of Federation of Bosnia and Herzegovina, Sarajevo 2019)

Age and gender structure of population

The age structure shows the youth, the maturity or the elderliness of a population. When analyzing the Census 2013, it is apparent that neither old nor very young population is very abundant in Mostar – the majority (69.84%) of population belong to the category of mature population (age 15-65), providing the favorable economic and social development basis.

According to data from Census 2013, female population represents the 51.60% of the total population of the City of Mostar. 35.19% of the population is represented by females belonging ti the category of mature population (age 15-65). Participation of age and gender categories of Mostar population according to Census 2013 is shown in Table 42.

[105] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[106] *Bulletin Demographical statistics 2018*
[107] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

Table 42: Participation of age and gender categories of Mostar population according to Census 2013[108]

Item	Total		Males		Females	
	#	%	#	%	#	%
Total	105,797	100	51,210	48.40	54,587	51.60
0-14	15,705	14.84	8,030	7.59	7,675	7.26
15-65	73,884	69.84	36,656	34.65	37,228	35.19
65 and older	16,208	15.32	6,524	6.16	9,684	9.15

6.2.2 Population and demographics for the settlements in the vicinity of the motorway section

Data for the analysis of population and demographics for the settlements in the vicinity of the motorway section are taken from the Census 2013 and from the socio-economic survey conducted in April-May and in November 2019 during the development of the LALRP for the section Mostar South-Tunnel Kvanj.

Data collected from Census 2013 contains information on entire population of the settlements located on the project affected area.

The questionnaires used for data collection during the socio-economic survey contained questions on different aspects of Project affected people (PAP) (owners of land plots that will be acquired for the construction of the road section Mostar South-Tunnel Kvanj). The questionnaire contained questions on demographics and ethnic background. Given that the question on nationality and/or ethnic background is a sensitive socio-political issue, the respondents were given the opportunity to respond to the question in an open-ended format.

The survey was initially conducted during individual hearings with PAP in the period April-May 2019 by the representatives of the Department of Property and Legal Affairs of JPAC (Mostar), on the basis of survey questionnaires prepared by land acquisition experts. Thus the answers are provided according to Cadastral Municipalities where PAP owns their land plots. During this period, out of 231 PAP in total, 92 PAP were surveyed, whereas 18 PAP did not wish to be surveyed. An additional survey was organised during the development of this LALRP in November 2019 in order to attempt to interview the remaining 121 PAP. Only 4 PAP were present in the only 4 inhabited houses in the field at the time of the survey, as the majority of the other PAP do not live in the Project area. Interviews were carried out with 2 affected PAP, while the other 2 did not wish to be surveyed. It can be concluded that half of affected PAP were contacted, and this can be considered as a representative number taking into account that not all PAP live within the Project area, and according to JPAC information some of PAP live abroad. Regarding households living on the affected land plots, the number of interviewed ones can be considered a representative number, as out of four households living on affected land plots, three were interviewed. In addition, a census database was developed to identify all categories of impacts, PAP affected by land acquisition (owner/users of affected land plots) and the expected loss of assets for each of the 572 land plots. Data collection for the census database is based on information from the Expropriation Study developed in March 2018, examples of property valuation (prepared by official court experts), and the aforementioned site visits.

The total number of households to be physically resettled is 4:

[108] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

- 2 houses (both in Malo Polje) are located within the expropriation zone according to the Expropriation Study – *one of these households was surveyed*,
- 2 houses (both in Kosor) will be affected as these households have requested to be resettled in line with Article 11 of the Law on Expropriation – *both of these households were surveyed*.

Population and demographics according to Census 2013 data

According to the 2013 Census of population, households and apartments in BiH, the territory of Mostar had 105,797 inhabitants, with population density of 90.04 residents per km^2. Table 43 below shows total population within the settlements on which territory the road section will be constructed and the population density per km^2. According to data provided in this table, Gnojnice is the most populated settlement (3,637 inhabitants) and occupies the biggest area (12.94 km^2), while Malo Polje is the least populated (469 inhabitants) and Ortijes has the smallest surface (0.95 km^2). Laksevine is the settlement with the highest density (677.2 inhabitants per km^2), while Malo Polje has the lowest density (50.6 inhabitants per km^2).

Table 43: Population density in Project affected settlements according to Census 2013

Settlement	*Total population*	*Area (km^2)*	*Density (inhabitants per km^2)*
Gnojnice	3,637	12.94	281.2
Ortijes	487	0.95	511.3
Laksevine	1,432	2.11	677.2
Kosor	507	2.82	179.5
Malo Polje	469	9.27	50.6
Blagaj	2,531	8.58	295.2
Hodbina	813	12.72	63.9

The demography of the area is characterised by two phenomena: emigration from villages to cities due to employment opportunities and seasonal movements of the population (living in the villages only during the summer season).

According to data from Census 2013 Gnojnice, Kosor, Malo Polje and Blagaj are settlements with the majority of population belonging to Bosniak ethnic group, while Ortijes and Laksevine are settlements with the majority of population belonging to Croat ethnic group. The majority of inhabitants from Hodbina belong to Serb ethnic group. Table 44 below shows details on ethnic background of population in affected settlements according to Census 2013.

Table 44: Ethnic background of population in affected settlements according to Census 2013

Settlement	*Total*	*Bosniaks*		*Croats*		*Serbs*		*Others*	
	#	*#*	*%*	*#*	*%*	*#*	*%*	*#*	*%*
Gnojnice	3,637	3,276	90.1%	205	5.6%	93	2.6%	63	1.7%
Ortijes	487	15	3.1%	364	74.7%	105	21.6%	3	0.6%
Laksevine	1,432	19	1.3%	1,299	90.7%	93	6.5%	21	1.5%
Kosor	507	436	86.0%	59	11.6%	5	1.0%	7	1.4%

Settlement	*Total*	*Bosniaks*		*Croats*		*Serbs*		*Others*	
	#	*#*	*%*	*#*	*%*	*#*	*%*	*#*	*%*
Malo Polje	469	347	74.0%	2	0.4%	115	24.5%	5	1.1%
Blagaj	2,531	2,492	98.5%	7	0.3%	4	0.2%	28	1.1%
Hodbina	813	276	33.9%	156	19.2%	357	43.9%	24	3.0%

According to data from Census 2013 male population represents the majotity in Gnojnice, Ortijes, Laksevine, Malo Polje and Hodbina, while females are the majority of population in Kosor and Blagaj. Table 45 below shows details on gender structure of population in affected settlements according to Census 2013.

Table 45: Gender structure of in affected settlements according to Census 2013

Settlement	*Total*	*Males*		*Females*	
	#	*#*	*%*	*#*	*%*
Gnojnice	3,637	1,812	50.2%	1,825	49.8%
Ortijes	487	263	54.0%	224	46.0%
Laksevine	1,432	738	51.5%	694	48.5%
Kosor	507	242	47.7%	265	52.3%
Malo Polje	469	245	52.2%	224	47.8%
Blagaj	2,531	1,241	49.0%	1,290	51.0%
Hodbina	813	412	50.7%	401	49.3%

Population and demographics of households who live on the affected land plots

The total number of affected households (to be physically resettled) is 4. Out of the 4 affected households, 3 of them were interviewed:

- 1 interviewed household is located in Malo Polje, and
- 2 interviewed households are located in Kosor.

Household members

The total number of persons (household members) living in the 3 households surveyed is 10. The smallest number of household members is 1, while the largest household consists of 7 members. All affected households are male headed households. The total number of women in these households is 4.

The oldest household member (female) is 84 years old, and the youngest (male) is 5 years old.

Ethnic background

1 respondent declared himself as Bosniak, 1 as Croat and 1 person declared himself as not declared.

Population and demographics of households who live on the affected land plots

The total number of affected land owners who do not live on the land plots which will be acquired is 192. Out of these 192 land owners 88 were interviewed. These 88 land owners own in total 136 land plots, of which:

- 46% of land plots are located in settlement Ortijes,

- 2% of land plots are located in Blagaj,
- 11% of land plots are located in Gnojnice Donje,
- 5% of land plots are located in Hodbina,
- 23% of land plots are located in Kosor, and
- 12% of land plots are located in Malo Polje.

Demographics and ethnic background

The total number of persons (household members) living in the 88 households surveyed is 291.

30% of land plots is owned by females, while 70% by males. Most of the respondents are between 35 to 75 years old.

Given that the question on nationality and/or ethnic background is a sensitive socio-political issue, the respondents were given the opportunity to respond to the question in an open-ended format. The majority of the respondents surveyed declared themselves as Serbs (56.82%), 20.45% of respondent declared themselves as Bosniaks and 17.05% as Croat. 2.27% of respondents reported that they declare themselves as "others", the same percentage of respondents did not reported on his ethnicity, and 1.14% of respondents reported that he is neutral. Below is a figure showing the information provided by respondents on their ethnic background.

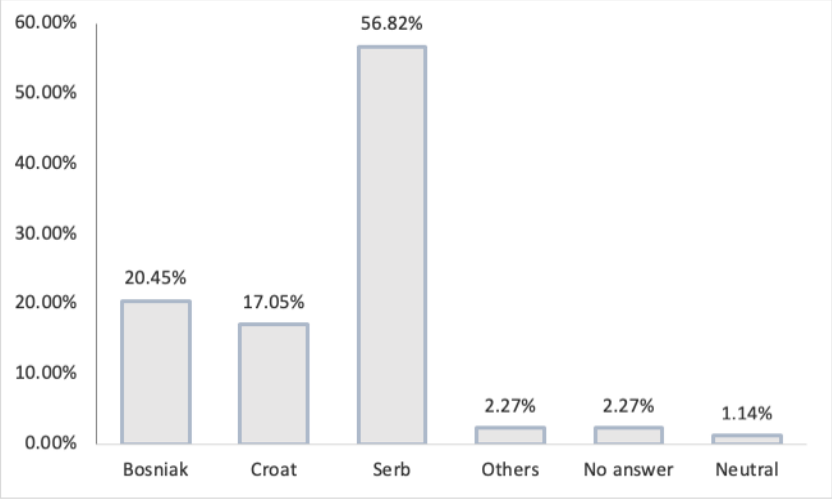


Figure 85: Ethnic background of interviewed land owners who do not live on land plots affected by land acquisition

Below is a table showing the information provided by respondents on their ethnic background in each settlement of the section. As shown in the table, in Ortijes, Malo Polje, Blagaj and Hodbina the majority of interviewed land owners declared themselves as Serbs, while in Kosor the majority of interviewed declared themselves as Bosniaks and in Gnojnice Donje as Croats.

Table 46: Ethnic background of interviewed land owners in each settlement who do not live on land plots affected by land acquisition

Settlement	Serbs	Bosniaks	Croats	Neutral	Others	No answer
Ortijes	34	3	1		2	1
Malo Polje	4		1			
Blagaj	2					1
Hodbina	4					
Gnojnice Donje	3	1	4	1		

Settlement	Serbs	Bosniaks	Croats	Neutral	Others	No answer
Kosor	3	14	9			

6.3 Current land use

Data on land use on the area affected by land acquisition for the construction of the road section Mostar South-Tunnel Kvanj are obtained from census performed during the development of LALRP for this Project and cadastral data. The total number of affected land plots in the 6 settlements is 375, according to the Expropriation Study. However, an additional 197 land plots are planned to be acquired based on Article 11 of the Law on Expropriation FBiH[109]. *Note*: All of these 197 land plots are actually owned by PAP identified in the Expropriation Study – the already affected PAP requested additional expropriation of their remaining land plots, hence the great number of supplemental requests.

Of these 572 plots in total (375 + additional 197):

- 506 (398,432 m^2) are private land plots and
- 66 (237,297 m^2) are state-owned land plots.

Total number of affected land plots in 6 settlements is shown in Table 47 below.

Table 47: Total number of affected land plots per settlement

Settlement/Cadastral Municipality	Total number of land plots	Surface of land plots (m^2)	Percentage of privately owned land plots	Percentage of state-owned land plots
Blagaj	10	20,012	70.00%	30.00%
Gnojnice Donje	98	199,828	70.41%	29.59%
Hodbina	19	112,488	84.21%	15.79%
Malo Polje	57	73,622	92.98%	7.02%
Kosor	140	101,781	94.28%	5.72%
Ortijes	248	127,998	93.95%	6.05%
Total	**572**	**635,729**	**88.46%**	**11.54%**

6.3.1 Land use on private land plots

Out of 506 (398,432 m^2) private plots, 106 (91,348 m^2) are used as **agricultural land**:

- 41 land plots (31,867 m^2) used as cultivated land,
- 32 land plots (22,848 m^2) used as orchards,
- 21 land plots (26,353 m^2) used as vineyards,
- 7 land plots (5,983 m^2) used for growing crops,
- 2 land plots (2,183 m^2) used as orchards (cherry and hazel trees),
- 2 land plots (1,599 m^2)used as vineyards and orchards combined,
- 1 land plot (515 m^2) used as cultivated land and orchards combined.

[109] Article 11 of the Law on Expropriation stipulates that landowners affected by a partial loss of their property are entitled to request complete expropriation and the corresponding compensation, in case partial expropriation would deteriorate the economic situation of the actual property owner or make the remaining part of the property useless or difficult to use.

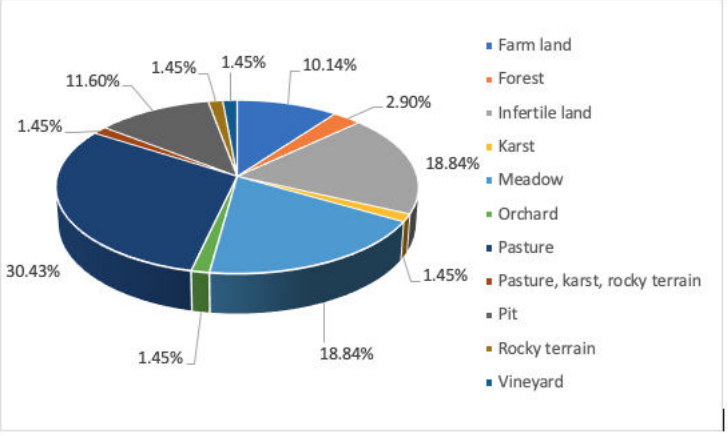
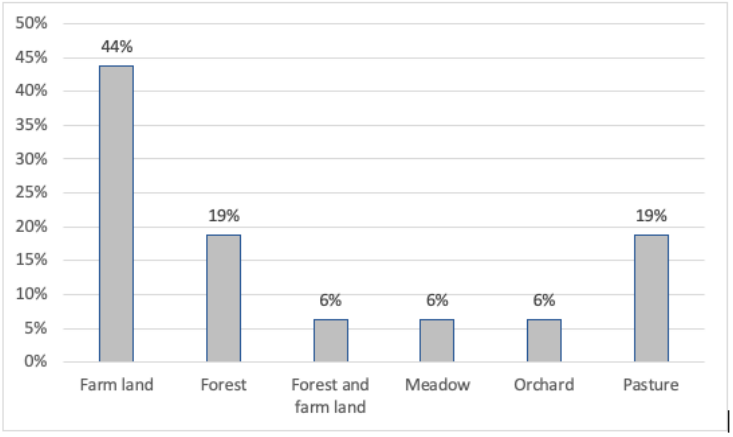
On 4 land plots there are **4 inhabited houses** which will be demolished:

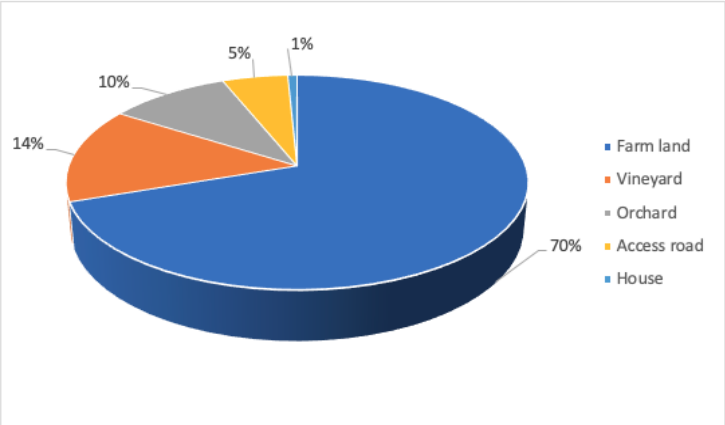
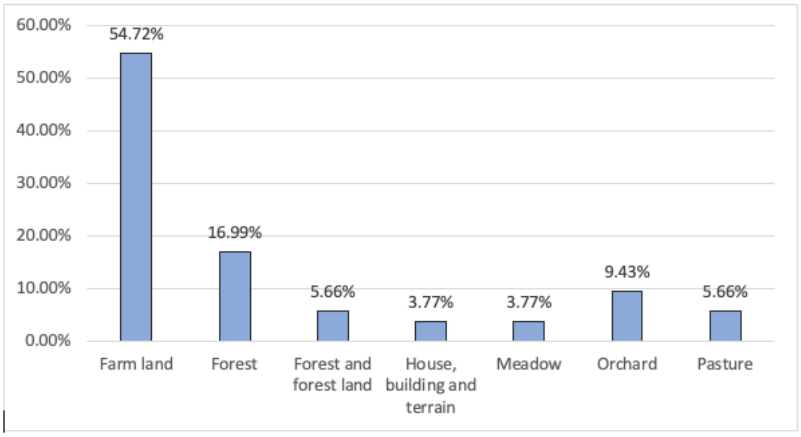
- two in Malo Polje
- two in Kosor.

23 land plots belong to **four businesses**:

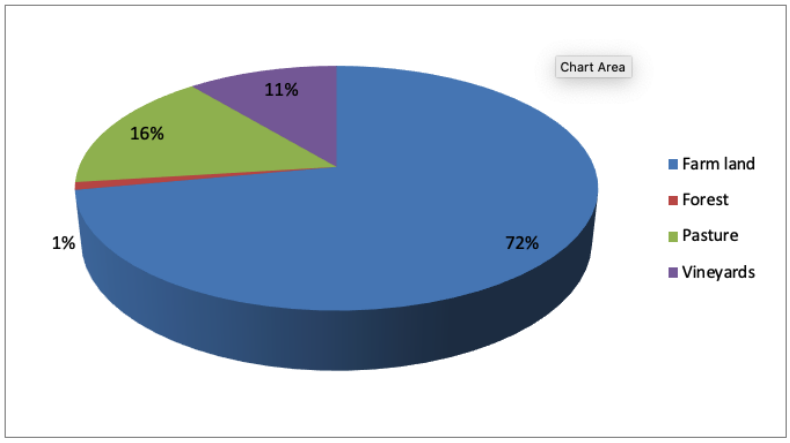
- 20 land plots belong to 2 businesses whose main business activities are production of wine and other alcoholic beverages. Out of these 20 land plots, 4 are used as vineyards. The other plots are trees, shrubs and grass. These 2 businesses will not need to be relocated.
- 2 land plots belong to a business whose main business activity is production and sales of fruits. This business will be relocated.
- 1 land plot belongs to a company who deals with renting, sale and purchase of property (restaurants, taverns, etc.). This business will be relocated.

Details are provided for each Cadastral Municipality below:

Gnojnice Donje	69 private plots (87,800 m^2), majority of which are classified as pasture (30.43%). The graph below shows details. 
Blagaj	3 private land plots (4,047 m^2), all categorised as meadows.
Hodbina	16 private land plots (55,368 m^2), majority of which farm land (44%). The graph below shows details. 

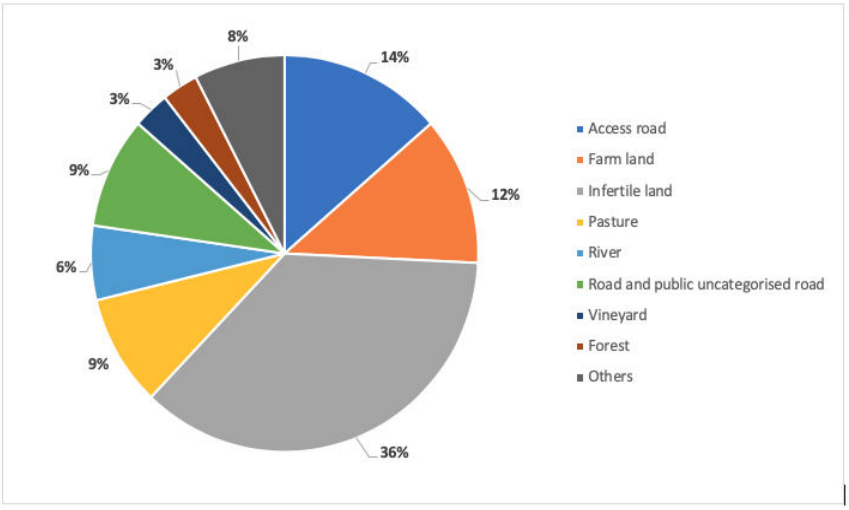
Kosor	132 private land plots (88,622 m^2), majority of which are classified as farm land (70%). One of the affected houses[110] is located in this settlement. The graph below shows details.  In addition, there are 23 auxiliary structures: - 2 auxiliary buildings (1 not registered) - 7 fences - 2 gates - 3 utility poles - 1 greenhouse - 1 swimming pool - 6 wells - 1 reservoir
Malo Polje	53 private land plots (41,591 m^2), the majority of which are classified as farm land (54.72%). There are 2 affected houses in this settlement. The graph below shows details.  Affected auxiliary structures in this settlement are: - 2 auxiliary buildings - 1 barn - 1 well - 3 neolithic tumulus

[110]The second affected house in this settlement is located on a land plot classified as vineyard.

Ortijes	233 private land plots (121,004 m^2), the majority of which are classified as farm land (72%). There are no auxiliary structures on these land plots. 

6.3.2 Land use on state-owned land plots

According to cadastral data[111] (official classification of land), state-owned land plots in the Project area are divided into the following categories:



Note: "others" means all other types of land, i.e. construction land, karst, pits …).

There are no residential or commercial structures on these plots.

On 17 of them, there are roads (access roads, local roads and uncategorised roads), while on 6 plots there are: airport parking, airport fence, small concrete building, temporary worker containers and local paths.

A company for stone exploitation has a concession on 10 state-owned land plots. This business will need to be relocated.

[111] Note: cadastral data does not necessarily correspond to the actual situation, as these data are most often outdated.

6.4 Education

Site-specific information on education levels is taken from the results of a socio-economic survey performed for gaining data for the development of the LALRP. This section contains information on educational levels of affected land owners. Two different type of information were collected throw the questionnaires used for socio-economic survey. For land owners who live on affected land plots the information on education levels is available for all household members, while for land owners who do not live on affected land plots the information on educational levels is provided for respondents (one member per each household).

3 households who live on the affected land plots were interviewed. The total number of persons (household members) living in the 3 households surveyed is 10. Out of 10 household members 3 persons have high school education and 1 person has primary school education. A majority of respondents (6 persons) did not report about their educational level.

Out of 88 interviewed land owners who do not live on the affected land plots, the majority (62%) of respondents have secondary education, while 18% have university education and 5% has elementary education. 1% holds a PhD and 14% did not report on their educational background.

Local educational establishments are not in the vicinity of the motorway section, so the construction of the motorway section will not affect negatively the access to local schools.

6.5 Employment, income and livelihoods

6.5.1 Employment, income and livelihood in the City of Mostar

General economic structure includes two categories of residents, economically active and economically inactive residents. Economically active residents include people performing some sort of business activity, temporarily unemployed persons and persons looking for a job for the first time.

Data on economic structure in wider area of the City of Mostar is taken from the Census 2013. The working age population of the City of Mostar is 90,092, of which 52.1% are females and 47.9% males. Economically active residents in the City of Mostar represent in total 47.2% of the working age population. Unemployed males represent 6.5% of the working age population, while unemployed females represent 5.7% of the working age population.

Economically inactive residents include retired persons, school children, students, housekeepers, persons unable to work, etc. Economically inactive residents are 52.7% of the working age population, and the majority are females. Table 48 shows the economic structure of the population of the City of Mostar according to Census 2013.

Table 48: Economic structure of the population of the City of Mostar according to Census 2013[112]

City of Mostar	*Working age population*		*Economically active residents*				*Economically inactive residents*	
			Employed		*Unemployed*			
	#	*%*	*#*	*%*	*#*	*%*	*#*	*%*
Total	90,092	100%	31,551	35.0%	11,003	12.2%	47,538	52.7%

[112] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

City of Mostar	*Working age population*		*Economically active residents*				*Economically inactive residents*	
			Employed		*Unemployed*			
	#	*%*	*#*	*%*	*#*	*%*	*#*	*%*
Males	43,180	47.9%	17,163	19.0%	5,888	6.5%	20,129	22.3%
Females	46,912	52.1	14,388	16.0%	5,115	5.7%	27,409	30.4%

According to the data of the Statistics Institute of the FBiH[113], in 2018 there were 54,133 employed persons in the Herzegovina-Neretva Canton, with average net salary of 970 BAM. The number of employed persons in the City of Mostar is 33,475, with the average net salary of 1,070 BAM.

The number of unemployed persons in the Herzegovina-Neretva Canton in 2018 was 30,703, and in the City of Mostar that number was 14,926. In qualification structure of unemployed persons, the majority are high school graduates (34%), then qualified workers representing 30%, unqualified persons 18%, university degree 11%, college degree 6%, then semi-qualified workers 1% as shown in Figure 86.

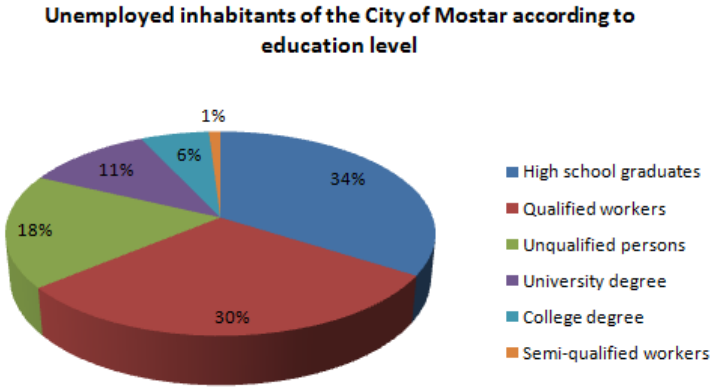


Figure 86: Unemployed inhabitants of the City of Mostar in 2018 according to education level

Out of the total number of persons who seek employment at the end of January 2020, there were 16,328 women or 54.1%. In the City of Mostar, the number of unemployed persons was 14,797 or 49.0% out of the total number of unemployed persons in Herzegovina-Neretva Canton[114].

The aforementioned unemployed persons, in particular the low-skilled ones, will have the opportunity to be temporary employed during the construction works related to the motorway section Mostar South-Tunnel Kvanj.

6.5.2 Employment, income and livelihood in settlements in the vicinity of the motorway section

Information on employment status, income levels and livelihoods of project affected people was collected during the socio-economic survey during the development of the LALRP. Questionnaires used for the socio-economic survey contained questions on the aforementioned aspects. Two different questionnaires were used, one for land owners who live on the affected land plots and one for land owners who do not live on

[113] Herzegovina-Neretva Canton in numbers 2019
[114] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

affected land plots. Data obtained during the survey were analysed separately for the two aforementioned categories of land owners.

Out of 4 land owners who live on the affected land plots, 3 were interviewed. Out of 3 respondents, 2 reported that are employed, while 1 did not reported any information on his employment status.

All respondents provided information on the income levels of their households. 1 household reported having less than BAM 500 of monthly income, while 1 household has income in the range of BAM 500 to 1000 and 1 household reported monthly income more than BAM 1,500.

2 households stated that their own agricultural production represents the main source of income, while for 1 household salary is the main source of income. 2 households (one from Malo Polje and one from Kosor) own orchards and use the harvest for commercial purposes. However, only the one from Kosor relies exclusively on agriculture as a source of income as it has 337 various fruit trees (cherry, plum, pomegranate and almond trees), whereas the other reported that the crops (wheat) represent a secondary source of income.

Out of 192 land owners who do not live on the affected land plots, 88 were interviewed. Out of 88 respondents, 57% of the heads of households reported to be unemployed, whereas 35% reported to be employed and 8% did not report on their employment status.

Out of 88 respondents, 86 reported on the level of their household income, as follows:

- 19 respondents reported monthly income more than BAM 1,500,
- 8 respondents reported monthly income in the range of BAM 1,000 to BAM 1,500
- 22 respondents reported monthly income in the range of BAM 500 to BAM 1,000
- 36 respondents reported monthly income less than BAM 500,
- 1 respondents reported monthly income less than BAM 200.

Out of 88 respondents, 66 respondents reported on their primary sources of income:

- 29 respondents reported pensions as the primary source of income,
- 24 respondents reported salaries as the primary source of income,
- 9 respondents reported agriculture as primary source of income,
- 4 respondents reported their own private businesses as primary source of income.

9 respondents reported that crops are their primary source of money. Even though one household reported that the land plot is used for sowing and represents the household's secondary source of money, no data on crops were provided by the respondent.

39% of the surveyed respondents use their land plots as orchards – the planted seedlings are mainly cherry, walnut, pomegranate, pear, plum, watermelon, strawberry, fig, vineyard and almond trees. 10% of the surveyed respondents do not use their land as orchards, and 51% did not gave an answer.

11 households declared that the sale of fruits represents their primary source of income, whereas 2 reported that such sale is their secondary sources of income.

There is one household which owns pigs and chickens and sells meat products.

6.6 Vulnerable groups

Vulnerable groups include people who, by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage or social status, may be more adversely affected by displacement than others and who may be limited in their ability to take advantage of resettlement assistance and related development benefits.

Information on vulnerable groups on Project affected land plots (Project footprint area) was collected during the socio-economic survey conducted during the development of the LALRP. The questionnaires used for data collection during the socio-economic survey contained questions on living conditions of Project affected people (PAP), including the identification of vulnerable categories.

The results of the socio-economic survey show that there are several vulnerable households identified in six settlements. The categories of vulnerability include, by order of frequency:

- Elderly persons,
- Persons with a disability or chronic illness and
- Unemployed persons.

Out of 4 land owners who live on the affected land plots, 3 were interviewed. None of the 3 interviewed land owners reported to have any type of vulnerability.

The total number of affected land owners who do not live on the affected land plots is 192, of which 88 were interviewed. Out of 88 respondents, 12 household heads (3 females and 9 males) reported on their own vulnerability (1 person with disability, 1 unemployed and the rest elderly persons). 6 respondents also reported that one or more of their family members belongs to the category of vulnerable groups. One of them is reported to have a chronic illness, and the other one is an elderly person, while no additional information was provided for the other 4. Table 49 below contains detailed information on vulnerable persons identified among the affected land owners who do not live on the affected land plots.

Table 49: Number of vulnerable persons identified

Cadastre Municipality/Settlement	*No. of vulnerable heads of household (HH)*	*Types of HH vulnerability reported*	*No. of vulnerable household members*	*Type of vulnerability of members who depend on HH reported*
Ortijes	4 (1 female, 3 males)	Elderly persons, disability	4 (3 females, 1 male)	-
Blagaj	1 male	Unemployed person	1 female	Elderly persons
Hodbina	1 male	-	-	-
Gnojnice Donje	3 (2 females, 1 male)	Elderly persons	-	
Malo Polje	1 male	-	1 female	Chronic illness
Kosor	2 males	-	-	-

In addition to the aforementioned vulnerable groups, two potential vulnerable groups are identified. One is represented by female population of the settlements in the vicinity of the motorway section which can be exposed to possible gender-based violence and harassment (GVBH) issues due to worker influx during construction phase. As already analysed in previous sections female population represents the 51.60% of the total population of the City of Mostar, and according to data from Census 2013 female population represents the majority in Kosor and Blagaj. However, mitigation measures are proposed in the section with mitigation measures regarding impacts from worker influx and risks to community safety.

The other identified vulnerable group is represented by Serb returnees, who live in the settlements near to the motorway section and who put several efforts in past years in reconstructing their houses and livelihoods. According to results from the survey implemented during the development of LALRP, 56% of interviewed land owners who do not live on land plots affected by land acquisition declared themselves as Serbs (mostly from Ortijes, Malo Polje, Blagaj and Hodbina). However, there is no information if all of them are returnees.

Assistance for vulnerable persons/households will be facilitated by JPAC according to their specific needs, on the basis of case-by-case screening to be carried out with support from the City of Mostar (Department of Social Affairs). Detailed assistance measures are provided in the LALRP for the Section Mostar South-Tunnel Kvanj.

6.7 Local economy

General information on economic aspects of the City of Mostar area is provided on the website of the City of Mostar, without details on economies in the settlements which are on the territory of the City[115]. The economy of Mostar area relies on the production of aluminium and metal industries, agricultural production, stone processing, electricity production from renewable sources of energy, and tourism sector.

Local economy of the Project area of influence is based mainly on agriculture (including vine production), stone exploitation, and tourism related activities. In Gnojnice some land plots are owned by companies which produce wine and other alcoholic beverages, as well as by state owned land plots used for stone exploitation based on concession agreement. Mostar Airport is also located Gnojnice, and has significant importance for the tourism sector, considering its vicinity with the cultural and historical sites located in Mostar and Herzegovina region. Ortijes, Laksevine and Kosor are characterised by small agriculture activities and land used as vineyards. Agricultural activities are one of main economy sector of Malo Polje and Hodbina. In addition, the economy of Kosor, Malo Polje and Blagaj is based on tourism sector, represented by villas and apartments for renting during spring, summer and autumn, as well as several camping sites (Figure 87).

[115] Source: http://www.gospodarstvoprivreda.mostar.ba/index.php/ba/grad-mostar/stanje-gospodarstva-privrede [accessed on June 28, 2020]

Figure 87: Location of villas and apartments for renting in Kosor, Malo Polje and Blagaj near Buna Stream

A total of 5 private businesses will be affected by land acquisition, of which 3 will need to be relocated (Table 50).

Table 50: Impacts on businesses

Type of business	*Settlement*	*To be relocated*	*Number of affected land plots*
Production of wine and other alcoholic beverages	Gnojnice Donje	No	4 (all covered by shrubs and grass)
Production of wine and other alcoholic beverages	Kosor	No	16 (4 are vineyards and the rest are covered by shrubs and grass)
Wholesaler	Ortijes	Yes	1
Production & sale of fruits	Ortijes	Yes	2
Stone exploitation	Gnojnice Donje	Yes	10 (state-owned plots used based on concession agreement)

For information on agricultural activities of owners of the land plots affected by land expropriation, please refer to section 6.5.

6.8 Traffic infrastructure

6.8.1 Road infrastructure

The following two main roads are located within the Project area of influence:

- M17 Salakovac – Mostar – Capljina – border of Croatia, and
- M6.1 Siroki Brijeg – Mostar – Nevesinje.

The main road M17 is part of the south European route E73 that connects Hungary and the Adriatic Sea in the area of the port of Ploce and it is one of the most important roads in the country. The road is regularly maintained and it has adequate horizontal and vertical signalization. However, M17 is not appropriate for the traffic frequency and is not suitable for driving characteristics of modern vehicles. Trunk road M17 is "slow" road, because it passes through many settlements, therefore no high average driving speed is possible to achieve (about 50-60 km/h).

The main road M6.1 south-western part of BiH. The M6.1 section starts in Siroki Brijeg, located within the West Herzegovina Canton, passes through the Herzegovina-Neretva Canton (through Mostar) and the finishes in Republika Srpska (Nevesinje). The existing road is asphalted, with canals, side ditches and tubular/plate culverts. The road M6.1 is also passing through many settlements, with no possibilities to drive on higher average speed than 50km/h.

The aforementioned main road M6.1 will be directly connected to the Corridor Vc road section Mostar South-Tunnel Kvanj. The Mostar South interchange, located at the beginning of the motorway section in Gnojnice settlement, will be directly connected to M.6.1 near to the Mostar Airport. This intersection of the two roads will enable the connection of the motorway with the southern part of Mostar (Figure 88). M17 will be indirectly connected to the Corridor Vc section due the connection of M17 with the M6.1.

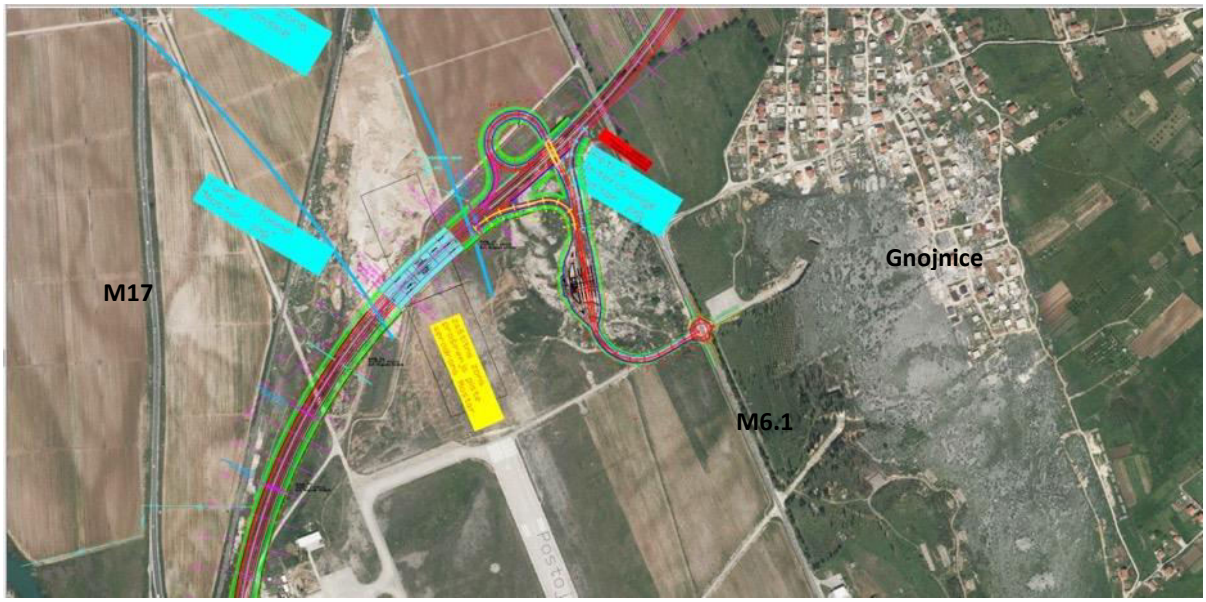


Figure 88: Intersection of the Mostar South Interchange with the main road M6.1 in Gnojnice

Based on the Traffic Study[116] prepared by IPSA Institute in April 2018 a baseline analysis of road traffic on the two main roads was developed.

The traffic data was obtained from automatic traffic meters, installed on various sections of the relevant road network for this Project. Table 51 below shows the location of automatic traffic meters along the main roads M17 and M6.1 in 2018.

[116] Traffic Study, IPSA Institute, April 2018

Table 51: Location of automatic traffic meters in the relevant Project area in 2018

Road ID	Counters ID	Section	Location
M6.1	582	Posusje-Siroki Brijeg	Privalj
M6.1	519	Siroki Brijeg-Mostar (Citluk)	Polog
M17	518	Tasovcici-Dracevo	Dracevo
M17	530	Gnojnica South-Buna	Ortijes
M17	517	Buna-Zitomislici	Buna

Source: Traffic Study, April 2018, IPSA Institute

The traffic intensity on the different sections in the relevant Project area differs significantly in 2018. According to annual average daily traffic (AADT) provided in the aforementioned Traffic Study, the main traffic intensity is registered on the M17 section Gnojnica South-Buna. This section goes parallel to the future motorway section Mostar South-Tunnel Kvanj. On this section 91% of vehicles is represented by passenger cars, 1.59% are buses and 7.41% by heavy goods vehicles. A summary table with the ADDT registered in 2018 on main roads M17 and M6.1 is shown below (Table 52).

Table 52: AADT and traffic flow structure in the main roads M17 and M6.1 registered in 2018

Road ID	Section	AADT in 2018	Share in AADT (%)				
			PassengerCars	Heavy Goods Vehicles			Buses
				2 axles	3 axles	4 axles	
M6.1	Posusje-Siroki Brijeg	4,746	90.00%	0.43%	5.88%	1.09%	2.60%
M6.1	Siroki Brijeg-Mostar (Citluk)	7,163	90.00%	0.43%	5.88%	1.09%	2.60%
M17	Tasovcici-Dracevo	4,205	92.00%	2.15%	3.85%	0.75%	1.25%
M17	Gnojnica South-Buna	14,096	91.00%	0.89%	6.06%	0.46%	1.59%
M17	Buna-Zitomislici	5,578	93.00%	2.25%	3.60%	0.50%	0.65%
M17	Zitomislici-Tasovcici	6,470	93.00%	4.47%	0.47%	1.74%	0.34%

Source: Traffic Study, April 2018, IPSA Institute

According to the Traffic Study for the Section Mostar South-Buna developed by IPSA Institute in April 2018 a total of 2,325 traffic accidents occurred on the roads of the Herzegovina-Neretva Canton in 2016, of which 681 traffic accidents with fatalities and injuries, and 1,644 traffic accidents with material damage. 22 people lost their lives, 136 people suffered serious injuries, while 894 people suffered minor injuries. An increase in the total number of traffic accidents in the period 2014-2016 was recorded, on average by 7.95% per year, while the number of traffic accidents with fatalities grew at an average rate of 6.45%. During 2016, 22 people were killed in traffic accidents, which is 13 less than in the previous year, and 3 less than in 2014. In addition, the number of severely injured slightly increased, while the number of people with minor injuries in 2016 recorded the lowest value in the observed period. According to the Traffic Study the project will result in 60% less of accidents compared to the baseline state.

In addition to the aforementioned main roads, the rest of the road network is made up of local roads, made of asphalt and macadam, which connects local settlements with the main roads M17 and M6.1. The local roads are used by local inhabitants to reach their houses and land plots. Based on the findings from the site visits conducted during the development of LALRP, the auxiliary airport runway is also used as road by local inhabitants to reach their land plots. Examples of local roads within the Project area of influence are shown in Figure 89 below.

Figure 89: Local roads in the Project area of influence

6.8.2 Railway infrastructure

The section Mostar South-Tunnel Kvanj passes near to the existing railway Mostar-Capljina in the area of Mostar Airport (Gnojnice). The aforementioned railway is a section of the Sarajevo-Capljina railway line which is part of the Pan-European Corridor V, branch C, e.g. Line (Ploce) – Capljina – Mostar – Sarajevo – Doboj – Bosanski Samac – (Budapest). The railway is single-track line and is mostly build in extremely adverse terrain conditions. The total length of this section is 171.76 km and the entire length of the railway is electrified and equipped with signal-safety devices. The total length of straight line is 80.54 km (about 47%), while 91.21 km are curves (about 53%). The minimum applied curve radius is 250 m, while maximum is 10,000 m. The part of the railway which passes near to the Corridor Vc section Mostar South-Tunnel Kvanj is a straight line (see Figure 90).

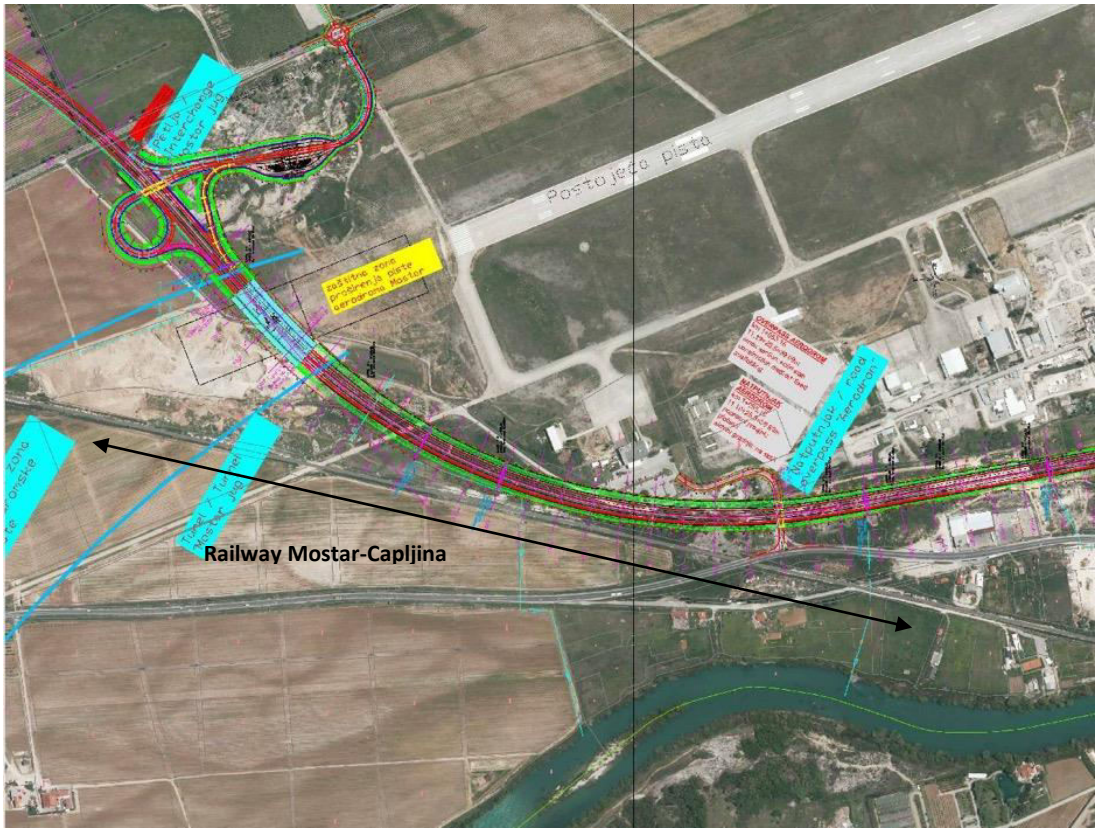


Figure 90: The existing railway section Mostar-Capljina in the area of Mostar Airport in Gnojnice

Although the repair of the railway line was mostly entirely done, today only cargo traffic is performed on the entire railway route and passenger traffic is performed from Sarajevo to Capljina. The maximum speed through BiH is 70 km/h. The railway company of the FBiH is a Public Enterprise (ZFBiH), and it is in charge of the public transport of passengers and goods and infrastructure management in the territory of FBiH[117].

6.8.3 Air transport infrastructure

Mostar Airport was reconstructed from military airport, and was opened for civilian air traffic in 1965, exclusively for domestic flights. During the Winter Olympic Games in 1984, Mostar Airport gained the status of an International Airport and was operational until 1991. Mostar Airport was reopened for air traffic in 1998. Nowadays, Mostar International Airport d.o.o. (LLC) is a public company owned by the City of Mostar with 88% ownership and Zagreb Airport with 12% ownership. The airport has regional significance, and it is particularly interesting considering important tourist destinations such as: Medjugorje ("religious tourism"), which is about 30 km away from the airport, with approximately 1 million tourists a year, Old Town Mostar with the Old Bridge, Buna spring and Tekija in Blagaj, Hutovo Blato.

As part of Airport infrastructure, there is one asphalted runaway (Length: 2.4 km, Width: 49 m) and one driveway parallel to the runaway, with five junctions to the runway. Additional Airport facilities are the passengers terminal, hangars, and the Airport parking (for passenger cars). The airport is capable of providing basic pick-up and departure services for passengers, aircraft and goods. The current capacity of the airport is 2-4 operations per hour[118].

The Mostar South-Tunnel Kvanj section alignment is located in the immediate vicinity of the Mostar Airport. The route passes parallel with the Mostar Airport runway towards Ortijes and Kosor settlements and follows the auxiliary airport runway at a distance of 35-45m.

6.9 Local infrastructure

6.9.1 Water supply and sanitation

The sources of Studenac, Radobolja and Bosnjaci – Potoci, Salakovac and Buna – Blagaj are used to supply Mostar and suburban settlements. The water supply of the Mostar City area with drinking water is provided by a water supply system, which is organizationally divided into two regional units (PJ), i.e. the water supply system PJ 1 (Mostar – West) and the water supply system PJ 2 (Mostar – East). Studenac, Radobolja and Bosnjaci are used to supply the city and suburban settlements as the central part of the system, and the sources of Salakovac and Buna – Blagaj as the local part of the system. The yield of these springs according to long-term measurements is: Salakovac Well (Q=1-25 m3/s), Bosnjaci (Potoci) (Q=0.1 – 1 m^3/s), Radobolja (Q=0.3 – 10 m^3/s), Studenac (Q=1 – 50 m^3/s) and Buna – Blagaj (Q=5 m^3/s)[119].

In Blagaj there is the spring Buna which is included in the system of public water supply. Settlements along the motorway section are supplied from this spring through local water supply systems. In addition irrigation of agricultural land affected by expropriation was performed by using water from 6 water wells (also acquired during land acquisition).

[117] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[118] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[119] IG Banja Luka, Environmental Impact Study for the subsection on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

In Mostar, at the location of Bisce Polje, a wastewater treatment plant (WWTP) has recently been constructed. This system is in function with only one third of its capacity as not all planned collectors have been finalised. Wastewater will be collected from two main collectors on the banks of the Neretva River (one located at the right bank of the Neretva River and the other one on the left bank) in the central zone of the city. The connection between the two collectors is under construction (part of the left bank collector which will cross the Neretva River at a location upstream of the Lučki Bridge and connect to the right collector. Then the wastewater will be taken by one collector to the WWTP Mostar[120].

The wastewater Mostar which is still not connected to the collectors directly discharges the wastewater into the Neretva River using sewerage system without prior treatment. Other settlements of the Mostar area on both sides of Neretva use individual septic tanks or direct discharges to the nearest water courses to dispose of wastewater.

Water discharge of the houses along the motorway section is done by using septic tanks for fecal water or discharging them into the stream Buna, without prior treatment. Collision point with the water supply and discharge is not identified.

6.9.2 Electricity supply system

The network of electric power transmission facilities in Mostar municipality is extremely branched and it is consisted of transformer stations, switchgear and transmission lines of all three transmission voltage levels (400 kV, 220 kV, 110 kV).

TS 400/220/110 kV Mostar 4 (Cule) is located southwest of the city and it is connected by 400 kV transmission lines from the Sarajevo 10 (Reljevo), Split and Trebinje transmission lines. The 220 kV transmission lines are connected to the Capljina HPP, the 220 kV Mostar 3 (Jasenica) substation, the 220 kV "EAL" – Mostar and Split (220 kV RP). 220 kV Mostar 3 substation is a very important junction of the EES through which 220 kV transmission lines are connected to EAL, Trebinje TS, Jablanica RP and Salakovac HPP. Grabovica HPP is connected to 220 kV transmission line by the Jablanica Power Plant and the Salakovac HPP to 220 kV Kakanj Power Plant.

110/x kV voltage level is the power level of the distribution. The most important 110/x kV transformer stations are 110/35 kV Mostar 1 substation in Rastani (6 outlets of 110 kV) and 110/35/10 kV substation, Mostar 2 (3 outlets of 110 kV) in Opine. Except these abovementioned, in the municipality of Mostar 110 kV network are also TS Mostar 5 (Rodac), TS Mostar 7 (Balinovac), TS Mostar 5 (Mine – constructed during the war), with associated 110 kV transmission lines. The construction of TS 110/20/35 kV Mostar 8 (Zalik), TS 110/20/35 kV Mostar 9 (Buna), TS Mostar 10 (Potoci) is in perspective. Within the construction of the Mostarsko Balto HPP, the construction of 110 kV connecting lines Mostarsko Blato – Mostar 5 and Mostarsko Blato – Mostar 9 is planned.

Of the planned 110 kV power lines, the construction of the 110 kV Mostar – Mostar 1 and Mostar 1 – Mostar 6 HPPs has been completed. The planned connection of the 110 kV Most HP – Mostar 2 HPP has not been realized, nor the connection lines for the Mostar 9 or the Mostar 10 substations (no transformer stations have been built). In the area of Mostar, five TS 35/10 kV are under voltage. Since the development of electricity

[120] Source: http://www.infrastruktura.mostar.ba/index.php/izgradnja-kanalizacionog-sistema [accessed on July 8, 2020]

distribution is in the direction of gradual elimination of 35 kV voltage, it is likely that these TS will grow into TS 110/10 kV and form a unique ring around the city[121].

6.9.3 Telecommunication services

Telecommunication services are provided by the following companies: HT Mostar and BH Telecom for fixed and mobile telephone systems, and Eronet only for mobile telephone system.

6.10 Project perceptions and consultations

Consultations with stakeholders were performed during different phases of Project preparation. Table 53 below contains a summary of implemented consultation activities that are of relevance for this Project.

Table 53: Summary of previous consultation and stakeholder's engagement activities[122]

Document/Study/Stage	*Summary of activities and issues of concern*
Public consultations in line with environmental permitting requirements	JPAC conducted the local EIA process for the entire Corridor Vc alignment (divided in four LOTs with respective EIAs). The project section that is considered for financing is part of LOT 4 Mostar North - South border section. The Scoping decisions for these four lots were issued in 2005 while the EIAs were approved in 2007. Public consultations were carried out in two stages: (i) after the Scoping Report and (ii) after the Final EIA Report. In both stages the documents were publicly disclosed for 30 days. Public consultations were organised in the municipalities along the corridor, including Mostar and Capljina (LOT 4). No significant public complaints had been recorded in respect to environmental and social issues on the project section. However, only Environmental Permit (EP) for the sections Pocitelj-Zvirovici, Zvirovici-Kravice and Kravice-Bijaca was issued based on the EIA Study for LOT 4. In addition, recently the EP for sections Tunel Kvanj-Buna and Buna-Pocitelj was issued. EP was not issued for the sections Mostar North-Mostar South and Mostar South-Tunnel Kvanj. JPAC initiated the environmental permitting procedure for the whole section Mostar South-Buna by preparing the EIA Study. JPAC agreed with FMET to amend the EIA Study for the sub-section Mostar South-Tunnel Kvanj in line with the EBRD requirements since it was later decided that EBRD will finance this section. The EIA is currently being revised to ensure compliance with local legislation and EBRD requirements, thus the legally mandatory public hearing has not been organised yet. The EIA will be submitted to FMET for EP in the second half of July 2020.
Public consultations in line with spatial planning requirements	*Spatial Plan of FBiH 2008-2028* Public consultations were also undertaken in 2012 in relation to the new Spatial Plan of FBiH 2008-2028 (which is still in parliamentary procedure). The Federal Ministry of Spatial Planning, on behalf of the Spatial Plan proponent (Government of FBiH), organized public hearings during a 60-day period, from 15 February 2012 until 15 April 2012. Public hearing was organized in each canton, and a central public hearing was organized in Sarajevo on 16 April 2012. The information on public hearing was sent to the Federal News Agency (FENA), and published in daily newspapers (*Dnevni Avaz* and *Oslobodenje*). According to the Report on consultation undertaken during the development of Spatial Plan of FBiH 2008-2028, a public consultation meeting was organised in Mostar on 13 March 2012. Issues raised related to the Corridor Vc were not relevant for the Project section covered by the Stakeholder Engagement Plan (SEP) developed for the section Mostar South-Tunnel Kvanj.

[121] IG Banja Luka, Environmental Impact Study for the subsection on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020
[122] For details on the public consultation related to development of the Project please refer to the Section 3.2 on alternative routes.

Document/Study/Stage	*Summary of activities and issues of concern*
	<u>*Spatial Plan for Area of Special Interest to FBiH – Motorway Corridor Vc*</u> The initial text of the Spatial Plan for the Motorway on Corridor Vc in FBiH was prepared in 2010 without the sections in Blagaj and Pocitelj, due to opposition by local communities. It was decided at the time by the FBiH Parliament to conduct additional research and consider alternative solutions for this section within a 6-month period. In 2011, the full draft of the amended Spatial Plan was made available for public consultations. Two public hearings were organised: ▪ a public hearing in Mostar (November 2011), organised by the Federal Ministry of Spatial Planning, and ▪ a public hearing in Sarajevo (November 2011), organised by the BiH Parliament (Committee for Transport and Communication). The Plan was then adopted by the FBiH Parliament and officially published in December 2017.
Presentation of the section Mostar South-Tunnel Kvanj in Blagaj	In January 2017, JPAC organised a presentation of the section route in Blagaj by JPAC. The local community expressed their concerns about impacts on settlements and agricultural land. JPAC representatives explained that the chosen route was the most cost effective and that all affected people would be properly compensated.
Consultations with land owners/users during the land acquisition procedure	<u>*Individual hearings with PAP*</u> The expropriation process was initiated by JPAC by submitting a proposal for expropriation to the City of Mostar as the expropriation authority. The proposal was submitted on January 29, 2019. The City of Mostar notified the project affected persons (PAP) of the submitted proposals for expropriation. The proposal contained data on property for which expropriation was proposed, the owners of such property and the purpose for which expropriation was proposed. During the land acquisition process, the City of Mostar convened and held individual hearings with PAP to determine the status of ownership and the compensation for the property through agreements. Minutes of all meetings were prepared. In addition, independent court experts for valuation of property (agricultural experts and construction experts) have started valuation of the existing state of land plots and assets on land in line with the provisions of the *Law on Expropriation*.
	<u>*Socio-economic survey*</u> A socio-economic survey was also conducted to solicit the opinions of the PAP about Project impacts and compensation arrangements, as well as to obtain specific data on current livelihoods and living conditions of PAP, including the identification of vulnerable categories. The survey was initially conducted during individual hearings with PAP in the period April-May 2019 by the representatives of the Department of Property and Legal Affairs of JPAC (Mostar). During this period, out of 231 PAP in total, 92 PAP were surveyed, whereas 18 PAP did not wish to be surveyed. An additional survey was organised during the development of the Land Acquisition and Livelihood Restoration Plan (LALRP) in November 2019 in order to attempt to interview the remaining 121 PAP. Only 4 PAP were present in in the field at the time of the survey. Interviews were carried out with 2 affected PAP, while the other 2 did not wish to be surveyed. It can be concluded that half of affected PAP were contacted, and in this can be a representative number taking into account that not all PAP live on Project area, and according to JPAC information some of PAP live abroad. Regarding household living on the affected land plots, the number of interviewed ones can be considered a representative number, as out of four households living on affected land plots, three were intervirewed. In addition, a census database was developed to identify all categories of impacts, PAP affected by land acquisition (owner/users of affected land plots) and the expected loss of assets for each of the 572 land plots. Data collection for the census database is based on information from the Exspropriation

Document/Study/Stage	*Summary of activities and issues of concern*
	Study developed in March 2018, examples of property valuation (prepared by official court experts), and the aforementioned site visits.
Consultations with relevant government authorities, ministries and public institutions	JPAC consulted several local government authorities and public institutions during the development of the Preliminary Design document. JPAC organised several meeting with BiH Air Navigation Services Agency (BHANSA), BiH Civil Aviation Directorate (BHDCA), Mostar Airport and Ministry of Defence of BiH in order to define the exact position of section road in the area of Mostar Airport, in order avoid any disturbance to daily activities of the Airport during construction and operation phase. In addition, JPAC contacted other institutions for the purpose of obtaining initial permits necessary for the issuance of the Urban Permit, such as: Adriatic Sea Basin District Agency, BH-Gas Ltd, Railways FBIH, Public Enterprise Elektroprivreda HZHB and Elektroprenos BH.

7 ASSESSMENT OF IMPACTS

7.1 Methodology

For each environmental and social component, the assessment will identify and report the likely significant environmental or social impacts. The significance can be described as the product of the degree of change predicted (the magnitude of impact) and the value of the receptor/resource that is subjected to that change (sensitivity of receptor).

For each impact, the likely magnitude of the impact and the sensitivity of the receptor are defined, quantitatively to the extent possible[123]. Generic criteria for the definition of magnitude and sensitivity are summarised below.

The assessment of **impact magnitude** is undertaken in two steps. Firstly, the identified impacts of the Project are categorised as beneficial or adverse. Secondly, impacts are categorised as major, moderate, minor or negligible based on consideration of parameters such as:

- Scale of the impact – how intense or severe the extent of the impact is likely to be
- Duration of the impact – ranging from "beyond decommissioning" to "temporary with no detectable impact"
- Spatial extent of the impact – for instance, within the site boundary, within district, regionally, nationally, and internationally
- Reversibility – ranging from "permanent thus requiring significant intervention to return to baseline" to "no change"
- Likelihood – ranging from "occurring regularly under typical conditions" to "unlikely to occur"
- Compliance with legal standards and established professional criteria – ranging from "substantially exceeds national standards or international guidance" to "meets the standards" i.e. impacts are predicted to be less than the standard would allow.

Thus, these characteristics collectively describe the nature, physical extent, and temporal condition of the impact. To facilitate a structured description of impact magnitude, a qualitative scale was applied, ranking the magnitude of change as negligible, minor, moderate or major developed for each of the magnitude characteristics.

Table 54 presents generic criteria for determining impact magnitude (for adverse impacts). Each detailed assessment will define impact magnitude in relation to its environmental or social aspect.

Table 54: Criteria for determining impact magnitude

Category	*Description (adverse impacts)*
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline; would violate national standards or Good International Industry Practice (GIIP) without mitigation.

[123] Typically, the approach for the assessments associated with health and safety, natural hazards and greenhouse gas emissions deviate from the methodology presented in the following sub-sections as significance cannot be uniformly assigned to the risks or impacts identified in these sections. Specific approaches and methodologies for these assessments are defined within these respective sections.

Category	*Description (adverse impacts)*
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but small change to the specific conditions assessed.
Negligible	No perceptible change to the specific conditions assessed.

Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration receptor resilience and value. Receptor resilience describes the ability of the receptor to withstand adverse impacts. It takes into consideration not only activity-impact-receptor pathways, but also environmental characteristics of the receptor that might make it more or less resilient to change.

Sensitivity is specific to each aspect and the environmental resource or population affected, with criteria developed from baseline information. Generic criteria for determining sensitivity of receptors are outlined in Table 55. Each detailed assessment will define sensitivity in relation to its specific environmental or social aspect.

Table 55: Criteria for determining sensitivity of a receptor

Category	*Description*
High	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes and/or minimal opportunities for mitigation.
Medium	Receptor with little capacity to absorb proposed changes and/or limited opportunities for mitigation.
Low	Receptor with some capacity to absorb proposed changes and/or reasonable opportunities for mitigation.
Negligible	Receptor with good capacity to absorb proposed changes and/or good opportunities for mitigation.

Likely impacts are evaluated considering the interaction between the magnitude and sensitivity criteria as presented in the impact evaluation matrix in Table 56.

Table 56: Impact evaluation matrix

		Magnitute						
		Adverse				Beneficial		
Sensitivity		Major	Moderate	Minor	Negligible	Minor	Moderate	Major
	High	Major	Major	Moderate	Negligible	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Negligible	Negligible	Negligible	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

For evaluating significance **before mitigation**, it is important to consider the likelihood that a given risk event is expected to occur and the magnitude of the expected impacts (consequence). Impacts that have been evaluated as being "moderate" or "major" are significant effects and identified as such in the specialist sections. Consequently, impacts that are "minor" or "negligible" are not significant. Understanding the significance of risks is important for prioritising the need for mitigation measures.

The impacts are assessed for pre-construction, construction and operation phase. The impacts in decommissioning phase are not assessed since it is anticipated that the project will have operational life of 50 years. If decommissioning take place, impacts are expected to be similar to those during construction.

Wherever the Project is likely to result in unacceptable environmental or social impacts, mitigation measures are proposed. Where mitigation measures are required the impact will be rated again to show the residual impact after implementation of mitigation or management controls.

Residual impacts are those significant impacts that remain after the application of mitigation and enhancement measures. Impacts considered 'major' or 'moderate' after application of mitigation and enhancement measures, are presented as significant residual impacts.

7.2 Assessment of environmental impacts

7.2.1 Habitats, flora and fauna

7.2.1.1 Introduction

The Project is expected to have impacts on biodiversity in general, with varying scopes in the different phases of construction works and during the operational phase. The key points that framework the below assessment are the following:

- three endemic terrestrial flora species have been registered in the project area,
- CR, EN and VU species registered during field surveys and desk research (IUCN or FBiH RL), as well as the species listed in HD Annex II/IV and BD Annex I
- registered nesting bird species Short-toed Lark (*Calandrella brachydactyla*) found on the grass habitats near the project area,
- bird colonies of Sand martin (*Riparia riparia*) and Bee-eater (*Merops apiaster*) located approx. 800 m from the motorway route
- endemic species of fish fauna have been determined in previous studies of Buna and Bunica streams
- Buna and Bunica streams, as tributaries of Neretva River, are classified as KBA Neretva River with tributaries
- the motorway passes through preliminary Natura 2000 site Buna-Bunica and will directly affect total of 8.43 ha of this area. There is a possibility for additional indirect impact of approx. 15 ha in absence of proper mitigation measures (this issue is further explained in Chapter 7.2.2.2 Appropriate assessment information).

Biodiversity impacts associated with pre–construction phase refer to inadequate and untimely planning of mitigation measures, as proposed in ESAP under PR 6 and 3 as well as in Biodiversity Management Plan (BMP).

Impacts on biodiversity features during the construction and operational phase are in principal assessed as adverse and can directly affect **terrestrial habitats and species** and **aquatic habitats and species**.

The following key impacts to the **terrestrial habitats and species** are considered likely because of the Project implementation:

- habitat permanent habitat loss
- fragmentation of habitats
- project related disturbance of species during construction and operation phase
- fatalities or injuries of species during construction
- impacts such as disturbance of fauna and potential road mortality.

Certain impacts on the **aquatic habitats and species** are expected as well during construction and partially during operational phase if mitigation measures are not implemented. The categorization of streams Buna and Bunica have good main physical and chemical parameters both upstream and downstream of the future location of the bridges.

Impacts on the streams Buna and Bunica are possible in case of major accidents, such as leakage from oil mechanization at the construction site or in case of improper handling of dangerous substances or waste e.g. hazardous waste and hazardous material. The appropriate mitigation measures are proposed for the operation phase (controlled drainage and oil separators for treatment of oily runoff water) so pollution of waters of Buna and Bunica streams may be related to accidental situations only.

An overview of the impacts and significance of effects are elaborated below separately for pre–construction, construction and operational phase.

7.2.1.2 Habitats

During construction phase, direct physical loss of habitats in the project area as part of works on preparation of construction site will be conducted. The anticipated removal is an adverse impact. The habitat types will be directly or indirectly affected within planned motorway and project footprint as given in previous sections. There will be additional general habitat loss and fragmentation due to the performance of construction works with increased edge effect. The construction of the project will also result in the potential loss and fragmentation of surrounding habitats.

The **project footprint area covers the area of 55.32 ha**; therefore, **this surface represents the area of permanent change of existing habitats**. The largest habitat loss will be for EUNIS habitat type X07 (intensively-farmed crops interspersed with strips of semi-natural vegetation) – 27.45 ha, followed by J3 (extractive industrial sites) – 9.50 ha and F6.37 Illyrian *Paliurus spina-christi* garrigues – 9.15 ha. The most valuable natural habitat types in the project area, such as the mixed thermophilous woodland (G1.7C) and natural dry grasslands (E1) will remain well preserved, as the tiny parts of these habitats will be directly affected by the construction of the motorway. Regarding the Construction Waste Landfill Rotimlja, it will require additional 18.15 ha of habitat loss.

The magnitude is expected to be major due to the spatial effect of this impact. The sensitivity is low as none of the habitats identified were considered to be high conservation value, e.g. no sensitive or Annex I habitats from Habitat Directive or priority habitats from Habitat Directive were found in the project area. Fragmentation of the area will be inevitable due to the construction of additional linear facility with increase of the edge effect in the remaining undisturbed areas. As such the impacts have been considered moderate and significant.

An additional area of **1071.32 ha may be indirectly affected** as a consequence of the disturbance caused by inadequate construction works outside of the construction areas. The magnitude for the potential additional disturbance of habitats is expected to be potentially with major magnitude, whereas the sensitivity of these

areas is considered to be low since the habitats along the future motorway were already formed under influence of anthropogenic factors. The project area along the future motorway is mostly dominated by ruderal nitrophilous vegetation and invasive species have been observed at many locations. However, due to the total surface of likely habitat disturbance of 1071.32 ha, the total loss of habitat is considered as a moderate adverse impact.

None of the identified habitats are protected according to the Habitats Directive. On some of the mentioned habitats species of conservation concern have been registered; however these findings have been assessed in the chapters below, as well as in CHA report.

During the operational phase, no additional habitat loss is anticipated as land take will occur only during the construction. Nevertheless, throughout the operation phase chemical pollution is likely to occur due to exhaust gasses from vehicles that may sediment to surrounding areas, especially along the habitats in proximity to the motorway route. The impact is caused by motorway traffic and it can result in increasing concentrations of heavy metals in soil. The impact is considered to be adverse, causing changes to the quality of the habitats, but in minor magnitude. Considering the fact that the most of the flora species along the future motorway will be weeds, likely resistant on higher concentrations of heavy metals, sensitivity is assessed as low for this phase and therefore the impact is considered negligible and not significant.

A summary of the estimation of impacts is shown in Table 57 below. Adequate mitigation messures have been proposed in Chapter 8 and BMP, and residual impacts (permanent loss oh habitat due to motorway construction) have been assessed in Chapter 9.

Table 57: Summary of impact assessment on habitats and their significance

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Habitats						
Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements Lack of information on baseline for diagnostic species *Scorzonera villosa* on dry grasslands and chasmophytic vegetation	Adverse	Moderate	Medium	Moderate	**Significant**
Construction	Habitat loss due to preparation of construction site and during the performance of construction works, fragmentation of habitats	Adverse	Major	Medium	Moderate	**Significant**
	Potential additional disturbance of habitats	Adverse	Major	Low	Moderate	**Significant**

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Operation	Chemical pollution of nearby habitats caused by motorway traffic which can result in increasing concentrations of heavy metals in habitats and food chains	Adverse	Minor	Low	Negligible	Not Significant

7.2.1.3 Vegetation and flora

Plant species identified at the project area will have direct (damage, loss) and indirect (emission) impacts **during construction phase.** Construction phase includes vegetation removal and clearance of flora species as part of the works on the preparation of construction site. Physical removal of vegetation is considered as an adverse impact and will be permanent for project footprint area. As previously mentioned, area along the future motorway is mostly dominated by ruderal nitrophilous vegetation and invasive species, therefore the magnitude is expected to be moderate and the sensitivity is medium. The impact is considered moderate and significant due to permanent changes of plant communities' structure and reduction of the density.

Construction works may temporarily affect plant species in the area, and work of heavy machinery during the construction phase may lead to plants being covered with dust. That can lead to blockage and damage to stomata, shading, and abrasion of leaf surface to cuticle. Impacts during construction phase are therefore adverse. Most of the present flora species along the future motorway are considered resistant to intensive anthropogenic pressure. Generally, the magnitude is expected to be minor and the sensitivity is medium. Earth works and their impact on disturbance of the plant species in the surrounding area is considered minor and not significant.

Direct impacts on flora **during the operation phase** are expected to a lesser extent and can occur as chemical pollution caused by motorway traffic which can result with increasing concentrations of heavy metals in soil that could have negative impact on vegetation and flora species of nearby habitats. The impact is considered to be adverse, causing mostly permanent change, but in small amount, therefore the magnitude is expected to be minor. Most of the flora species along the future motorway during this phase will be represented with weeds likely resistant on higher concentrations of heavy metals and sensitivity to this impact is low. The impact is considered negligible and not significant.

A summary of the estimation of impacts is shown in Table 58 below. Adequate mitigation messures have been proposed in Chapter 8 and BMP, and residual impacts (vegetation removal and clearance of flora species in the phase of preparation of construction site and during the performance of construction works) have been assessed in Chapter 9.

Table 58: Summary of impact assessment on vegetation and flora and their significance

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Vegetation and Flora						
Pre-construction	▪ Adverse impacts due to inadequate planning of works and Main Design requirements ▪ Lack of up-to-date information on baseline for endemic flora	Adverse	Moderate	Medium	Moderate	**Significant**
Construction	▪ Vegetation removal and clearance of flora species in the phase of works on preparation of construction site and during the performance of construction works ▪ Destruction of vegetation and deforestation will lead to water runoff and soil erosion.	Adverse	Moderate	Medium	Moderate	**Significant**
	▪ Dusting of nearby flora species due to performance of construction works	Adverse	Minor	Medium	Minor	Not Significant
Operation	▪ Chemical pollution caused by motorway traffic which can result with increasing concentrations of heavy metals in soil could have negative impact on vegetation and flora species of nearby habitats	Adverse	Minor	Low	Negligible	Not Significant

7.2.1.4 Terrestrial fauna

Disturbance **during the construction phase** has the potential to affect species, mammals, reptiles and birds in particular. Impacts will be temporary and will include noise, vibration and light disturbance from construction activities. Also, construction phase activities can cause fatalities or injuries of fauna species due to vegetation removal and preparation of construction site. This impact is adverse, and it can result with negative effects especially for sensitive terrestrial fauna species that have seasonally variable vulnerability due to breeding, critical feeding times or seasonal migrations. In absence of mitigation, the magnitude is considered to be moderate, however the sensitivity is high due to the presence of sensitive fauna species of conservation concern. Therefore, the impact is considered to be major and significant. Due to opportunities for effective mitigation measures stipulated by BMP and good construction practices, the magnitude of construction related impacts may be reduced to be minor magnitude.

Potential additional habitat loss and degradation could have negative consequences on sensitive terrestrial species or it could affect fauna species that have a seasonally variable vulnerability due to breeding, feeding habits or seasonal migrations, such as for Short–toed Lark (*Calandrella brachydactyla*) and Sand Martin (*Riparia riparia*) as well as Bee-eater (*Merops apiaster*) or sensitive bat species in the project area. According to the data provided in the Baseline Chapter of this study, during the construction phase, specific mitigation measures are necessary to preserve the existing grassland habitats of Short–toed Lark (*Calandrella brachydactyla*) and Calandra lark (*Melanocorypha calandra*).

Nesting population of bird species Sand Martin (*Riparia riparia*) and Bee-eater (*Merops apiaster* have been observed in the settlement Ortijes, 800 m from the planned motorway location. Considering the conservation requirements, the sensitivity is low; however the large colony of these species and the ecology (e.g. feeding in low flight) as well as the existing threat to these species at main roads in the surrounding areas increases the sensitivity to medium.

Regarding the Short–toed Lark (*Calandrella brachydactyla*), the vicinity of the nesting populations and the fact that more than 50% of the population of the species nests in the buffer zone of the planned motorway increases the sensitivity to the same degree with potential major magnitude. Therefore, although potential impact, it is considered to be major and significant. Measures proposed in BMP could mitigate the impact to minor. Regarding the mitigation needed to preserve the **appropriate habitat of Short-toed Lark, Figure 50 shows the area that must be avoided during construction activities.**

Additional area assessed as suitable habitat for terrestrial invertebrates *Z. cerisy, Z. polyxaena* and *L. dispar* that should **avoided during construction as** are grassland habitats and wet meadows along Buna and Bunica streams.

The increase in vehicle movement from construction activities could also lead to possible injuries and mortality of species (mammals, reptiles and amphibians). The magnitude of the impact will depend on the feature affected and is considered medium sensitivity; however, it is anticipated to be of moderate magnitude for all species. The effects will therefore, be of moderate significance during the earthworks. This impact may be effectively mitigated as given in BMP.

During operation phase, disturbance of species is possible as a result of traffic and noise. Edge effect for fauna species is likely to be expected and it is considered as an adverse impact. Sensitivity of the impact is expected to be medium due to the presence of species of conservation concern. Due to the expected minor magnitude (as these impacts will be mitigated from the design phase), the general impact is considered minor and not significant.

Also, during the operation, potential collision of fauna species due to high speed of vehicles (bird species e.g. Sand Martin and Bee-eater, bat species, other small mammals, amphibians and reptiles) is possible. Mitigation measures such as protective bird panels will reduce possibility of collisions, as well as adequate fencing of the motorway will be implemented as a technical standard of the motorway. The general impact is considered moderate.

Increased traffic may lead to negative impacts from increased level of light and noise that can affect sensitive fauna species such as bats. The magnitude is expected to be minor while the sensitivity is medium due to the conservation requirements of these species. The impact is considered minor and not significant.

A summary of the estimation of impacts is shown in Table 59 below. Adequate mitigation messures have been proposed in Chapter 8, ESAP and BMP. The residual impacts have been assessed in Chapter 9, and are considered to be insignificant if all requirements of ESAP and BMP are timely implemented, for which

biologist/ecologist employed by the Contractor will be implemented (these provisions to be included in the Tender Documents).

Table 59: Summary of impact assessment on fauna and their significance

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Fauna						
Pre-construction	▪ Adverse impacts due to inadequate planning of works and Main Design requirements ▪ Lack of up-to-date information on baseline for migratory birds, bats, invertebrates	Adverse	Moderate	High	Major	**Significant**
Construction	▪ Disturbance of fauna species due to increased level of noise, vibration and light in the zone of construction activities	Adverse	Moderate	High	Major	**Significant**
	▪ Potential disturbance of nests/roosts of species that have a seasonally variable vulnerability due to breeding, feeding times or seasonal migrations, such as Short – toed Lark (Calandrella brachydactyla) and Sand Martin (Riparia riparia) or sensitive bat species in the project area	Adverse	Major	Medium	Major	**Significant**
	▪ Potential fatalities or injuries of fauna species due to vegetation removal and movement of heavy machinery	Adverse	Moderate	Medium	Moderate	**Significant**
Operation	▪ Edge effect for fauna species	Adverse	Minor	Medium	Minor	Not Significant
	▪ Potential collision of fauna species due to high speed of vehicles (bird species e.g. Sand Martin and Bee-eater, bat species, other small mammals, amphibians and reptiles)	Adverse	Moderate	Medium	Moderate	**Significant**
	▪ Negative impacts of increased light and noise levels on sensitive fauna	Adverse	Minor	Medium	Minor	Not significant

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
	species such as bats					

7.2.1.5 Aquatic ecology

According to desk research on fish of the project area, critically endangered, endangered and vulnerable species have been registered in these watercourses and given below (national and international):

The IUCN category	*IUCN RL*	*FBiH RL*
Critically endangered (CR)	**1 species:** Anguilla anguilla - European eel	**3 species:** Anguilla anguilla - European eel Salmo marmoratus - Marble trout Salmothymus obtusirostris oxyrhinchus - Softmouth trout
Endangered (EN)	**1 species:** Salmothymus obtusirostris oxyrhinchus - Softmouth trout, Adriatic trout	**2 species:** Chondrostoma knerii - Dalmatian Nase Gasterosteus aculeatus – Burnstickle
Vulnerable (VU)	**2 species:** Squalius svallize - Adriatic dace Chondrostoma knerii - Dalmatian Nase	**1 species:** Squalius svallize - Adriatic dace
Near threatened (NT)	**1 species:** *Samarutilus rubilio* - South European roach	-
Least Concern (LC)	13	10

The results of the analyses of ecological guilds of fish (Chapter 5.2.4 Fauna (Fish), have shown that in the research area dominant role play tolerant species (33.33%), which are less sensitive to the physical and chemical degradation of water, unlike intolerant species, which have demands for higher oxygen supply and preference to the rheophyilic conditions. Significant part (33.33%) of all recorded species spends all life stages in the running waters (rheophylic species). Considering feeding habits, here dominant role play insectivorous (23.81%) and omnivorous species (23.81%). Significant part of fish species (14.29%) belong to the group of long migratory species.

As already stated in Chapter 5.2.4 Fauna (Fish), fish species express various form of reproduction. Reproductive guilds are used for assessment of changes in the structure of fish communities, which is connected with changes in availability of various habitat types. Lithophyle guild (spawning on the gravel) and phytophyle guild (spawning on the plants) are used as a measure of the reproductive structure of fish communities, because availability and suitability of specific ecological niches or spawning substratum **decreases with the level of degradation**. This could have significant indirect impacts on the reproduction of species which have specific demands for spawning. Therefore, loss or compression of gravel results in the reduction of lithophyle species in the community. **Lithophilic species** in this area are: Eurasian minnow - *Phoxinus phoxinus*; **Bullhead - *Cottus gobio (HD II)***; Brown trout - *Salmo trutta m. fario*; Rainbow trout - *Oncorhynchus mykiss*; European chub - *Squalius cephalus albus*, and Grayling - *Thymallus thymallus*. Phytophilic species are: Carp - *Cyprinus carpio*, and Prussian carp - *Carassius gibelio*.

Some of the aforementioned species in Chapter 5.2.4 Fauna (Fish), are also sensitive and intolerant species: Bullhead – *Cottus gobio*, Brown trout – *Salmo trutta m. fario*, European bitterling – *Rhodeus sericeus amarus* and grayling – *Thymallus thymallus*.

Life cycles of a large number of aquatic organisms are adjusted to periods of high waters and low water flow rate, which marks a new stage in their life cycle. For these reasons, even small fluctuations in the amount and period of certain rate of the flow could have significant impact not only to aquatic organisms, but also on the organisms **living in riparian zone**, which has as final consequence disturbance of the structure and function of food chains. Therefore it is necessary to ensure sustainable long term protection of natural aquatic habitats and adequate protection of aquatic habitats.

Regarding the aquatic invertebrates, White–clawed Crayfish (*Austropotamobius pallipes*) is among the most sensitive species that inhabits streams Buna and Bunica (IUCN EN, FBiH EN and HD Annex II). It represents both international and national rare and endangered species; therefore, it is important to adequately mitigate the anticipated negative impacts during pre-construction and constructions phase to conserve sensitive habitats of mentioned species.

According to desk research, **Pygmy Cormorant (*Phalacrocorax pygmaeus*)**, listed as CR on FBiH Red List, uses streams Buna and Bunica for food and rest and this species requires protection measures to be applied with regard of water quality and preservation of riverine habitats.

According to the Preliminary Design (2018), two bridges are anticipated and during **construction phase,** piles and pylons as supporting structures are planned to be founded and constructed in both watercourses. In addition to this, training of Buna and Bunica streams is planned, thus including removal of riverine vegetation. This will lead **to permanent changes and direct loss of aquatic habitat and degradation of riverine vegetation**. The magnitude is expected to be moderate due to localised construction works, however the sensitivity of the biodiversity features if considered as high and the overall impact is considered major and adverse.

Ecosystems of streams Buna and Bunica might be impacted both directly and indirectly, due to waste disposal, soil and excavated materials, inadequate disposal of construction material, increase of the turbidity of water as a result of earthworks in the vicinity of water flow. During construction, impacts on water ecosystems and its fauna (especially ichthyofauna and aquatic invertebrates) can be expected, unless the proposed mitigation measures to avoid these impacts are implemented during development of the Main Design, as given in BMP and ESAP PR 6. Bridge Buna and Bridge Bunica shall be constructed without any disturbance of the stream beds. Also, piles and pylons, that will be support of the bridges shall be designed and set outside of both watercourses.

Impacts on the streams Buna and Bunica are also assessed in cases of accidents at construction site, such as leakage of oil mechanization. In spite of adequate mitigation measures and good construction practices at construction site and minor magnitude, due to high risk of reducing suitable habitat for intolerant, rare species such as White–clawed Crayfish (*Austropotamobius pallipes*) the sensitivity of the receptor is expected to be high. During the construction phase, direct and indirect impacts can cause serious changes in suitable habitats of sensitive species therefore the magnitude is expected to be major. The impact is considered to be major and significant.

The Preliminary Design foresees the construction of the oil separators and controlled drainage as a technical standard of the motorway. **During operation phase**, chemical pollution may be therefore expected only in major accidental situations or leakages due to e.g. failure of oil separators, that could have negative impact on quality of Buna and Bunica ecosystems and the sensitive species of conservation concern inhabiting these

waters. Changing conditions of physical–chemical parameters of watercourse can cause reduction of sensitive and intolerant species. Chemical pollution is an adverse impact causing permanent changes in sensitive ecosystems. The sensitivity is expected to be high. However, considering that adequate mitigation measures are planned, the impact magnitude is expected to be minor. As such the impact is considered moderate and significant.

Also, operational phase could have potential negative impacts on sensitive aquatic species and degradation of their habitats in case of accidental situations, as a indirect impact. Although accidental situations could cause serious degradation of present ecosystems in this area, the probability of accidental situation during the operational phase is low. As such the impact is considered moderate.

A summary of the estimation of impacts is shown in Table 60 below. Adequate mitigation messures have been proposed in Chapter 8, ESAP and BMP. The residual impacts have been assessed in Chapter 9, and are considered to be insignificant if all requirements of ESAP and BMP are timely implemented. The changes of the motorway design of are required in ESAP and again in BMP in order to meet all PR 6 requirements. These provisions need to be included in the Tender Documents, as well as the provision that Constractor needs to have a biologist/ecologist in its team.

Table 60: Summary of impact assessment on aquatic ecology and their significance

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Aquatic ecology						
Pre-construction	▪ Adverse impacts due to inadequate planning of works and Main Design requirements	Adverse	Moderate	High	Major	**Significant**
Construction	▪ Aquatic habitat loss due to removal of riverbanks vegetation in the phase of construction site preparation and during the performance of construction works ▪ Aquatic environment alternation due to performance of construction works ▪ Degradation of the riverbed ▪ Negative impacts on critically endangered and intolerant ichthyofauna species, endangered aquatic invertebrates and their habitat due to degradation of the aquatic habitats	Adverse	Moderate	High	Major	**Significant**
Operation	▪ Potential pollution caused by accidental	Adverse	Minor	High	Moderate	**Significant**

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
	situations of motorway traffic and leakages due to e.g. failure of oil separators					
	▪ Potential negative impacts on sensitive aquatic species and degradation of their habitats in case of accidental situations	Adverse	Minor	High	Moderate	**Significant**

7.2.2 Protected areas

7.2.2.1 Protected areas in the project aera of influence

There are no officially designated protected areas (PAs) in the project area and in the project area of influence, therefore impacts were not taken into consideration. Impacts on protected areas are not expected during the pre–construction, construction and operation phase. No impacts are expected; hence, no mitigation measures are required.

7.2.2.2 Appropriate assessment information

Although the country of BiH is not currently part of the European Union (EU) the EBRD, who has been approached to fund this project is signatory to the European Principles for the Environment[124] and therefore require that an Article 6 assessment is undertaken for this project if required.

Under Article 6(3) of the Habitats Directive (92/43/EEC), an appropriate assessment is required where a plan or project is likely to have a significant effect upon a European site, either individually or in combination with other projects, therefore the impacts to the potential Natura 2000 site Buna-Bunica have been assessed below to meet PR 6 requirement.

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives Article 6(3)

This Article has been interpreted as meaning that any project is to be subject to an appropriate assessment if it cannot be proven, beyond reasonable scientific doubt, that there is no significant effect on that site (a precautionary approach), either alone or in combination with other plans or projects.

However, when working in non-EU countries, there should be a clear reason or rationale for which sites should be subject to an AA. For this reason, as part of this report, a preliminary scoping exercise has been undertaken in order to ascertain if a) the site is an official site or candidate site, b) has been created as either a Natura 2000 site or an Emerald Site.

Natura 2000 in FBiH

[124] The European Principles for the Environment (EPE) were adopted by the Council of Europe Development Bank, the EBRD, European Investment Bank, Nordic Environment Finance Corporation and Nordic Investment Bank. The EPE is an initiative launched in response to the drive for increased harmonisation of environmental principles, practices.

There are no officially registered Candidate or Nominated Natura 2000 sites in FBiH since the country is not member of EU. The greatest progress in terms of implementation of the Natura 2000 in FBiH has been made through the Project *"Support to the Implementation of the Birds and Habitats Directive in BiH"* (October, 2012-2014). The Project supported FBiH institutions in approximation of the EU Birds and Habitats Directives. The experts on the project carried out field research and identified more than 200 species and 60 habitats of the Natura 2000 network - in a total of 122 areas (about 19% of the territory of FBiH). These results may in the future be used for creation of an ecological network which will become part of the Natura 2000 network following the accession of FBiH to the EU (see Figure 92 below and Figure 59 in Chapter 5.2.7).

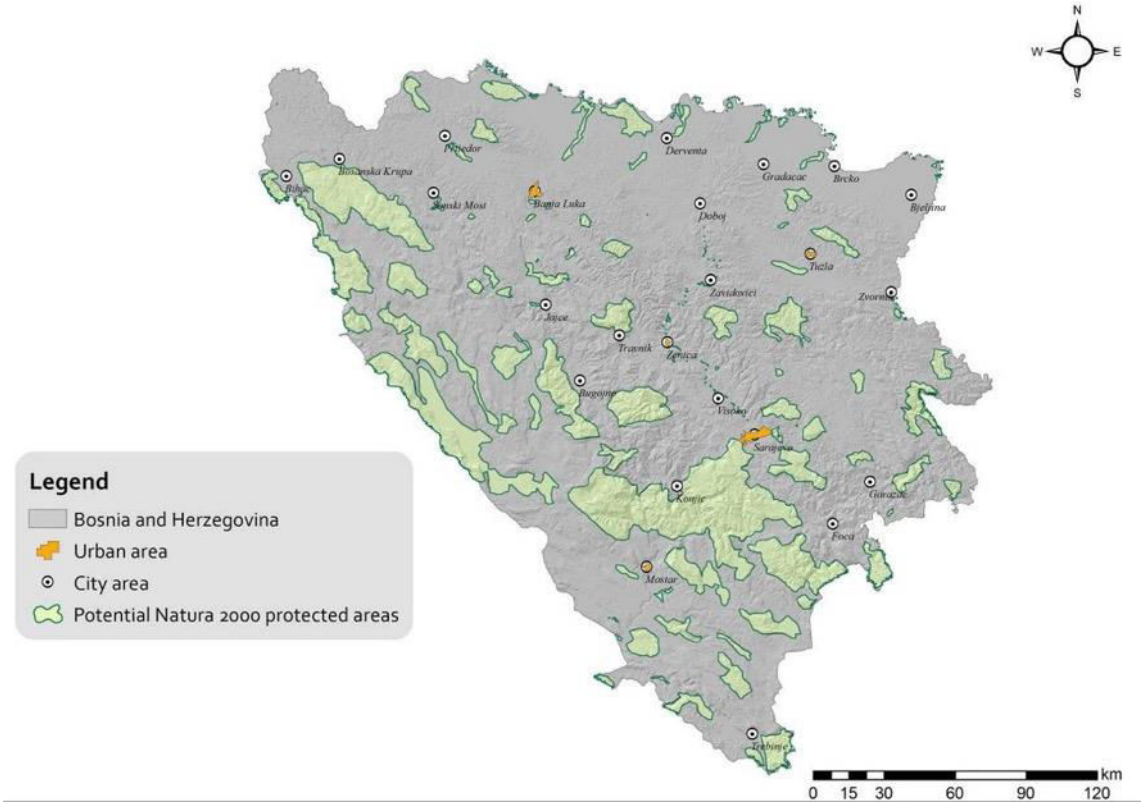


Figure 91: Potential Natura 2000 Sites in BiH

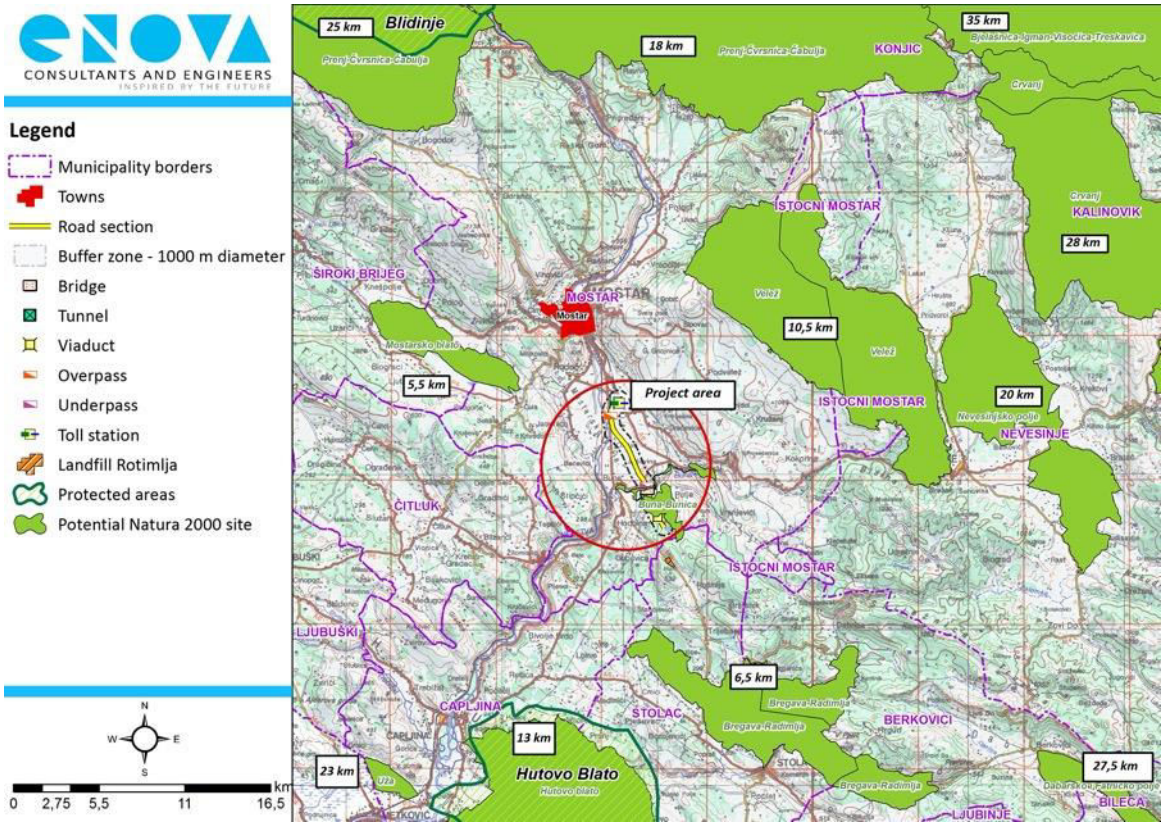


Figure 92: Potential Natura 2000 Sites within radius of 35 km

What the project did was to achieve the following results:

- Draft list of the potential Natura 2000 sites in FBiH
- Developed Draft Management Plans for three Natura 2000 pilot areas (Tišina, Vranica, and Orjen-Bijela gora) – **notably not for the Buna-Bunica area**
- Draft regulations and decrees aiming at supporting the establishment of the Natura 2000 network in BiH
- Establishment of the Natura 2000 information system
- Raised knowledge and public awareness about the nature in BiH and the importance of Natura 2000.[125]

As already mentioned in this report, potential Natura 2000 site Buna-Bunica was investigated as an area of interest (USAID 2016). A portion of this area corresponds to the motorway sub-section Mostar South-Tunnle Kvanj, containing the total of 8.43 ha and approx 15% of the total length of the sub-section (passes over Buna and Bunica streams and through the woodland and garrigue areas of Hodbina Hill).

The Buna-Bunica Natura 2000 site does not appear to have been registered officially as a candidate site and it is simply regarded as an area of interest. It is envisaged that this project is "work in progress" and that if the site were ever registered as a Candidate Natura 2000 site it would be targeted to specific habitats and species of conservation concern and would therefore cover a smaller area than current. No Natura 2000 Network sites appear on the Natura 2000 Network Viewer http://natura2000.eea.europa.eu/# for BiH.

[125] USAID (2016) Bosnia and Herzegovina Country Biodiversity Analysis, Sarajevo, July 2016

Although Buna-Bunica area was previously included as potential Natura 2000 site on the FBiH Draft list of potential Natura 2000 sites; the Buna-Bunica does not then subsequently or additionally feature as an Emerald Site. As a result of this, it is considered that the Buna-Bunica site is far off becoming a candidate site, in order for it to be taken into account and subject to an Appropriate Assessment.

Out of the mentioned biodiversity features summarized in Table 23, for the area of Buna – Bunica BA 8200008 there are no listed Natura 2000 habitats, and were also not confirmed in the project area. Regarding aquatic species, both fish and aquatic invertebrates have been confirmed in this ESIA report for which specific mitigation measures to avoid any impacts to the streams Buna and Bunica is required by ESAP and BMP, developed as part of this assignment. Regarding terrestrial species, specific mitigation measures have been suggested as part of BMP. Regarding the bats, additional monitoring has been required for inspection of possible roosts, migration corrirors etc. and the requirement for micro-aligning of the motorway to avoid any impact for roosts that may be found during monitoring in pre-construction phase. By implementing all mitigation and monitoing measures suggested in ESAP and BMP, possible impact to these features will be fully mitigated, therefore no impact is expected to preliminary Natura 2000 site Buna-Bunica, except the general land take. Considerig the fact Management Plan for this particular area has not been adopted yet, no conservation objectives are defined for this area and the project has no potential to impair the implementation of such objectives.

The same initiative also discusses other potential Natura 2000 sites, where the nearest are Mostarsko Blato, Bregava-Radimlja and Velež which are located 5.5 km, 6.5 and 10.5 km away from the route. For the same reasons as above, these sites have also been discounted from the need for an Appropriate Assessment.

Emerald Sites in FBiH

The Bern Convention was ratified by Bosnia and Herzegovina in 2008. According to the *Updated List of Officially Nominated Candidate Emerald Sites*[126], the state has officially nominated 29 sites as candidate Emerald sites. None of the proposed Emerald Sites are in the Project area, therefore have been scoped out as being impacted by the project and will therefore is not taken forward for Appropriate Assessment Screening.

Other Planned Protected Sites

There are a number of Planned and designated Protected Areas in FBiH, as stated in Chapter 5.2.6. No officially designated protected areas (PAs) are envisaged by the project area, as shown in Figure 57, all of the PAs of FBiH/BiH are located at least 10 km away from the route. The closest two planned protected areas at level of FBiH are: (i) Igman – Bjelasnica – Treskavica – Visocica – Rakitnica River Canyon and (ii) Prenj – Cabulja – Cvrsnica – Vran, both situated outside of the radius of 15 km of air distance or more from the project area.

In addition to these, Figure 93 below provides the information on spatial distribution of an ongoing initiatives regarding designation of five new protected areas through mentioned the GEF/UNEP project (more information provided in Chapter5.2.6)[127] All five ongoing initiatives regarding designation of mentioned areas are located more than 30 km away from the project area.

[126] Council of Europe, Updated List Of Officially Nominated Candidate Emerald Sites, December 2017
[127] Available at: https://www.thegef.org/project/achieving-biodiversity-conservation-through-creation-effective-management-and-spatial

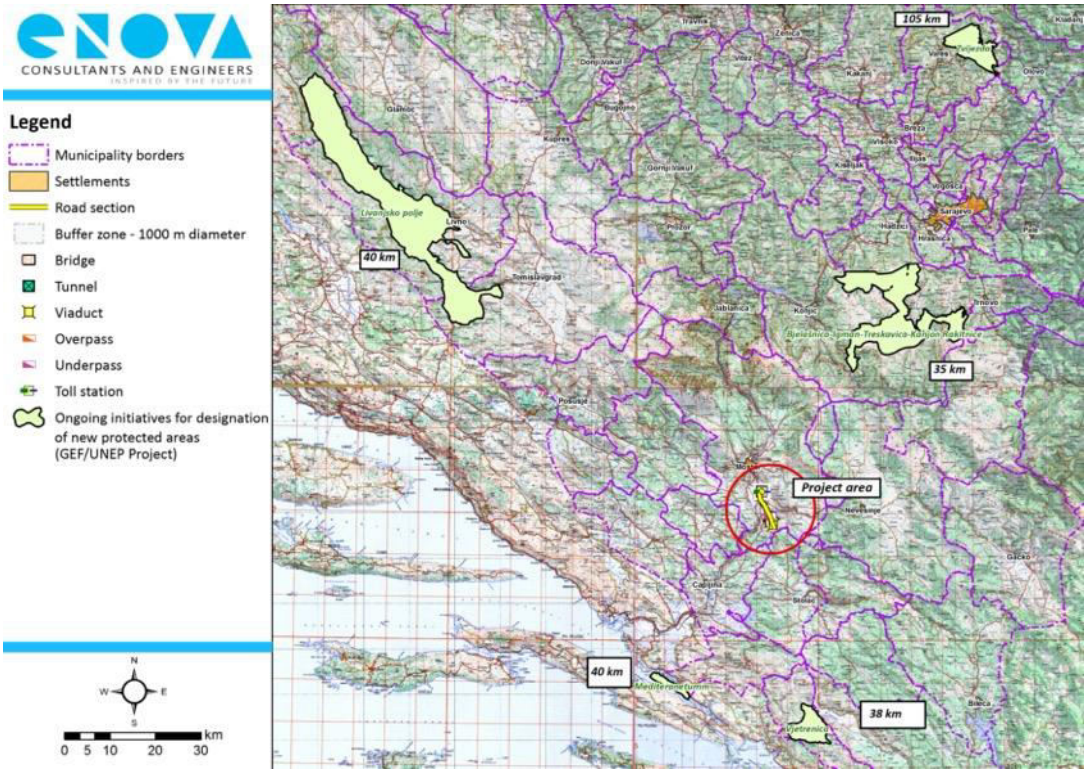


Figure 93: Ongoing initiatives for designation of five new protected areas with regard to the motorway route

In BiH, there are 3 Ramsar and 4 International Bird Areas (Table 61).[128] None of these areas would be impacted upon by planned motorway section as they are at least 10km from the project area.

Table 61: Ramsar and IBA Sites in BiH[129]

Ramsar sites		*Year*	*Surface (ha)*
Hutovo blato (FBiH)		2002	7,411
Bardača (RS)		2007	3,500
Livanjsko polje (FBiH)		2008	45,800
IBA130	*IBA Criterion*	*Year*	*Surface (ha)*
Boračko jezero (FBiH) (BA002)	B2	2000	26
Bardača (RS) (BA003)	A1	2000	3,500
Hutovo blato (FBiH) (BA001)	A1, A4i, B1i, B2, B3	2011	7,411
Livanjsko karst field and Buško lake (BA004)	A4iii, B1i, B2, B3	2011	45,868

[128] Available at : http://www.birdlife.org/datazone/sitesearchresults.php?cty=27&fam=0&gen=0 (last accessed on 30th June 2020).
[129] Available at: http://nasljedje.org/sr_RS/prirodno-nasljedje/266 (last accessed on 30th June 2020). http://datazone.birdlife.org/site/results?thrlev1=&thrlev2=&kw=&reg=0&cty=27&snm=&fam=0&gen=0&spc=&cmn= (last accessed on 30th June 2020)
[130] Available at: http://datazone.birdlife.org/country/bosnia/ibas

7.2.2.3 Ecosystem services

Impacts on Ecosystem services have been assessed partially through impacts on Habitats, flora and fauna, as well as partially as part of the assessment of impacts on social issues (Land acquisition, Loss of Livelihoods and Tourism).

7.2.3 Water

The assessment of impacts on water resources is underpinned with the following facts:

The project is situated in karst terrain which has minimal or no ability to purify polluted wastewater.
The two bridges on the section will be constructed over Buna and Bunica streams that have important ecological features and are main receptors of all potential water pollution.
The alignment is situated in the vicinity of Neretva River that is, although not in the direct area of influence, a potential indirect receptor of water pollution due to permeability of karst terrain.
Geotechnical investigation revealed that there is no ground waters on the site. However, the caution with managing effluent discharge is needed due to the karst terrain.
Ecological quality of surface waters is generally good, however the analysis of surface waters baseline data must be repeated before the construction in order to reconfirm the baseline.

In the **construction phase**, the main causes of potential negative impact on water resources are:

- Nature of construction works
- Presence of construction machines at the site
- Installation of concrete batching plant[131]
- Generation of different types of wastes
- Discharge of sanitary waters from workers' camps.

The main impacts on water resources in the construction phase are:

Temporary localised diversion of drainage paths around construction camps and site workings
Increase risk of localised pollution due to the maintenance of construction vehicles at the site (e.g. lubricants and oil changes, washing of vehicles)

- Sediment release into river systems during bridge construction in river bed and on the banks
- Sediment release into river systems resulting from depositing of construction waste into the rivers
- Reduction in water quality in river systems resulting from depositing of municipal and other special waste categories into the rivers
- Reduction in water quality in river system resulting from potential release of contaminants into the river as well as localised water quality issues due to discharges from construction facilities including concrete batching plant and workers camp.

In the **operation phase,** the main causes of potential negative impact on water resources are:

- Precipitation intercepted by the motorway surfaces
- Flooding due to lack of maintenance of drains/culverts
- Sanitary waters at the location of toll station
- Movement of vehicles on the motorway
- Accidents on the motorway

[131] The location of the concrete batching plant will be decided by the Contractor and specified in the Construction Site Organizational Plan

- Winter maintenance activities.

Therefore, the operational impacts are anticipated to include:

- Reduction in water quality in river system resulting from direct release of intercepted surface run-off which is usually contaminated with fuel, oil and lubricants leakage, tyre ware, dust, wind-borne particles, different pollutants settling from the atmosphere and defrosting salts and gravel of small granulation used in winter maintenance activities.
- Reduction in water quality in river system resulting from spill over of surface runoff not intercepted and treated by drainage system, usually occurring in case of floods. Reduction in water quality in river system resulting from direct release of sanitary water from toll station which is usually contaminated with organic pollution. Heavy contamination of river systems caused by accidental spill of hazardous material (e.g. oil and oil derivatives, hazardous chemicals, etc.) resulting from traffic accidents. This impact has been estimated as a lifelong Project impact.
- Reduction in water quality in river system resulting from use of de-icing agents in road winter maintaining activities.

Typical pollutants in surface run-off are listed in Table 62.

Table 62: Pollutants in the surface run-off

Pollutants	*Pollution sources*
Solid particles	Pavement wearing, vehicles, atmosphere and road maintenance
Nitrogen and phosphorus	Atmosphere and artificial fertilisers
Lead	Lead in form of tetramethyl lead from exhaust gases, tyre wearing
Zinc	Tyre wearing, motor oils and lubricants
Iron	Rust from vehicles, metal structures on the road (bridges, bump rail), movable motor parts
Copper	Metal protective coatings, bearing and motor brushes wearing, movable engine parts, brakes wearing, fungicides and insecticides
Cadmium	Tyre wearing and pesticides use
Chromium	Metal protective coatings, movable engine parts, brakes wearing
Nickel	Diesel fuel and gasoline, lubricating oils, metal protective coatings, brakes and asphalt surfaces wearing
Vanadium	Fuel additives
Titan	Pavement markings colour
Manganese	Movable engine parts
Sodium, Calcium and Chlorides	Defrosting salts
Sulphates	Pavement bed, fuel and defrosting salts
Oil and oil derivatives	Sprinkling and leakage of fuel, anti-freeze and hydraulic oils, asphalt surface moistening

While assessing the impacts the following facts are taken into consideration:

- In the construction camp organisation plan the appropriate water supply and wastewater collection and treatment system will be designed and implemented
- According to the information presented in the preliminary design, construction of bridges over Buna and Bunica foresee a pier foundation on piles, some of which will be erected in the riverbed. Both streams are sensitive from the aspect of aquatic ecology, therefore mitigation measures provided in the ESMP relevant to the redesign of bridges to avoid construction works in the riverbed must be implemented.
- The preliminary project design has foreseen construction of surface drainage collection and treatment system that will intercept all surface run-off from motorway surfaces and treat it in the appropriate treatment facilities (Sequencing Batch Reactors at the location of toll station and oil and grease separators along the route). This is the key mitigation measure that is already foreseen by the JPAC in order to mitigate impact on water resources. The number of oils separators must be increased to specifically cover the two bridges. Therefore, in the operation phase the possible impacts are largely mitigated through the proposed design.
- Mostar is situated in the area with Mediterranean climate. Winters are very mild, temperatures rarely go below zero and snow is not common. Therefore, it is assessed that de-icing agents will rarely be used, if ever, and this impact is considered to be not significant.

Table 63 below provides a summary of impacts and assessment of their significance.

Table 63: Summary of impacts on waters and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Water						
Pre-construction	▪ Design solution for the bridges that requires construction activities in the river bed	Adverse	Moderate	Medium	Moderate	Significant
	▪ Number of oil and grease separators for motorway drainage is not sufficient to ensure protection of the water quality in Buna and Bunica streams	Adverse	Moderate	Medium	Moderate	Significant
Construction	Reduction in water quality in river systems due to: ▪ Temporary localised diversion of drainage paths around construction camps and site workings ▪ Maintenance of construction vehicles at the site ▪ Sediment release during bridge construction in river bed and on the banks ▪ Depositing of construction waste, municipal waste and other special waste categories into the rivers ▪ Localised discharges from	Adverse	Moderate	Medium	Moderate	Significant

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
	construction facilities including the concrete batching plant and workers camp					
Operation	Reduction in water quality in river system resulting from: ▪ direct release of intercepted surface run-off ▪ direct release of sanitary water from toll station ▪ accidental spill of hazardous material resulting from traffic accidents.	Adverse	Moderate	Medium	Moderate	Significant
Operation	Reduction in water quality in river system resulting from use of de-icing agents	Adverse	Minor	Low	Negligible	Not significant

7.2.4 Air quality

The assessment of impacts on air quality is underpinned with the following facts:

- The pollution sources are mainly traffic and heating. Except for alumina production located south of city of Mostar, and temporary closed due to unresolved ownership issues, heavy industrial activity is not present in the area.
- Air quality in Mostar is satisfactory, the fluctuations in the parameters are observed during winter.
- The climatic conditions explained in chapter 5.6, especially the strong winds penetrating through Neretva valley from the Adriatic sea ("bura" and "jugo") during winter help in dispersing pollutants and preserving air quality.

In the **construction phase**, the main causes of potential negative impact on water resources are:

- Nature of construction works
- Presence of construction machines at the site

The main impacts on air quality in the construction phase are:

- Emissions of construction dust associated with the soil handling, loading activities, storage of material onsite, transport of materials within site, drilling and digging (including soil excavation), movement on unpaved roads and transport of material offsite
- Emission of exhaust gases from combustion processes in generators and other construction equipment /vehicles that contain nitrogen oxides (NOx), sulphur dioxide (SO2), carbon monoxide (CO) and fine particulate matter.

The risk of dust emissions from construction site causing loss of amenity and/or health or ecological impacts is related to[132]:

- the activities being undertaken (earth works, number of vehicles etc.);
- the duration of these activities;
- the size of the site;
- the meteorological conditions (wind speed, direction and rainfall);
- the proximity of receptors to the activities;
- the adequacy of the mitigation measures applied to reduce or eliminate dust; and the sensitivity of the receptors to dust.

Based on criteria presented in the *Guidance on the assessment of dust from demolition and construction*, the potential for dust emission magnitude from earthworks, construction and movement of vehicles is defined to be large (Table 64).[133] Translated into impact magnitude, the assessment results in overall **moderate impact magnitude** that produces detectable change but not a fundamental temporary or permanent change.

Table 64: Dust emission and impact magnitude

Activity	*Criteria*	*Dust emission magnitude*	*Impact magnitude*
Earth Work	▪ site area > 10,000 m2 ▪ the soil type is potentially dusty ▪ > 10 heavy moving vehicles active at any time ▪ total material moved > 100,000 tones	Large	Moderate
Construction	▪ site area > 10,000 m2 ▪ the soil type is potentially dusty ▪ potentially dusty surface material	Large	
Vehicle movement	▪ vehicles >3.5t outward movements in any one day ▪ potentially dusty surface material ▪ unpaved road length is >100 m	Large	

The two main receptors of concern are:

- "human receptors" referring to any location where a person or property may experience the adverse effects of airborne dust or dust soiling or exposure to PM_{10} over a time period relevant to the air quality objectives and
- "ecological receptors" referring to any sensitive habitat affected by dust soiling. These include the direct impact on vegetation or aquatic ecosystems of dust deposition and the indirect impacts on fauna 'e.g. on foraging habitats).

In the project area of influence, both types of receptors are present. Construction works will be carried out in close vicinity of commercial facilities and private houses in settlement of Malo Polje, as well as in close proximity of sensitive ecosystems of Buna and Bunica streams, thermophilic forests and growing vineyards[134]. It is to be noted that dust is predominantly composed of the larger fractions of this range which do not penetrate far into the respiratory system.

[132] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, version 1.1. available at http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf
[133] ibid.
[134] Noise modelling in Detailed Design Phase will determine exact locations of appropriate noise barriers/other noise mitigation measures

The receptor sensitivity analysis takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors (some of the houses are <20m away from the construction site)
- in the case of PM_{10}, the local background concentration, which are confirmed not to exceed annual average concentrations, except for the peaks during the winter months
- site-specific factors, such as low presence of natural shelters, such as trees, to reduce the risk of wind-blown dust and strong winds.

Based on criteria presented in the *Guidance on the assessment of dust from demolition and construction*, the sensitivity of receptor is defined to be **medium** (Table 65)[135].

Table 65: Dust emission and impact magnitude

Activity	*Criteria*	*Sensitivity of receptors*
Sensitivity of people to dust soiling effect	▪ The enjoyment of amenity would not reasonably be expected ▪ Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling ▪ The people or property including crops would reasonably be expected to be present continuously or at least regularly for extended periods, as part of the normal pattern of use of the land.	Medium
Sensitivity of people to the health effects of PM_{10}	▪ Location where members of the public and workers are exposed over a time period ▪ Distance from the source at certain locations is <20 m	Medium
Sensitivity of receptors to ecological effects	▪ Location with a local designation where the features may be affected by dust deposition ▪ Potential ecological receptors are located <20m away from the construction site	Medium

In the **operation phase, t**he main causes of potential negative impact on air quality is the movement of vehicles on the motorway. Therefore, the operational impacts are anticipated to include reduction of air quality due to

Emission of exhaust gases from combustion processes in vehicles that contain nitrogen oxides (NOx), sulphur oxides (SOx), carbon monoxide (CO) and fine particulate matter.

In order to assess the impacts of traffic on air quality, concentrations of air pollutants are calculated in the EIA Study prepared by IG Banja Luka using computer modelling (Merkblat über Luftverunreinigungen an Strassen, MluS-90) for typical cross section of the motorway[136]. And while details and assumption are presented in their Study from April 2020, the table below shows the summary results for typical air pollutants on this section.

Table 66: Forecast air pollutant concentrations in the Mostar South-Kvanj tunnel section, at a wind velocity of 3.9 m/s

[135] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, version 1.1. available at http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf
[136] IG Banja Luka, Environmental Impact Assessment Study for sub-section on Corridor Vc Mostar South - Tunnel Kvanj

Pollutant concentration (mg/m3)	*Distance from the carriageway (m)*						
	1.0	*3.0*	*5.0*	*10.0*	*20.0*	*50.0*	*100.0*
Carbon monoxide (sr)	0.3542	0.3081	0.2812	0.2409	0.1979	0.1390	0.0936
Carbon monoxide (max)	1.0991	0.9562	0.8726	0.7476	0.6143	0.4314	0.2905
Hydrocarbons (sr)	0.0585	0.0509	0.0465	0.0398	0.0327	0.0230	0.0155
Hydrocarbons (max)	0.1755	0.1527	0.1394	0.1194	0.0981	0.0689	0.0464
Nitrogen monoxide (sr)	0.2785	0.2423	0.2211	0.1895	0.1557	0.1093	0.0736
Nitrogen monoxide (max)	0.8654	0.7529	0.6871	0.5887	0.4837	0.3397	0.2287
Nitrogen dioxide (sr)	0.1597	0.1494	0.1433	0.1342	0.1245	0.1113	0.1010
Nitrogen dioxide (max)	0.4963	0.4641	0.4452	0.4170	0.3869	0.3457	0.3139
Lead (sr)	0.00039	0.00034	0.00031	0.00026	0.00022	0.00015	0.00010
Lead (max)	0.00117	0.00102	0.00093	0.00080	0.00066	0.00046	0.00031
Sulphur dioxide (sr)	0.0162	0.0141	0.0129	0.0110	0.0091	0.0064	0.0043
Sulphur dioxide (max)	0.0502	0.0436	0.0398	0.0341	0.0280	0.0197	0.0133
Soot (sr)	0.0024	0.0021	0.0019	0.0016	0.0013	0.0009	0.0006
Soot (max)	0.0073	0.0063	0.0058	0.0050	0.0041	0.0029	0.0019

The results indicate that increased concentrations acts are expected only in the close vicinity of the motorway. The cumulative impact are also expected when observed in conjunction with other sources in the area (pelase see Chapter 7.4 Assessment of cumulative impacts).

Relying on information presented in the Environmental Impact Study of Corridor Vc, section: Konjic (Ovcari interchange)-Mostar North, with a length of 36.50 km, that a reduction of pollutant emissions on the M17 motorway will be up to 69% compared to the current situation, it can be concluded that with construction of this section Mostar South-Tunnel Kvanj, the similar reduction of pollutants emitted from traffic on M17 can be expected.

The conclusion of the 2020 IG ESIA Study states that the pollutant emissions will increase in the zone of forest and agricultural areas compared to the current situation, especially in the area where the route crosses the Buna and Bunica streams; but the calculated concentration indicate that no significant deterioration of the air quality will occur.

Although traffic studies have identified an increase in annual average daily traffic by 2060, it is considered that the pollutant emissions into the air will not further increase as consequence of:

1. Engine development in the automotive industry (direct fuel injection, turbocharging, automatic deactivation of unnecessary cylinders, atart-stop systems, reducing fuel consumption)

2. Development of exhaust gas treatment (using oxidation catalysts, gas reductions using selective catalysts, the use of filters to reduce solid particle emissions)
3. Use of hybrid vehicles
4. Use of electric vehicles
5. Reducing emissions during cold start
6. Fuel quality improvements.

Table 67 below provides a summary of impacts and assessment of their significance.

Table 67: Summary of impacts on air quality and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Air quality						
Construction	Reduction in air quality due to: ▪ Emissions of construction dust ▪ Emission of exhaust gases from combustion processes in generators and other construction equipment /vehicles.	Adverse	Moderate	Medium	Moderate	Significant
Operation	Reduction in air quality due to: ▪ Emission from exhaust gases from vehicles using the motorway	Adverse	Minor	Medium	Minor	Not significant

7.2.5 Land

The assessment of impacts on geomorphology and soil quality is underpinned with the following facts:

- The project area belongs to Dinaric karst morphology.
- This sub-section runs for the most part along the Mostar field, dominated by limnoglacial and alluvial structures of the River Neretva and its tributaries Buna and Bunica, and with some diluvium structures.
- All three agro-zones are present in the project areas of which 5% is high quality agricultural land, 50% lower quality agricultural land and the rest is the land not suitable for agricultural production.
- The motorway passes through areas that are mainly used for cultivation and agriculture. The northern section is passing close to the industrial area including the airport, while southern section is situated in the natural environment (coniferous forest and grasslands).

In the **construction phase**, the main causes of potential negative impact on geomorphology and soil quality are:

- Nature of construction works
- Presence of construction machines at the site
- Generation of different types of wastes
- Uncontrolled discharge of sanitary waters from workers' camps.

The main impacts on land and soil quality in the construction phase are:

- Occurrence of landslide and rockfall along the route in regard to terrain type and slope stability. Slope stability may be sensitive by the creation of road cuts or embankments, especially during the works on the bridges in river alluvium while rockfalls might be an issue during excavation works on Hodbina Hill leading to the Tunnel Kvanj.
- It is possible, that without adequate protection measures soil erosion could occur on road embankments and bridge embankments. It is also possible, that stockpiles of soil located close to surface waters could infiltrate the water courses during heavy rainfall and cause siltation of the rivers. Erosion may also occur in the section of tunnel water discharge into the river.
- Topsoil stripping may bring risks of erosion of exposed ground and increased water runoff and siltation of watercourses. The use of heavy machinery and equipment, particularly on steep slopes to clear construction corridors may also result in serious compaction and erosion problems. For instance, presence of quarries and borrow sites (the sources for road building materials) if not properly rehabilitated, may cause erosion.
- Damage and/or loss of topsoil may occur in case the topsoil is not removed; mixed with subsoil and/or other material during and after removal. Impact on topsoil outside the boundaries of the RoW may also happen – the topsoil not subject to removal may be compacted by heavy vehicles, scattered during transportation to temporary stockpiling site as well as lost by wind and water erosion when in stockpiles. The quality of topsoil may deteriorate if the stockpiles are not managed properly.
- Construction machinery (vehicles and equipment for construction) moving around the location may create soil compaction, which may harm the soil's productivity, impair drainage, and increase the risk of flooding. This disruption consists of localized changes in the profile of the soil in the immediate surroundings of the excavations;
- Changes in land use – e.g. from agricultural to construction land;
- Deforestation of 141,210 m^2 of the forest land in terms of cutting, clearing, and removal of forest or stand of trees where land is converted to a non-forest use;
- Soil dewatering due to increase in surface runoff (10-20% water loss) and evaporation (60-70% water loss) as a result of removal of vegetation and changes in land slopes.
- Increase risk of localised pollution due to the maintenance of construction vehicles at the site (e.g. lubricants and oil changes, washing of vehicles)
- Localised reduction in soil quality resulting from potential release of wastewater onto soil
- Localised reduction in soil quality resulting from depositing of municipal and other special waste categories. Workers at the construction site may generate solid and liquid waste. Uncontrolled (storing, handling and depositing) and untreated wastes are major sources of pollution that may disrupt soil quality (e.g. pollutants settling in soil may impair the success of soil organisms, thus increasing the likelihood of erosion).

All potential impacts are localised to the project footprint area, temporary and limited to the construction phase only. According to the engineering and geological characteristics, the terrain is categorised as stable, therefore not susceptible to erosion and landslides. Only in the zone of Buna and Bunica streams the soils are formed in alluvium and the ground has settling character, which need to be carefully considered in the Main design related to footing of the bridge constructions (already addressed in Preliminary design). In case of localised damage to soil or soil quality, such impact is reversible and can be remediated. With application of appropriate mitigation measures the impacts can be fairly minimized even completely annulled, especially those impacts related to change of soil quality.

Land use impacts are assessed in Chapter 7.3 Assessment of social impacts. This impact is considered permanent and irreversible.

In the **operational phase** no significant impact on the geomorphology is expected; however, several potential impacts on soil quality have been identified as a result of:

- Precipitation intercepted by the motorway surfaces
- Sanitary waters at the location of toll station
- Movement of vehicles on the motorway
- Accidents on the motorway
- Winter maintenance activities.

The main impacts on land and soil quality in the operation phase are:

- Reduction in soil quality along the route as a result of direct discharge of surface run-off that contains pollutants from traffic (e.g. particulate matter $PM_{2.5}$ and PM_{10}, sulphur dioxide, nitrogen oxides, carbon monoxide, and volatile organic compounds) and defrosting salts for de-icing the surfaces.
- Reduction in soli quality as a result of accidental fuel and oil spills from motor vehicles participating in an accident that may be washed off from road surfaces and enter the soil.
- Reduction in soil quality as a result of use of de-icing agents in road winter maintaining activities.

These impacts will be manifested in a longer time period in comparison to the construction phase where such impacts are expected to be of a temporary character. However, the design and construction of appropriate surface run-off collection and treatment system, as well as development of appropriate Spill Response Plan should be enough to mitigate these impacts. As Mostar is situated in the area with mild winters de-icing agents will rarely be used, if ever, and this impact is considered to be not significant.

Table 68 below provides a summary of impacts and assessment of their significance.

Table 68: Summary of impacts on land and soil quality and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Land						
Pre-construction	▪ No impacts	-	-	-	-	-
Construction	Change in geomorphology of the terrain due to: ▪ Occurrence of landslide and rockfall due to the nature of construction works. ▪ Compaction and erosion as a result of using heavy machinery and equipment	Adverse	Moderate	Low	Minor	Not significant
Construction	Reduction in soil quality due to: ▪ Deforestation ▪ Soil dewatering ▪ Direct discharge of wastewater from maintenance of construction vehicles at the site and sanitary waters from construction camp ▪ Inappropriate waste disposal	Adverse	Moderate	Medium	Moderate	Significant

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Operation	Reduction in soil quality along the route as a result of: ▪ direct discharge of surface run-off ▪ accidental fuel and oil spills	Adverse	Moderate	Medium	Moderate	Significant
Operation	Reduction in soil quality resulting from use of de-icing agents	Adverse	Minor	Low	Negligible	Not significant

7.2.6 Climatic factors

The possible impacts of motorway construction on the climate are related to emission of greenhouse gases (GHG) from the road transport. It is worth mentioning once more that, although Bosnia and Herzegovina has low emissions of carbon dioxide from transport, road transport is the dominant means of transport and GHG gas emissions from transport are expected to rise.

Performance Requirement 3 of the EBRD Environmental and Social Policy (2014) states quantification of emissions is required where direct operational emissions are expected to be more than 25,000 tCO_2 per year. In order to determine the level of impact, a GHG assessment is carried out in line with EBRD Protocol for Assessment of Greenhouse Gas Emissions (2017). The baseline and project emission scenarios have been calculated based on the RoadCO_2 estimation tool and relevant scientific research for calculation of GHG emissions for the road construction projects. RoadCO_2 is a web-based tool developed to estimate GHG emissions during the entire lifecycle of a road project. The tool is equipped with a database that covers almost all GHG-emitting, road-related activities, including those originating from both direct and indirect sources. The tool utilizes the methodology proposed by the Intergovernmental Panel on Climate Change (IPCC) for GHG emissions estimation.

Table 69: Input data requirements and calculation methods

Sector Emission	*Input Data Requirements*	*Calculation Method*
Construction Phase	▪ Quantity of materials (m^3) ▪ Density of materials (kg material/m^3) ▪ Emission factor (EF) (kg CO_2e/kg material) ▪ Fuel consumption rate (FCR) (L fuel/Eq.h) ▪ Quantity (Equipment-Eq) ▪ Duration of construction works (h) ▪ EF (kg CO_2e/L fuel) ▪ Mass (kg transported) ▪ Distance (km) ▪ EF (kg CO_2e/kg transported.km)	$E_{material}$ = Quantity of materials (m^3) x Density of materials (kg material/m^3) x EF (kg CO_2e/kg material) $E_{equipment}$ = FCR (L fuel/Eq.h) x Quantity (Eq) x Duration of construction works (h) EF (kg CO_2e/L fuel) $E_{transportation}$ = Mass (kg transported) x Distance (km) x EF (kg CO_2e/kg transported.km) $E_{total} = E_{material} + E_{equipment} + E_{transportation}$
Operation phase	▪ FCR (L fuel/km.vehicle) ▪ Traffic volume (veh/y) ▪ Distance (km) ▪ EF (kg CO2e/Lfuel) ▪ Wattage (kW/lamp) ▪ Quantity (lamp) ▪ Duration (h/y)	$E_{traffic}$ = FCR (L fuel/km.vehicle) x Traffic volume (veh/y) x Distance (km) x EF (kg CO_2e/Lfuel) $E_{lighting}$ = Wattage (kW/lamp) x Quantity (lamp) x Duration (h/y) x EF (kg CO_2e/kWh) $E_{irrigation}$ = Irrigation rate (L/day.tree) x Quantity (tree) x Duration (d/y) x EF (kg CO_2e/L)

Sector Emission	*Input Data Requirements*	*Calculation Method*
	▪ EF (kg CO2e/kWh) ▪ Irrigation rate (L/day.tree) ▪ Quantity (tree) ▪ Duration (d/y) ▪ EF (kg CO2e/L) ▪ Power (kW/pump) ▪ Quantity (pump) ▪ Duration (h/y) ▪ Annual sequestration rate (kgCO2e/tree.y)	$E_{stormwater\ pumping}$ = Power (kW/pump) x Quantity (pump) x EF (kg CO_2e/kWh) **Sequestration** = Quantity (tree) x Annual sequestration rate (kgCO_2e/tree.y) $E_{total} = E_{traffic} + E_{lighting} + E_{irrigation} + E_{stormwater\ pumping}$ + **Sequestration**

The following two scenarios are analysed:

- **Baseline scenario:** The baseline scenario includes the location of the Mostar South near Mostar Airport. The location consists of the two main roads M6.1 and M17.3 with the Mostar Airport located near the main road M6.1.
- **Project scenario:** According to the Preliminary Design, the 9.2 km long sub-section Mostar South-Tunnel Kvanj is the northern part of the Section Mostar South-Buna. The sub-section begins with the Mostar South interchange and ends with the entrance into Tunnel Kvanj. The interchange is located near the Mostar Airport, and represents the intersection of the motorway with the existing main road M6.1 by connecting the motorway.

Input data

The activity data of the considered scenarios were extracted from the Preliminary Design - bill of quantities (BOQ) section, especially for the construction phase of the project scenario and therefore the construction phase was not considered for the baseline scenario. The unavailable data were either collected through site visits or were estimated based on engineering judgment or findings from the scientific literature related to road construction projects.

The quantities of materials in the BOQ section are expressed in different units but due to the fact that the methodology requires the quantity of material to be expressed in units of mass, along with the density of the material, the units were converted into mass in cases where they were initially expressed in units of volume, area, or length.

Table 70: Materials used for the project scenario and their corresponding EF values

Materials	*Unit*	*Project scenario*	*EF (kg CO_2e/kg)*[137]
Cement bound (stabilized) sub-base of naturally crushed stone material	m^3	38,355.87	0.132
Base-bearing course of asphalt mixture of bituminous well graded crushed stone of granulometric composition of 0/22S with road bitumen binder	m^3	21,704.20	0.071
Uniformly graded crushed stone	m^3	13,694.59	0.0052
Soft rock	m^3	174,585.41	0.0052
Crushed mineral aggregate	m^3	22,157.14	0.0052

[137] Intergovernmental Panel on Climate Change (IPCC)

Sealing course of stone mastic asphalt SMA 11s of silicate stone grains and road bitumen	m^3	5,363.20	0.071
Sealing course of stone mastic asphalt BB 11k of silicate stone grains and bitumen	m^3	1,676.00	0.071
C 35/45 cement concrete gutter	m^3	1,538.60	0.132

The data related to the construction equipment specify the type of equipment used, its quantity and usage duration. An assumption on input data of the construction phase (type of equipment used, usage duration) was made, since the Main project has not been drafted yet. The construction equipment was assumed to operate for six hours per day, five days a week. Moreover, diesel was assumed to be the type of fuel used to operate this equipment[138].

Table 71: Input data on equipment used in construction phase

Equipment type	*Quantity*	*Operation hours*
Loader	5	1,440
Excavator	5	1,440
Grader	5	1,440
Rollers	5	200
Steel vibrating roller	5	300
Soil compactor	5	400
Paver	5	300
Dozer	5	300
Dump truck	10	1,440

The operation phase extends over the road's service lifetime, which is usually between 30 and 50 years. The calculation of emissions was conducted only for vehicle movement while street lighting, irrigation, storm water pumping and sequestration activities were estimated to have zero contribution taking into account that relevant data were not available in this phase of the project. Nevertheless, the contribution of this parameter to the total project emissions is very low compared to the vehicle movement.

Table 72: Input data for activities of the operation phase – baseline and project scenario

Activity	*Item*	*Baseline scenario (2018 yr)*		*Project scenario (2050 yr)*		
Vehicle movement	Passenger cars	M6.1	M17	M6.1	M17	Corridor Vc
	(n. veh.)	2,614,495	5,145,040	5,915,920	7,417,165	7,417,165
Street lighting	N.A	0		0		
Irrigation/sequestration	N.A	0		0		

For the baseline scenario, traffic counts were measured at 2 different locations covering the entire network. Measurements were conducted between late 2017 and early 2018 and the results were extrapolated to obtain an average annual traffic count. As for the project scenario, annual traffic counts were extracted from the

[138] Article: Estimation of Greenhouse Gas Emissions Produced by Road Projects in Abu Dhabi, United Arab Emirates
Mohammed H. Alzard, Munjed A. Maraqa, Rezaul Chowdhury, Qasim Khan, Francisco D. B. Albuquerque, Timur Ibrahim Mauga and Khaled Nazmi Aljunadi, Sustainability 2019

Traffic study within the Preliminary design which predicted that 50% of traffic from the baseline scenario will be transferred to the new Corridor Vc.

According to the official statistics data in Bosnia and Herzegovina, 70% of vehicles run on diesel while the remaining 30% use gasoline. The emission factors of gasoline (2.384 kg CO_2e/L) and diesel (2.669 kg CO_2e/L) were obtained from the IPCC. Furthermore, for both scenarios, the travelled distance was assumed to be equal to the length of the constructed segment.

Results

The results presented in Table 73 show that the construction phase contributed to GHG emissions within the project scenario. The table shows that baseline scenario contributes approximately 14,003 tons CO_2e/y annually, while the project scenario contributes approximately 44,930 tons CO_2e/y.

Table 73: Emissions baseline and project scenario expressed in different units

Parameter	*Unit*	*Baseline scenario (2018)*	*Project scenario (2050)*
Construction	tCO_2e	0	14,967.39
Construction	ton CO_2e/lane/km	0	1,626.89
Construction	ton CO_2e/y	0	7,483.69
Operation	ton CO_2e/y	14,003.19	37,446.78
Airport Mostar	ton CO_2e/y	N/A	N/A
Total emissions	**ton tCO_2e/y**	**14,003.19**	**44,930.48**

CO_2 emissions from the operation phase of the baseline scenario have been increased by 62%, whereas the total CO_2 from the project operation and construction phase increased by 68% compared to the baseline scenario. The increase in emissions from the operation phase is the result of the projected increase in traffic by 2050. According to the Traffic study, the traffic on M17 and M6.1 will be increased each year by 2%.

However, direct total annual emissions of CO_2 for the baseline scenario are 14,003 tCO_2e, while for the project scenario they amount to 44,930.48 tCO_2e. Moreover, the table shows that the operation phase (vehicle movement) contributes about 80% of the emitted gases in the project scenario, while the contribution of the construction phase is about 20% due to usage of materials (concrete, asphalt etc.) and equipment.

The results also show that construction emissions for 9.2 km of Corridor Vc are 1,626.89 tons CO_2e/lane/km while the value reported by the scientific article[139] is 2,875 ton CO_2e/lane/km. Even though the two values are comparable, the value obtained in this study is lower probably due to lack of relevant data.

According to the Third National Communication and Second Biennial Update Report on Greenhouse Gas Emissions of Bosnia and Herzegovina (2016)[140], the total CO2e emissions from the transport sector were 2,896,000 tCO2e in 2013. Therefore, the total project emissions contribute about 2% of the total CO2e emissions from the transport sector in BiH compared to the results from national emission inventory.

[139] Article: Estimation of Greenhouse Gas Emissions Produced by Road Projects in Abu Dhabi, United Arab Emirates
Mohammed H. Alzard , Munjed A. Maraqa, Rezaul Chowdhury, Qasim Khan, Francisco D. B. Albuquerque, Timur Ibrahim Mauga and Khaled Nazmi Aljunadi, Sustainability 2019
[140] Third National Communication and Second Biennial Update Report on Greenhouse Gas Emissions of Bosnia and Herzegovina under the United Nations Framework Convention on Climate Change, July 2016

The cumulative CO_2 emission effect of the baseline and project scenario, i.e. total emission will be higher due to the Mostar Airport which is located nearby, and which was not included in the calculations due to lack of available input data.

The calculated emissions for this road section will be increased comparing to the baseline scenario. However, the GHG emissions in the construction phase are temporary and their magnitude is considered to be negligible, while in the phase of operation, considering this section to be part of the Corridor Vc, the impact is considered to be moderate in magnitude.

The sensitivity of receptors to GHG emission is difficult to assess as the impact is indirect through occurrence of natural disasters caused by climate change. The information on climate change impacts in Mostar does not exist. The visible impacts are mainly related to increase in temperature, droughts and fires. Sensitivity of receptors depends mainly on the type of natural disaster. And while the sensitivity to fires is assessed as high, demonstrated through previous experience with historical fires in the Mostar area and insufficient capacities of firefighters and civil protection, the sensitivity to droughts is assessed as low due to abundant surface and ground water resources that can be used to keep the agriculture activities alive.

According to the information presented in the 2013 Study on Preliminary Flood Assessment Risk for Watercourses of Category I in FBiH commissioned by the two Water Agencies[141], significant historical floods are observed in the "Mostarsko blato" area caused by waters from Lištica stream which is more than 10 km air distance from the Mostar South Interconnection. For the area of Mostar and the project area in general, the assessment showed no flood risk. Nevertheless, the preliminary water permit obtained for this section orders to have the motorway structures (culverts, bridges, etc.) designed to sustain 1-100 year flood waters. The current project design has yet to address climate resilience issues in detail such as drainage system capacities, slope stabilisation protection, specification of surfacing materials, etc.

Based on the information presented above, the overall sensitivity is assessed as medium.

Therefore, the contribution of GHG emission in the phase of construction to sensitivity of receptors is assessed as negligible and in the operation phase as moderate (Table 74).

The detailed design shall include design measures and materials specification in light of the anticipated climate change forecasts and projections over the lifetime of the project, to ensure sufficient resilience to climate variability and climate change. Additional mitigation measures to address climate resilience risks will be specified in the contract specification and if appropriate the Contractor will be require to prepare a Climate Resilience Construction Management Plan.

Based on a simulation run by European Topic Centre on Air Pollution and Climate change Mitigation (ETC/ACM)[142], cutting motorway speed limits from 120 to 110 km/h could deliver fuel savings for current technology passenger cars of 12–18 %, assuming smooth driving and 100 % compliance with speed limits. Significant fuel savings can be achieved by encouraging drivers to maintain a consistent speed and restrict their speed (eco-driving), including through effective enforcement of speed limits. CO2 emissions are directly linked to fuel consumption therefore cutting the motorway speed can help reduce GHG emissions from transport. The modelling results also suggest that speed limitations of 80–90 km/h on motorways when entering cities and on city ring roads could significantly reduce both fuel consumption and pollutants emitted, in addition to delivering safety benefits.

[141] Hydro-Engineering Institute Sarajevo, April/May 2013
[142] https://www.eea.europa.eu/themes/transport/speed-limits-fuel-consumption-and

Table 74: Assessment of impacts on climate

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Climatic factors						
Construction	GHG emissions	Adverse	Negligible	Negligible	Negligible	Not significant
Operation	Low resilience to climate variability and climate change	Adverse	Moderate	Medium	Moderate	Significant
Operation	GHG emissions	Adverse	Moderate	Medium	Moderate	Significant

7.2.7 Existing material assets including cultural-historical and archaeological heritage

Impacts on existing material assets are assessed in Chapter 7.3 Assessment of social impacts.

The assessment of impacts on cultural-historical and archaeological heritage is framed with the following facts:

- 15 protected good of cultural and historical heritage are located in the project area.
- Remains of a prehistoric fort and settlement from the Roman times are located on the Hadzajlica Kicin hill in Malo Polje, located at the 500 m clearance distance from the road section Mostar South-Tunnel Kvanj, being on the edge of the project area of influence.
- Three tombstones below the future Buna Bridge in Malo Polje.

In the **construction phase**, the main cause of potential negative impact is the

- nature of construction works that will require deep digging and removing of soil
- presence of machinery and workers on site

Therefore, the impact identified is:

- damage to visible and buried cultural, archaeological and architectural heritage during execution of construction works and movement of machines/vehicles around the construction site

Federal Institut for Protection of Monuments has approved the execution of construction works under conditions of finding exact location of the indentified monuments in respect to the motorway alignment and execution of preventive arcehological surveys (drilling boreholes) to avoid later chance finds. In case of chance find, the Institute has ordered immediate suspension of works.

No impacts are identified in the **operational phase**.

Table 93 below provides summary of impacts and assessment of their significance.

Table 75: Summary of impacts on cultural-historical and archaeological heritage and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Water						

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Pre-construction	▪ No impacts	-	-	-	-	-
Construction	▪ Damage to visible and buried cultural, archaeological and architectural heritage during execution of construction works and movement of machines/vehicles around the construction site	Adverse	Major	High	Major	Significant
Operation	▪ No impacts	-	-	-	-	-

7.2.8 Landscape

The assessment of impacts on landscape is framed with the following facts:

- Two dominant elements of the landscape are found in the project area: the natural system (rivers, forest) and the system created by human activity (agricultural land, settlements and infrastructure).
- The landscape imagery is completely open and vivid thanks to the rich floristic composition and significant ecological capacity of the landscape.
- There is also the presence of constructed urban segments however they fit into the ambient and form a harmonious landscape image. The settlement system is strongly connected with the transport system and, through that, with the natural morphology.
- The project route will change the existing landscape and the visual
- The new spoil landfill site will fill up a naturally formed depression and will change the existing landscape and visual.

In the **construction phase**, there will be changes to the existing landscape and a variety of visual impacts due to necessary earth works and civil works, temporary storages of building material and construction of necessary facilities, presence of personnel and machinery, and new constructing structures including the landfill for excess excavation material. Construction of motorway structures will primarily result in the following landscape and visual impacts:

- removal of the existing vegetation
- temporary construction compounds and presence of plant and associated equipment
- presence of new motorway and new and widened access roads
- presence of temporary construction facilities (e.g. construction compounds)
- presence of construction activity within the river channel
- cut and fill in hillsides
- establishment of new spoil landfill site.

Part of the construction site will be located in urban area and part of the construction site on the forest ground with few or no receptors nearby which would be affected by a change in landscape or visual amenity. Where settlements are present, the construction works will be clearly visible to residents and users of nearby infrastructure and facilities (e.g. airport, road M17, etc.). The sensitivity of the existing landscape character is considered to be low as the project area is mainly area of urban intrusion. In the route length of approximately 7.5 km, the existing landscape is not particularly sensitive to change as it is already changed by urban

interventions and similar road structures. Approximately 2.7 km of the route is passing through the landscape dominated by grasslands and forest with no or limited urban influence present. Existing woodland vegetation would need to be cleared to accommodate the construction works. This part of the landscape is assessed to be moderately sensitive to change.

The magnitude of change for the landscape resource is considered to be low as the nature of the incised valleys would limit the spatial influence of changes to existing landscape features. The loss of woodland cover and changes to topography are expected to be localised and largely associated with the existing road network. The new landfill will fill up a natural depression and with appropriation recultivation measures (to be foreseen under the Land section) it will give a new natural visual to the landscape. Therefore, the overall effect on landscape character during construction is considered to be minor adverse and not significant.

The visual receptors considered include residents of the settlements, local people working in predominately outdoor occupations (such as farmers in the vineyards) and users of surrounding infrastructure. Some of the works will be executed in the close vicinity of houses. The overall sensitivity of the receptors is considered to be medium.

Thus, changes in visual amenity during the construction phase will be largely visible to the receptor in the northern section, while it will be screened and filtered by the existing wooded vegetation and the strong valley topography throughout in the southern section. The addition of new features will form conspicuous elements in the landscape that will result in a detectable change in visual amenity and views. Overall, the magnitude of change for the visual receptors are considered to be low due to the presence of similar elements in urban area and acceptance of the project by the residents who understand the overall importance of the motorway construction.

The main landscape/visual impact in the **operational phase** will be associated with the permanent motorway structures constructed above the ground. The same impact analysis is applicable as in the case of the construction impacts.

Table 76 below provides summary of impacts and assessment of their significance.

Table 76: Summary of impacts on landscape and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Landscape						
Pre-construction	▪ No impacts	-	-	-	-	-
Construction	▪ Changes to the existing landscape and visual impacts due to the construction works	Adverse	Minor	Medium	Minor	Not significant
Operation	▪ Changes to the existing landscape and visual impacts due to the presence of permanent motorway structures	Adverse	Minor	Medium	Minor	Not significant

7.2.9 Noise

The assessment of impacts of noise is framed with the following facts:

- The project area is divided in three distinctive zones: industrial zone (airport and other commercial facilities), residential zone (settlements Kosor and Malo polje) and nature (forest)
- The motorway is passing in close vicinity to commercial and residential objects
- Baseline monitoring of noise indicated that the limit values for the outdoor noise level defined for the acoustic zone IV are not exceeded as defined by the Law on Noise Protection[143]
- No noise modelling is available.

In the **construction phase**, the main causes of potential negative impact of noise are:

- Nature of construction works
- Presence of construction machines at the site

On construction sites there are many different noise sources and these sources exhibit many differing types of noise such as background noise, idling noise, blast noise, impact noise, rotating noise, intermittent noise, howling, screeches and squeals that need to be controlled.

The noise emission intensity depends on types of working machines and motor vehicles that are used during the construction (age of the machine and technical condition of mechanical parts) as well as the organisation of construction sites and activities during construction, which can minimise the number of idle motions of freight vehicles and hours of working machines while awaiting loading. No blasting is foreseen or expected.

The two main receptors of concern are “human receptors” that includes workers on site, local residents and users of surrounding infrastructure, and “ecological receptors” referring to sensitive fauna disturbed by increase in noise and vibrations.

At the construction site itself noise activity can:

- disturb speech communication and communication via devices (noise above 65 dB reduces a possibility to maintain speech communication at a distance shorter than 1 metre, and aggravates telephone communication),
- decrease work ability, productivity and concentration due to prolonged exposure to intense noise,
- damage hearing.

In the project area of influence, the increased noise can lead to psychic fatigue with a decreased attention span and feeling of unease.

No information on noise modelling are available at the time of preparation of this Study. The noise modelling will be done as a part of the main design. Therefore, the assessment of impacts is based on expert judgment.

Based on the experience from similar sites, the increase in noise levels at the construction site can be up between L_{eq}80-90dB(A) depending on the number of machines working simultaneously and type of works performed. The sound level at operator can vary from 85db(A) to up to 110db(A) depending on the type of the machine he is operating[144]. Impact equipment (such as pile driver, pneumatic breaker) is the biggest noise hazard to operators and workers nearby while earth moving equipment (such as bulldozer, truck, paver, etc.) exposes a greater number of workers to noise hazards. For the workers on site it is important to have

[143] Official Gazette of FBiH, no. 110/12
[144] Laborers Helath and Safety Fund of North America, Controlling Noise on Construction Sites, Guidance document, available at https://www.lhsfna.org/LHSFNA/assets/File/bpguide%202014.pdf

protective equipment and implement OHS measures (job rotation, activity planning, scheduling of operations, etc.) that will protect them from negative impacts of prolonged exposure to noise.

Concerning the residents in the area, the noise is decreasing with the distance from the source so it is fair to assume that largest impact will be on the houses located in close vicinity to the construction camp. Doubling the distance from the noise source lowers the noise level by 6dB. The scheduling of work, appropriate placement/containment of noisy equipment, as well as appropriate planning of noisy works can reduce the impact on residents in the area.

In the **operation phase**, the main cause of increased noise levels is the motorway traffic. The modelling of noise that will be developed as a part of the main design will indicate the levels of noise and accordingly the installation of noise barriers on critical locations where the noise levels are increased will be proposed.

Impacts of noise on ecological receptors is assessed in Chapter 7.2.

Table 77 below provides a summary of impacts and assessment of their significance.

Table 77: Summary of impacts of noise and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Noise						
Pre-construction	▪ No impacts	-	-	-	-	-
Construction	▪ Impact on workers and residents from increased levels of noise during construction works	Adverse	Moderate	Medium	Moderate	Significant
Operation	▪ Impact on residents from increased levels of noise from motorway traffic	Adverse	Moderate	Medium	Moderate	Significant

7.2.10 Waste and materials management

The assessment of impacts from wastes and materials management is framed with the following facts:

- Waste Management Plan and Construction Waste Management Plan are prepared for this Project.
- The main type of waste that is generated during the motorway construction is the excess excavated soil (rocks and soil) which will be disposed on the landfill Rotimlja that will be opened for this purpose.
- Generated non-hazardous municipal waste and hazardous waste from the working and storage areas will be managed in cooperation with local communal utility and disposed on the reginal landfill Uborak in Mostar.
- The hazardous waste and other types of special waste categories will be transferred for management to a licenced operator.

In the **construction phase**, there are a range of impacts which can occur from the mismanagement of waste generated and inappropriate sourcing of materials. The potential adverse impacts of the project in the construction and operational phases:

- Use of potentially finite and/or scarce resources
- Ineffective spoil/excavated material handling, storage and disposal causing contamination of the environment or sedimentation of water resources
- Contamination of environments (particularly surface watercourses, groundwater and the ground) due to leakage and spillage of wastes associated with poor waste handling and storage arrangements
- Fugitive emissions, such as dust, associated with the handling and storage of some waste streams
- Visual amenity impacts associated with poor storage of waste
- Environmental damage caused by sourcing the material from illegal borrow pits or buying it from illegal material providers.

By far the most significant waste stream (in terms of volume) which will be generated because of the construction phase of the Project is the waste soil from excavation activities (reference quantities are given in Chapter 5.9.2). The location for spoil disposal is already decided and a preliminary design of the landfill site prepared.

Besides the excavated spoil, the most significant materials that are expected to be used as part of the construction phase are the various grades of concrete, shotcrete and cement/grout. The primary environmental impacts associated with the use of concrete are elevated dust levels during use of the concrete batching plan and CO_2 emissions and embedded CO_2 associated with concrete production. Other impacts associated with material use will be the use of finite materials and the material storage. If not appropriately stored and contained, materials could result in contamination of the environment.

Materials and waste handling impact assessment is primarily about identifying waste streams and adopting an appropriate approach in line with Good International Industry Practice (GIIP), which seeks to avoid the generation of waste in the first instance, rather than mitigating potential impacts to a defined baseline environment. After identifying the potential sources of waste arising from each phase of the project and, where possible, quantifying waste generated, the assessment focuses on measures to reduce, reuse and recycle, as well as the solutions available for waste disposal. Waste will be generated across the entire project affected area and if properly managed, the area impacted will not go beyond the project site limits. However, if any hazardous substances or spoil/excavated materials require special disposal treatment offsite or are not handled and stored properly, there is potential that groundwater and/or the aquatic environment could become contaminated outside the project area.

Illegal sourcing of material can cause permanent damage to environment as it will not be followed by appropriate mitigation measures. Therefore, this impact is assessed as major and will require careful consideration by the Contractor when choosing source of materials for construction and supervision by JPAC to avoid illegal activities.

In the **operational phase**, the likely waste types include solid, liquid, hazardous, non-hazardous, municipal and inert wastes. Operational waste volumes from the project will be significantly less than those generated during the construction phase. Wastes generated will arise from the tool station and any maintenance-related activities. Good International Industry Practice (GIIP) approach will be implemented in managing and handling the waste generated. Details are described in the Waste Management Plan.

Table 78 below provides a summary of impacts and assessment of their significance.

Table 78: Summary of impacts of waste and materials management and assessment of their significance

Phase	*Type of impact*	*Adverse/ Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Waste						
Construction	Contamination of environment due to leakage and spillage of wastes associated with poor spoil and waste handling and storage/disposal arrangements	Adverse	Major	High	Major	Significant
Construction	Environmental damage caused by illegal material sourcing.	Adverse	Major	Medium	Major	Significant
Operation	Contamination of environment due to leakage and spillage of wastes associated with poor waste handling and storage arrangements	Adverse	Minor	Medium	Minor	Not significant

7.3 Assessment of social impacts

7.3.1 Methodology

During development of social impact assessment, the same methodology is used as during the impact assessment of environmental aspects, with some changes in criteria for determining the impact magnitude and sensitivity. The social impact assessment has included consideration of both intended and unintended socio-economic and community consequences of the Project, beneficial and adverse, and any social change processes invoked by those interventions. Social impacts are conceptualised as changes to one or more of the following:

- people's way of life – how they live, work, play and interact with one another on a day-to-day basis,
- their community – its cohesion, stability, character, services and facilities,
- their culture –shared beliefs, customs, values and language use,
- their environment – air and water quality; availability and quality of food consumed; the level of hazard or risk, dust and noise exposure; sanitation facilities; physical safety; and, access to and control over resources,
- their health and wellbeing – whereby health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity; perceptions of safety,
- their personal and community property rights – access issues; economic effects and experiences of personal disadvantage or advantage.

Adverse impacts will be avoided wherever possible; otherwise management and mitigation measures have been identified to reduce effects on the community. Measures are included to enhance beneficial impacts and share their benefits more widely, in particular amongst local people who may also be affected negatively by the Project.

The significance of the social impacts has been determined through consideration of the level of vulnerability (sensitivity) of Project affected individuals, households, communities and other social groups (social receptors), and the magnitude of the impact experienced by them. The assessment of impact significance has been undertaken using the overarching framework presented for assessing environmental impacts, however specific magnitude and sensitivity criteria for socio-economic impacts are presented in Table 79 and Table 80.

Table 79: Criteria for determining social impact magnitude

Category	*Description (adverse impacts)*
Major	A highly likely impact that would have implications beyond the Project life affecting the wellbeing of many people across a broad cross-section of the population and affecting various elements of the local communities', or workers', resilience.
Moderate	A likely impact that continues over several years throughout the Project life and affects the wellbeing of specific groups of people and affecting specific elements of the local communities', or workers', resilience.
Minor	A potential impact that occurs periodically or over the short term throughout the life of the Project affecting the wellbeing of a small number of people and with little effect on the local communities', or workers', resilience.
Negligible	A potential impact that is very short lived so that the socio-economic baseline remains largely consistent and there is no detectable effect on the wellbeing of people or the local communities', or workers', resilience.

Table 80: Criteria for determining sensitivity of a social receptor

Category	*Description*
High	An already vulnerable social receptor with very little capacity and means to absorb proposed changes or with very little access to alternative similar sites or services, and/or minimal opportunities for mitigation.
Medium	An already vulnerable social receptor with limited capacity and means to absorb proposed changes or with little access to alternative similar sites or services, and/or limited opportunities for mitigation.
Low	A non-vulnerable social receptor with some capacity and means to absorb proposed changes and with some access to alternative similar sites or services, and/or reasonable opportunities for mitigation.
Negligible	A non- vulnerable social receptor with plentiful capacity and means to absorb proposed changes and with good access to alternative similar sites or services, and/or good opportunities for mitigation..

7.3.2 Community impacts

7.3.2.1 Worker influx

Even if at this stage of project documentation there are no estimates on how many workers will be employed by the construction contractor, this section contains an analysis of potential impact caused by worker influx. The exact information on the number to be employed by the Contractor for construction works will be known upon the development of the Main Project for the motorway section Mostar South-Tunnel Kvanj. Worker accommodation (camps) needs to be provided by the Contractor for construction works, in line with local legislation and the EBRD worker accommodation guidelines.

During the **construction phase**, workers influx can cause both adverse and beneficial impacts.

Potential adverse impacts on the local communities form workers influx is the exposure of local population to diseases including communicable diseases and Sexually Transmitted Diseases (STD) - or Sexually Transmitted Infections (STI) and possible gender-based violence and harassment (GVBH) issues (e.g. any form of potential gender-based violence and harassment, bullying, intimidation, and/or exploitation due to the influx of workers to the project area). However, the health risk is expected to be low if measures for the Contractor to manage influx and GVBH and provide appropriate medical resources for workers are implemented. Also, COVID-19 is not expected to be a significant issue in the project area in case all measures and local legislation with an aim to prevent the spread of COVID-19 are implemented. In addition, mitigation measures are proposed to be implemented in case if there is a spike of infection rates. These measures serve to prevent the spread of COVID 19 in project area.

The number of people likely to be affected by the arrival of non-local workers (positively and adversely) is calculated based on total number of population living in 7 settlements along the motorway section (data from Census 2013) and it is 9,876. Therefore, the magnitude of the impact is assessed as moderate. During the socio-economic survey performed for the development of the LALRP, presence of permanent population with vulnerable households[145] was identified and so the sensitivity of the communities to changes from worker influx is medium. The assessment of significance of worker influx during construction is therefore moderate adverse impact and therefore significant.

The beneficial impact was also assessed. The arrival of a non-local working population can also bring benefits to a local community through increased revenue into the local economy, such as providing local goods or services. However, taking into account that local economy of the Project affected area of influence is based on villas with restaurants, the magnitude of the impact is assessed as moderate, however it is necessary to take into consideration that there is a possibility that some local workers will be contracted too, which means that the sensitivity of the impact is low. The assessment of the significance of the beneficial impact of worker influx during construction is therefore minor adverse impact and therefore not significant.

Workers influx is not foreseen during **pre-construction and operational phases**. A summary of the estimation of these impacts is provided in Table 81 below.

Table 81: Summary of impact assessment on community from worker influx

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Worker influx						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Worker influx	Adverse	Moderate	Medium	Moderate	Significant
		Beneficial	N/A	N/A	Minor	Not significant
Operation	N/A	N/A	N/A	N/A	N/A	N/A

7.3.2.2 Community health and safety and road safety

During the **construction phase** main impacts on community health and safety and road safety are related to risks caused by air pollution (dust and exhaust gasses), noise emissions, soil and water contaminations, and increased volume of traffic due to construction works. These risks are described below:

- Dust emissions generated by the site construction activities can have impact on air quality in the vicinity of the construction site. With increased wind velocities dust can, however, move to an extent of even disturbing local communities. In addition to dust, exhsaust gasses from the mechanization can create disturbances to local communities.
- Noise emissions produced by machanization used at construction site can cause nuisance to people living in the vicinity to the construction site.
- Soil and water contaminations are caused by construction related activities and can have a long-term impact if not properly mitigated and/or remediated. Water pollution (both surface and ground water) and soil pollution can have harmful consequences to local communities in case the contaminated

[145] Out of 88 respondents, 12 reported on their own vulnerability and 6 respondents also reported that one or more of their family members belongs to the category of vulnerable groups.

groundwater reaches water sources used by local communities (i.e. for irrigation in agriculture). Contamination from Project area could lower soil productivity, introduce contaminants into the food chain, and present health risks to people.

- Construction trucks, equipment and vehicle movements will increase existing traffic volumes. Increased traffic may result in road safety risks. This ncrease in construction related journeys can pose risks to inhabitants of local communities living near to local roads which will be used for construction vehicle movements during construction works.
- The presence of construction sites carries a risk of unauthorised access by the public and exposure to risks such as falls and hazardous materials.

The aforementioned risks are considered as adverse impact on community health and safety and road safety. The impact magnitude is expected to be moderate during the construction phase. The sensitivity is expected to be medium as in this case negative impacts have direct effects on people living near to local roads which will be used for construction vehicle movements during construction works. This negative impact can be mitigated by implementing mitigation measures aimed at providing community health and safety during construction phase. As such the impact is considered moderate and significant.

During the **operational phase** some of the above described risks can occur, and will persist during the entire operation phase but with a lower intensity then during the construction phase. For example noise emission will be permanent due the passage of car on the motorways. The nearest receptors will be the houses located at distance of cca. 50 m in Kosor and Malo Polje. Similar issue is for exhaust gasses which will be produced by cars on motorway section. However this impact will have lower intensity than during the construction phase, and for this reason its magnitude is minor. The sensitivity is expected to be low as only nearest receptors will be affected. .As such the impact is considered minor and not significant.

In addition, during the operational phase road safety will be improved. According to the Traffic Study for the Section Mostar South-Buna developed by IPSA Institute in April 2018, the project will result in 60% less of accidents compared to the baseline state. The improved design standards used for this Project (compared to those used to design the existing network), should result in smaller number of accidents for the same realized transport (expressed in vehicle/km). In addition, the separation of transit flows will relieve the existing congested road network, so the risk of an accident will be reduced. This is considered as a beneficial impact, with moderate magnitude. The sensitivity is assessed as medium as it will affect positively all people living near the existing road network and people using the existing road network. As such the impact is considered moderate and significant.

Impact on community health and safety and road safety are not identified **during pre-construction phase**. A summary of the estimation of this impact is provided in Table 82 below.

Table 82: Summary of impact assessment on community health and safety and road safety

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Community health and safety						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Community health and safety Road safety	Adverse	Moderate	Medium	Moderate	Significant
Operation	Community health and safety	Adverse	Minor	Medium	Minor	Not significant
	Road safety	Beneficial	Moderate	Medium	Moderate	Significant

7.3.2.3 Job creation

During the **construction phase**, the Project is expected to generate temporary local employment during the construction phase. Contactors for construction works will need low skilled workers to be employed on construction site. Thus the possibility for employing unemployed persons from the nearest local communities is high, which will have also positive impact on the local economy. As already stated, the exact information on the number to be employed by the Contractor for construction works will be known upon the development of the Main Project for this motorway section. According to data obtained during the socio-economic survey performed during the development of LALRP for this motorway section, out of 88 interviewed owners of land plots which will be acquired during the land acquisition procedure, 57% of the heads of households reported to be unemployed. In the City of Mostar, the number of unemployed persons was 14,797 or 49.0% out of the total number of unemployed persons in Herzegovina-Neretva Canton[146]. In addition, according to the baseline on educational levels of local population, the majority (62%) of inhabitants affected by land acquisition has a secondary education. Unemployed local residents with secondary education could potentially be employed as low skilled workers during construction works.

Due to this unemployment rate the employment opportunity during the construction works is assessed as a beneficial impact with medium sensitivity. The magnitude of such impact is assessed as minor given the fact that this impact will be only temporary without permanent effects. As such the impact is considered minor and not significant.

The **operational phase** is expected to generate permanent direct employment opportunities for a small number of people which will work on the pay toll station at the interchange Mostar South. This is considered a positive impact although the magnitude is negligible given the very small number of people who would be affected by it. The sensitivity of the community to employment is assessed as medium given the high unemployment in the region. Therefore, the significance of employment generation during the operational phase is negligible and not significant.

In addition, as a result of the temporary employment during the construction period is the loss of employment upon the end of construction works. This impact will affect inhabitants of local communities engaged by the Contractor for construction works during the construction phase. This impact will affect only people from settlements in the vicinity of the motorway section who will be temporary employed by the Contractor for construction works including vulnerable people, therefore the sensitivity is assessed as medium. The magnitude is assessed as moderate as the loss of job will have negative consequences on households incomes and way of living.

This impact is not identified during the **pre-construction phase**. A summary of the estimation of this impact is provided in Table 83 below.

Table 83: Summary of impact assessment on community from job creation

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Job creation						

[146] IG Banja Luka, Environmental Impact Study for the sub-section on the Corridor Vc Mostar South-Tunnel Kvanj, April 2020

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Job creation	Beneficial	Minor	Medium	Minor	Not significant
Operation	Job creation	Beneficial	Negligible	Medium	Negligible	Not significant
	Loss of employment of temporary engaged workers	Adverse	Moderate	Medium	Moderate	Significant

7.3.2.4 Disruptions to water and sanitation, electricity and telecommunication

Disruptions to water, electricity supply, telecommunication connections in settlements along the motorway section could represent a negative impact to local communities by causing disturbances in everyday-life activities. According to data obtained through available sources, permits obtained from electricity and gas suppliers for the issuance of Preliminary Water Consent and site visit during the development of the LALRP for Mostar South-Tunnel Kvanj, there are small possibilities of impacts on access to these public services during **construction phase**.

According to the Preliminary Consent obtained from the gas supply company[147], no collision point are identified between gas supply network and the motorway section as in the area of Project influence there is no a gas network.

In Blagaj there is the spring Buna which is included in the system of public water supply. Settlements along the motorway section are supplied from this spring through local water supply systems. In addition irrigation of agricultural land affected by expropriation was performed by using water from 6 water wells (also acquired during land acquisition). Water discharge of the houses along the motorway section is done by using septic tanks for fecal water or discharging them into the stream Buna, without prior treatment. Collision point with the water supply and discharge is not identified.

Telecommunication services are provided by the following companies: HT Mostar and BH Telecom for fixed and mobile telephone systems, and Eronet only for mobile telephone system. Also no collision is identified with the supply of this service.

According to Preliminary Consent obtained the joint stock company for the transmission of electricity Elektroprenos BiH[148], three collision points are identified on the following overhead transmission lines (OTLs) owned by this company: OTL 400 kV Mostar 4 – Gacko, OTL 110 kV Mostar 1 – Caplina and OTL 110 kV Mostar 2 – Stolac. In addition, according to the Expert Opinion of the electricity supply company operating in Mostar[149], the following 5 collision points are identified:

- collision with OTL 10(2) SFOR (Zracna Luka) at chainage 0+420.00,
- collision with OTL 10(2) SFOR (Zracna Luka) at chainage 0+700.00 to 1+020.00,
- collision with OTL 10(2) SFOR (Zracna Luka) at chainage 1+600.00,

[147] BH GAS Preliminary Consent for the construction of the Motorway Section on Corridor Vc Mostar South-Buna, No. 01-05-1456/19 issued on 16 April 2019
[148] Elektroprenos Preliminary Consent for the construction of the Motorway Section on Corridor Vc Mostar South-Buna, No. 08-5261/17 issued on 17 October 2017
[149] JP Elektroprivreda Hrvatske Zajednice Herceg Bosne d.d. Mostar Expert Opinion for the construction of the Motorway Section on Corridor Vc Mostar South-Buna, No028-10-2017/0111-1 issued on 3 May 2018

- collision with OTL 10(2) Hodbina at chainage 5+380.00, and
- collision with OTL 10(2) Hodbina at chainage 8+240.00.

The preliminary consent contains detailed instruction and mitigation measures to be implemented during consruction works in order to mitigate possible negative impacts and have continous supply of electricity in areas affected by aforementioned collisions.

Taking into account the aforementioned description of possible collision points it can be concluded that disruption to water and sanitation, electricity and telecommunication represent an adverse impact. The magnitude of this impact is assessed as minor since it may create some temporary disturbances to local communities. The sensitivity of the local communities to such disruptions is assessed as medium since they will affect parts of settlements near to the collision points. The significance of this impact is considered to be minor adverse and therefore not significant.

Economic displacement is not foreseen **during pre-construction and operational phases**. A summary of the estimation of these impacts is provided in Table 84 below.

Table 84: Summary of impact assessment on community from disruptions to water and sanitation, electricity and telecommunication

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Disruptions to water and sanitation, electricity and telecommunication						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Disruptions to water and sanitation, electricity and telecommunication	Adverse	Minor	Medium	Minor	Not significant
Operation	N/A	N/A	N/A	N/A	N/A	N/A

7.3.3 Land acquisition and physical displacement

The Project is expected to involve land acquisition and resettlement activities during **pre-construction phase**. The Project will require acquisition of land and structures (residential, commercial and auxiliary), with physical relocation of 4 households and 3 businesses. Land acquisition will be, as defined by national legislation, "complete expropriation"[150].

The total number of affected land plots in the 6 settlements is 375, according to the Expropriation Study. However, an additional 197 land plots are planned to be acquired based on Article 11 of the Law on Expropriation FBiH, which stipulates that landowners affected by a partial loss of their property are entitled to request complete expropriation and the corresponding compensation, in case partial expropriation would deteriorate the economic situation of the actual property owner or make the remaining part of the property useless or difficult to use.[151]

[150] According to the Law on Expropriation of FBiH, complete expropriation allows the expropriation beneficiary to obtain legal title over the expropriated property, while the rights of the previous owner over the real property cease to exist.
[151] It is possible that additional requests by PAP will be filed, and they will be decided on a case by case basis.

All of these 197 land plots are actually owned by PAP identified in the Expropriation Study – the already affected PAP requested additional expropriation of their remaining land plots, hence the great number of supplemental requests.

Of these 572 plots in total (375 + additional 197):

- 506 are private land plots and
- 66 are state-owned land plots.

The total number of households to be physically resettled is 4:

- 2 houses (both in Malo Polje) are located within the expropriation zone according to the Expropriation Study, and
- 2 houses (both in Kosor) will be affected as these households have requested to be resettled in line with Article 11 of the Law on Expropriation.

In addition, a total of 5 private businesses will be affected by land acquisition, of which 3 will need to be relocated.

A Land Acquisition and Livelihood Restoration Plan (LALRP) for the road section Mostar South-Tunnel Kvanj has been developed in March 2020. Detailed data on the affected land plots, households and businesses is provided in the LALRP.

Additional access roads are also planned to be designed. They are necessary for improving the local road network and to ensure access to land plots cut by the motorway crossing. This means that additional land acquisition is possible, but without additional resettlement or acquisition of houses and other buildings. These details will be known after the Main Design is prepared.

Land acquisition is considered as an adverse impact. As described above, physical displacement of 4 households and 3 businesses is expected due to the future land acquisition. The magnitude of these impacts from land acquisition is assessed as major since a big number (572 in total) of land plots will be permanently acquired, with the displacement of aforementioned households and businesses. The sensitivity of the local communities to the loss of land is assessed as medium since 18 affected land owners (12 heads of households and 6 household members) are considered vulnerable people. The significance of this impact is considered to be major adverse and therefore significant.

Land acquisition activities will be finalised before the beginning of construction activities, therefore the aforementioned impacts are not foreseen in **construction and operational phases**. A summary of the estimation of these impacts is provided in Table 85 below.

Table 85: Summary of impact assessment from land acquisition and physical displacement

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Land acquisition and physical displacement						
Pre-construction	Land acquisition Physical displacement	Adverse	Major	Medium	Major	Significant
Construction	N/A	N/A	N/A	N/A	N/A	N/A
Operation	N/A	N/A	N/A	N/A	N/A	N/A

7.3.4 Economic displacement

The Project is expected to economic displacement and loss of livelihoods of the land owners affected by the land acquisition during **pre-construction phase**. During the development of the LALRP a socio-economic survey was performed. During this survey both local businesses and land owners affected by land acquisition were interviewed.

A total of 5 private businesses will be affected by the land acquisition. Two big companies for the production of vines and other alcoholic beverages will be affected by the loss of land. These two companies did not want to be surveyed so no information on the main perceived losses for these two companies is available. However these two businesses will not be reallocated and according to census, one of them will lose 4 land plots, while the other will lose 16 land plots. Most of these land plots are covered by shrubs and grass. Only 4 land plots owned by the second company are vineyards.

The owners of the remaining 3 businesses were interviewed and all of them will need to be relocated. These 3 businesses are employing a total of 21 employees. 2 of them are located in Ortijes and 1 in Gnojnice Donje. All businesses are registered. 2 businesses actively use their own land plots for business purposes. Only one business uses state owned land plots which are under concession for stone exploitation. The director of this last business reported the possibility to close its business in case of impossibility to find a new stone pit.

In addition to economic displacement of businesses, 11 households who do not live on affected land plots declared that the sale of fruits represents their primary source of income, whereas 2 reported that such sale is their secondary sources of income. 2 households living on affected land plots stated that their own agricultural production represents the main source of income.

Economic displacement is considered as an adverse impact. Loss of place of business and loss of business income is expected for 3 companies, as well as loss of livelihood for aforementioned households, due to the land acquisition. The magnitude of these impacts is assessed as major. The sensitivity of the local communities to the loss of livelihood and economic displacement is assessed as medium since one of the affected land owners is considered vulnerable. In addition, project activities are also expected to impact agricultural activities within 106 land plots affected by land acquisition (91,348 m^2 used as agricultural land). The significance of these impacts is considered to be major adverse and therefore significant. However compensation entitlements for such losses are provided within the developed LALRP for Mostar South-Tunnel Kvanj.

During the **construction phase**, local traffic congestions may potentially impact, in terms of access restrictions, the active businesses on the territory of the project affected area. Temporary losses of business income during construction works (businesses which are not relocating) may occur in settlements of Kosor, Malo Polje and Blagaj where several villas and apartments for renting, as well as several camping sites are identified.

Temporary losses of business income during construction works is considered as an adverse impact. The magnitude is expected to be moderate as customers may experience restrictions in reaching villas and apartments for renting. The sensitivity is expected to be medium as for such businesses apartment renting represents the source of income, even if the losses of business income during construction works may be only temporary, and compensation will be provided for loss of income until the completion of construction works which directly impact the business operations of the business (mitigation measure defined by the LALRP). As such the impact is considered moderate and significant.

Economic displacement is not foreseen during **operational phase**. A summary of the estimation of these impacts is provided in Table 86 below.

Table 86: Summary of impact assessment from economic displacement

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Economic displacement						
Pre-construction	▪ Loss of place of business ▪ Loss of business income ▪ Loss of livelihoods of the land owners	Adverse	Major	Medium	Major	Significant
Construction	▪ Temporary losses of business income during construction works	Adverse	Moderate	Medium	Moderate	Significant
Operation	▪ N/A	N/A	N/A	N/A	N/A	N/A

7.3.5 Restrictions on land use and damage to private property

During the **construction phase**, it may be necessary to temporarily occupy privately owned land plots for the purpose of construction of access roads and placement of staff, machines and material. Construction activities may cause damage to land plots, natural or other assets (e.g. structures, trees) due to temporary disposal of excavation materials and heavy machinery parks. During construction activities and preparation of construction site, significant quantities of excess excavated material will arise and need to be disposed (1,939,734.55 m^3 from general construction excavation activities and 48,366 m^3 from excavation of Tunnel Mostar). It is possible that some of the excavated material will be temporarily disposed on privately owned land.

The anticipated restrictions on land use due to construction activities are considered an adverse impact. The magnitude is expected to be moderate as the local community may experience restrictions in use of parts of their land plots. The sensitivity is expected to be low as the occupation of private owned land plot may be only temporary, and compensation will be provided for loss of the possibility to continue to use land as intended as mitigation measure. As such the impact is considered minor and not significant.

Damage to private property is also considered an adverse impact. The magnitude is expected to be moderate as there may be a noticeable damage to private property caused by temporary disposal of excavation materials and heavy machinery parks. However, this is not expected to be a permanent change. The sensitivity is expected to be low as there are reasonable opportunities for mitigation through compensation entitlements provided within the developed LALRP for Mostar South-Tunnel Kvanj. As such the impact is considered minor and not significant.

Similar impacts are not foreseen during **pre-construction or operation phases**. These impacts are estimated in Table 87 below.

Table 87: Summary of impact assessment related to restrictions on land use and damage to private property

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Restrictions on land use and damage to private property						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	▪ Land use restrictions ▪ Damage to private properties	Adverse	Moderate	Low	Minor	Not significant
Operation	N/A	N/A	N/A	N/A	N/A	N/A

7.3.6 Access restrictions

During **construction phase**, possible impacts are access restrictions due to construction activities on which will be performed on local roads. Impacts in terms of access restrictions may vary in the different phases of the Project. Temporary access restrictions may occur in particular during the construction of following motorway components which will be constructed near on directly on local roads:

- construction of motorway section on the local road which connects the main road M17 with the Mostar Airport at chainage 0+950.00 to 1+050.00,
- overpass "Aerodrom" which is going over motorway Mostar Jug-Buna at chainage 1+050.00 and allows access to Mostar Airport,
- motorway section in Kosor at chainage 5+800.00 to 5+900.00 which is going to cut the local road in Kosor,
- underpass "Kosor" which going through road structure of motorway Mostar Jug-Buna at chainage 6+179.82 and allows communication between neighbouring settlements,
- bridge Buna (L=326m) crosses over the Buna Stream and the local road at chainage 6+500.00 to 6+550.00,
- bridge Bunica (L=211m) crosses over the Bunica stream and the local road at chainage 7+450.00,
- viaduct Brijeg (L=258m) which passes over a local road in Hodbina at chainage 8+300.00 to 8+435.00.

At the location where local roads will be cut by motorway, new connection roads will be constructed for providing local community access to their land plots as well as the access to Airport Mostar. In addition, JPAC will work on the reconstruction of local roads used by local community (incl. visitors to the airport) during their daily activities. This means that no risk of permanent access restriction is identified (for detailed information, please refer to Chapter 2.5 on associated facilities which will be constructed or reconstructed).

In addition, the population of settlements may experience access restrictions due to deliver of materials and machinery.

The anticipated access restrictions due to construction activities are considered an adverse impact. The magnitude is expected to be minor as the local community may experience access restrictions to some land plots they use. However, access restrictions are expected to be temporary. The sensitivity is expected to be medium as alternative route will be used, and where local road will be cut by motorway a new connection road will be constructed as mitigation measure. As such the impact is considered minor and not significant.

During the **pre-construction and operation phases**, the aforementioned impacts are not foreseen. The summary of the impact evaluation is given in Table 88 below.

Table 88: Summary of impact assessment from access restrictions

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Access restrictions						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Access restrictions	Adverse	Minor	Medium	Minor	Not significant
Operation	N/A	N/A	N/A	N/A	N/A	N/A

7.3.7 Road damage and impacts on local traffic

The Project is expected to have impacts on roads and traffic, with varying scopes in the different phases of construction works. During the **construction phase**, there will be an increase in traffic on the existing local road network because of vehicle movements to transport building materials and dispose of excavated spoil material. The local roads are asphalted or macadam roads which are susceptible to damages, especially under heavy weights.

The anticipated damage to local roads is an adverse impact. The magnitude is expected to be moderate as there may be a noticeable damage to the local roads caused by heavier traffic than is currently experienced. However, this is not expected to be a permanent change. The sensitivity is expected to be low as there are reasonable opportunities for mitigation through road repair which will be performed by JPAC (via Contractors for construction). As such the impact is considered minor and not significant.

The construction of the interchange Mostar South, of the overpass “Aerodrom” with the connection road to Airport Mostar the traffic on main roads M6.1 and M17 will be increased (including heavy machinery and trucks) and operated with speed restrictions. In addition, traffic congestion is expected on local roads in the area of Project footprint and traffic limitations causing traffic delays and restricted access on these road sections are foreseen. This is mainly linked to the delivery of construction material to site and collection of resulting waste from construction work in construction phases.

The anticipated increase in traffic flows and traffic congestion is an adverse impact. The magnitude is expected to be moderate as there will be a noticeable increase in traffic, which has the potential to cause traffic congestion, however this will not be a permanent change. The sensitivity is expected to be low as there are few receptors in the project area and there are reasonable opportunities for mitigation. As such the impact is considered minor and not significant.

During **operational phase** only impact related to traffic congestion is identified. It may be caused by some maintenance/reconstruction activity so with lower magnitude compared to the construction phase. It is also expected to be temporary impact. The traffic congestion can happen also on the motorway section and involve a lot of users passing on that corridor section during maintenance/reconstruction activities. For this reason zje sensitivity is assessed as medium. As such the impact is considered minor and not significant.

During the **pre-construction phase**, the aforementioned impacts are not foreseen. A summary of the estimation of impacts is shown in Table 89 below.

Table 89: Summary of impact assessment from local road damage and impacts on local traffic

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Road damage and impacts on local traffic						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	▪ Local road damage ▪ Traffic congestions	Adverse	Moderate	Low	Minor	Not significant
Operation	Traffic congestions	N/A	Minor	Medium	Minor	Not significant

7.3.8 Health and safety risks for workers

Site preparation, construction and operation activities and the use of temporary workers' accommodation (camps) pose potential risks to the health, safety, security and, therefore, wellbeing of construction workers if not managed appropriately.

During construction and operation phases, occupational health and safety (OHS) risks can be expected. The impacts can be:

Direct (possibilities of injuries caused by activities performed during construction phase or by accidents that may occur both during construction and operation phase (these accidents can have a wider extension, involve local community and cause possible dangers and disease));
Indirect (emissions, soil and water contamination, etc.).

During the **construction phase** workers will be exposed to many risks that are directly related to activities performed on construction site. Potential impacts are identified as follows:

- *Falling from heights:* The risks related to work at heights are associated to falling of workers and falling of objects onto those working below. Falls from heights are the main causes of fatal accidents in the construction industries and the consequences are generally more severe the greater the falling height. Falls can occur from unguarded edges or openings at height, through fragile materials, into excavations, from ladders, from places of work on an existing facility.
- *Traffic accident:* Risks related to working near or on roads with live traffic depend on the type of work that will be performed. They may include collisions between vehicles operating inside the site, collisions of passing vehicles with site machinery, equipment and workers (in case the site is not adequately signed and physically protected).
- *Power stroke:* Working near high voltage power lines can cause serious and fatal injuries due to direct contact with live lines or arcing from those lines to nearby equipment. The major risks related to electricity are electrocutions and burns and they can be caused by the use of poorly maintained electrical equipment, work near overhead power lines, contact with underground power cables during excavation work or horizontal boring or drilling.
- *Injuries from construction machinery:* These risks depend on the type of equipment used during construction and the construction activities. Risks like roll-over of the equipment and objects falling onto the equipment are related to earthmoving equipment (e.g. loaders shovel excavators,), while risks which imply workers falling from height, collapse of the equipment in use due to overloading, and failures due to poor slinging techniques are related to lifting equipment (e.g. mobile cranes).
- *Accidents:* Accidents can be related to injuries from explosion and fires. Explosion risks usually occur from the use of solvents and ignition by sparks, damage of pipes containing explosive gases and

unexploded ordinance in the ground. Fire risks can be caused by the use of flammable liquids, welding or abrasive cutting techniques used in places not specially prepared for such works, liquid gases used with an open flame, flammable and combustible materials.

- *Manual handling:* Negative impacts to workers can also derive from risks related to manual handling which involves lifting and moving loads by hand or other bodily force.
- *Excavations and working in confined spaces:* Negative impacts to workers can also derive form risks related to excavations (collapse of sides, people, objects or materials falling in, etc.) and working in confined spaces (risk of injury associated with working in pits, trenches and drainage channels).

Other impacts that can affect workers are indirect and they are related to risks caused by air pollution (dust), noise emissions and vibration, and soil and water contaminations, as described below:

- *Dust emissions* are generated by the site construction activities and operations that involve excavations, movement of vehicles and cut and fill activities, and can have impact on air quality in the vicinity of the construction site. During site clearing and land preparation activities, dust can cause dangers to workers and cause diseases like pneumoconiosis, asthma, chronic bronchitis and/or emphysema. In addition to dust emissions other emissions into air are likely to occur as a result of the combustion of fossil fuels and exhaust gases from the mechanization.
- *Noise emissions and vibration* can cause nuisance to workers. Workers on construction sites can be exposed to loud sources of noise which can permanently damage a person's hearing. The main sources of vibration from powered hand-held tools are demolition hammers, drills, hammer drills, angle grinders. Vibration from work with powered hand-held tools, equipment or processes can damage the hands and arms of users.
- *Soil and water contaminations* are impacts that can have consequences both on workers. Water and soil pollution on construction sites and during maintenance of motorway section can be caused by inadequate handling of hazardous substances (i.e. diesel and oil, and other harmful chemicals), inadequate waste handling), equipment damage which may lead to leakage of lubricants and fuel (increased input of oils into water and soil). These risks can have harmful consequences to worker due to exposure to hazardous materials which can casue possible intoxication. Other disturbances can be caused by noxious odors from polluted sites.

The aforementioned possible health and safety risks for workers are considered as adverse impact. The magnitude is expected to be major during the construction phase as construction workers are directly exposed to such risks which can cause permanent negative consequences to workers health. The sensitivity is expected to be low as in this case negative impacts have direct effects on construction workers. Negative OHS impacts can be mitigated by implementing mitigation measures aimed at providing a safe working environment for construction workers. As such the impact is considered moderate and significant.

During the **operational phase** some of the above described impacts can occur. During this phase there will also be the risk of falling from heights (for example during maintenance works on the Buna and Bunica bridges, or on the viaduct Brijeg) and other risks such as injuries from construction machinery. In addition indirect impacts will also persist during the operation. Dust emissions are possible in case of maintenance works but their negative impact on workers will be reduced to minimum by implementing the adequate protective measures. Exhaust gases and noise emissions during operation phase, will be caused by cars on the motorway section. During maintenance works, these emissions can cause some disturbances to maintenance workers. However, these disturbances are foreseen to be lower than during construction phase.

The anticipated health and safety risks during the operation phase are considered an adverse impact. The magnitude is expected to be moderate as the negative impacts on maintenance worker health and safety will

be caused during short periods (only maintenance works) and the accidents will have less possibility to occur than during construction phase. Maintenance and possible reconstruction activities will involve less machinery than during construction phase, thus means less possibility of injury. The sensitivity is expected to be low as in this case negative impacts have direct effects on maintenance workers and can be mitigated by implementing adequate OHS measures. As such the impact is considered minor and not significant.

During **pre-construction phase** there are no risks related to OHS. Table 90 below shows a summary of the impact evaluation.

Table 90: Summary of impact assessment from healt and safety risks for workers

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Health and safety risks for workers						
Pre-construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Health and safety risks for workers	Adverse	Major	Low	Moderate	Significant
Operation	Health and safety risks for workers	Adverse	Moderate	Low	Minor	Not significant

7.3.9 Danger from UXO

The motorway section passes through the area where the war took place in period 1992-1995, and according to data provided by Bosnia and Herzegovina Mine Action Center (BHMAC), Kajgin Kicin in Hodbina is one of UXOs suspicious area that need to be inspected and demined. This problem is considered as a temporary restriction to space and can be solved through demining activities. This potential mine-field is located on private property and it is necessary first or to acquire the affected land plots through the land acquisition process, or to obtain consent from the land owner for demining activities.

In addition, according to BHMAC information demining is in progress on land plots located at the end of the motorway section at chainage 8+950.00 to 9+125.00, while land plots located at chainage 8+650.00 to 8+950.00 have already been demined. Figure 94 shows the area in Kajgin Kicin affected by potential presence of UXOs coloured in red, the area with demining in process coloured in yellow and the area already demined coloured in green.

According to the information provided by BHMAC no other land plots along the motorway section are UXOs suspicious areas. Although the remaining area along the motorway section is proclaimed safe, a special attention is needed during the earth moving works and blasting works, and in case of any doubt BHMAC will be contacted for further instructions. Thus the danger from mines and UXOs represent a potential impact both during **pre-construction and construction phases**.

Danger form mines is an adverse impact. The magnitude is expected to be major as the negative impact from the explosion of UXOs could have permanent consequences on workers or deminers health (causing fatal outcomes). The sensitivity is expected to be low as there are few receptors in the project area (workers

contracted for construction works or deminers[152] contracted for demining) and there are reasonable opportunities for mitigation. As such the impact is considered moderate and significant.

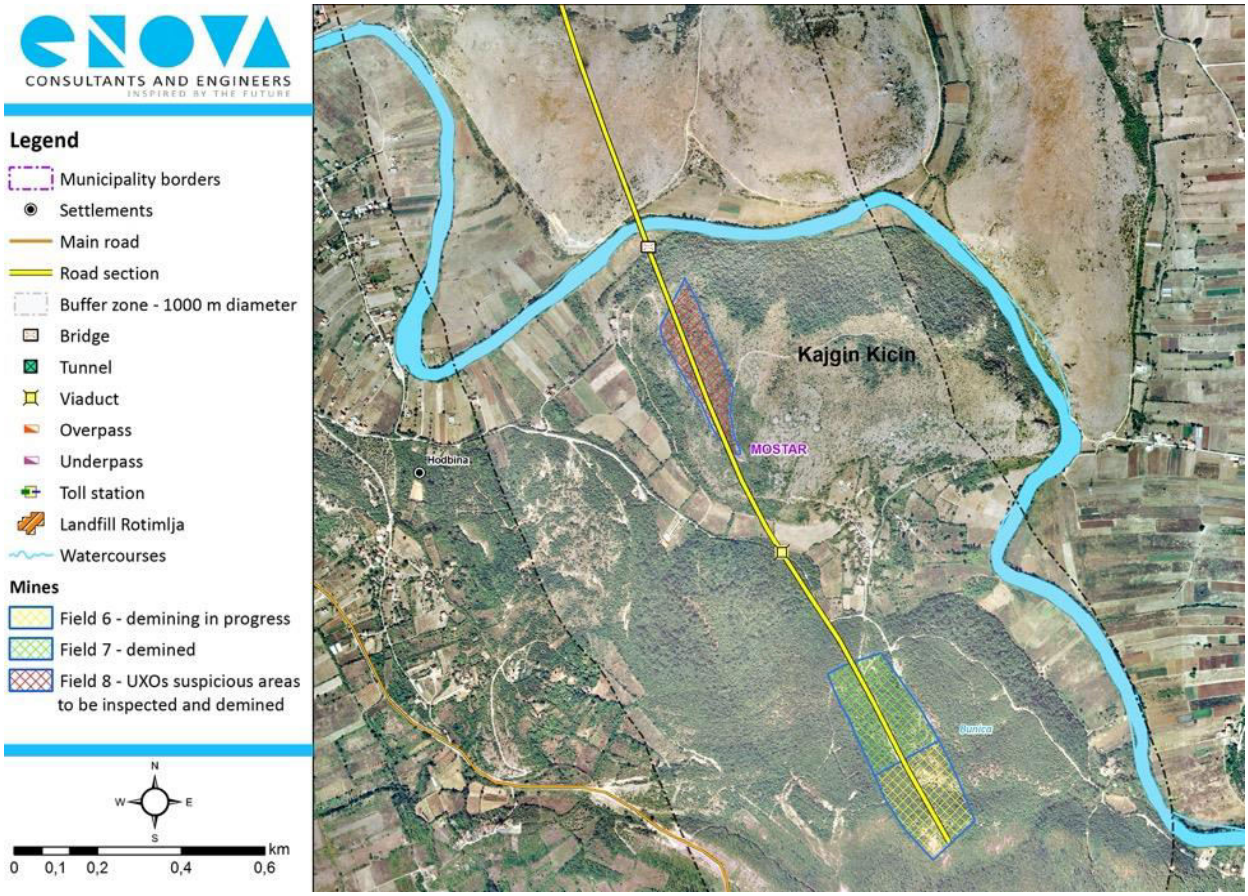


Figure 94: UXOs suspicious areas to be inspected and demined in Kajgin Kicin in Hodbina

This impact is not foreseen during **operation phase**. Table 91 below shows a summary of the impact evaluation.

Table 91: Summary of impact assessment related to danger from mines

Phase	*Type of impact*	*Adverse/Beneficial*	*Magnitude*	*Sensitivity*	*Impact evaluation*	*Significance (before mitigation)*
Danger from mines						
Pre-construction	Danger from mines	Adverse	Major	Low	Moderate	Significant
Construction	Danger from mines	Adverse	Major	Low	Moderate	Significant
Operation	N/A	N/A	N/A	N/A	N/A	N/A

[152] In 2019, there were 2 demining accidents in BiH, in which 2 deminers were killed while 4 deminers were injured. Source: http://www.bhmac.org/?page_id=747&lang=en [accessed on June 30, 2020]

7.4 Assessment of cumulative impacts

The methodology for cumulative impact assessment follows the six-steps approach to a Rapid Cumulative Impact Assessment (RCIA)[153]. The main focus of RCIA is to identify Valued Environmental and Social Components (VECs), determine their baseline conditions, identify relevant development and natural processes within the cumulative impact zone, assess the cumulative impacts and proposed measures. It should be noted that the assessment of cumulative impacts is based on review of limited number of existing studies and plans. The assessment of cumulative effects is not intended to provide a detailed assessment of the effects of future developments. In many instances the layout, design and location of developments are not finalized. As such, assessment has been undertaken at a high level in the context of broad development parameters sufficient to provide an understanding of the likely E&S effects of future developments and to enable adequate consideration of cumulative effects.

Data for the analysis are collected from available spatial plans and other relevant documents and information, with the aim of identifying existing and planned infrastructure project in the area. Information gathered during field visits were also used. The analysis of documents did not reveal existence of any future infrastructure projects in the area, however the available information was limited. Table 92 gives an overview of existing infrastructure project, of which some have potential for expansion in the future, and possible impacts that can be expected from their operation/existence.

Table 92: Existing and planned infrastructure projects and possible impacts

Existing and planned infrastructure / projects in the project area	*Possible impacts from existing and planned infrastructure / projects during operation phase*
Adjacent sections of motorway on the Corridor Vc to be constructed	Noise emission, air emission, surface run-off discharge, waste generation
Reconstruction of local roads as a part of community projects related to construction of motorway	Noise emission, air emission, surface run-off discharge, waste generation
Main road M17	Noise emission, air emission, surface run-off discharge, waste generation
Main road M6.1 to Nevesinje	Noise emission, air emission, surface run-off discharge, waste generation
Mostar Airport	Noise emission, air emissions (incl. GHG gases), water use, wastewater and waste generation
Existing railway	Noise
Settlements Gnojnice Donje, Dracevice, Jasenica, Ortijes, Bacevici, Laksevine, Blagaj, Kosor, Malo Polje, Hodbina, Laksevine, Gubavica	Water use, water pollution, waste generation

Table 93 presents a summary of the identified VECs which have the potential to be under the impact of the motorway sub-section development. VECs refer to sensitive or valued receptors of cumulative impacts.

[153] IFC's Good Practice Handbook: Cumulative Impact Assessment and Management, 2013

Table 93: Identified Valued Environmental and Social Components

Physical	*Biological*	*Social*
Air quality	Aquatic ecology	Community health and safety
Waste generation		Transportation and access (local roads)
Noise		Amenity (landscape and visual)
Water quality		

During the construction phase of the motorway it can be expected that the construction of this sub-section will occur at the same time as the construction of the Tunnel Kvanj. At this moment, it is not known when and for how long these two projects will overlap in time. The environmental and social effects that motorway construction will have on the environment can be observed in conjunction with potential impacts from the construction of Tunnel Kvanj and observable impacts of the existing facilities listed in Table 92. Table 94 below provides a summary of identified impacts during the construction phase.

Table 94: Summary of cumulative impacts resulting from construction activities and their assessment

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance / Impact evaluation*
Air Quality	Construction nuisance related to short term localised noise and dust	Cumulative effects on air quality from motorway construction are observed in conjunction with the air emissions from construction of Tunnel Kvanj and existing roads and air traffic around the project area. Dominant types of emission from the construction activities is dust. Dominant types of emission from the existing traffic and airport ground operations are exhaust gases. Therefore, the cumulative effects can mainly be observed from emissions dust, carbon dioxide, nitrogen dioxide, and $PM_{2.5}$. GHG assessment also showed the increase of GHG emissions during construction. The construction works are time limited and impacts temporary. The major impact is related to dust emissions. Tunnel construction by its nature produce dust that is ventilated from the tunnel pipe and discharged in environment at the tunnel exit. It is not expected that dispersion of dust will reach closest houses in Malo Polje and	Moderate	Low	Minor / Not significant

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance / Impact evaluation*
		Kosor that are under the impact of road construction. Related to emission from traffic, the current air quality in Mostar is satisfactory, the fluctuations in the parameters are present during winter. Strong winds coming from Adriatic Sea along the Neretva valley help in dispersing pollutants and preserving air quality. Having all this in mind, this impact is evaluated as not significant.			
Waste generation	Waste collection and disposal	During construction activities significant quantities of excess excavated material will arise and need to be disposed. This is considered to be a cumulative impact in case the construction of adjacent motorway section Tunnel Kvanj-Buna starts at the same time with the construction of this project. The landfill Rotimlja that will receive excess soil from the construction is designed for both these sections, therefore no cumulative impacts are expected here. The excess soil from reconstruction of local roads (community projects) is expected to be low in quantity and can also be disposed to Rotimlja landfill. The cumulative impact can be also expected from generation of municipal waste and other special categories of waste that are managed by licensed operators and are disposed either on regional landfill in Mostar (municipal waste) or are disposed in appropriate manner (special waste categories).	Negligible	Negligible	Negligible/ Not significant
Noise	Increase in noise level	During construction phase, noise emission will increase, however this will be temporary and limited to daytime periods since construction activities will be implemented during the daytime. Noise will be emitted from construction vehicles and machinery as well as from excavations and blasting (blasting is not anticipated and will be used as the last choice). During construction works, noise generation due to tunnelling activities	Moderate	Medium	Moderate/Significant

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance / Impact evaluation*
		and other activities associated with construction may result in disturbance of nearest settlements. Considering the noise generated by Airport Mostar, and existing noise caused by movement of vehicles on the main road M17and main road M6.1 to Nevesinje, and occasional noise from the railway, it can be expected that ambient noise levels will be increased compared to the present state. Having in mind that construction of sections is done in settlements and near the houses, appropriate mitigation measures are needed to reduce the noise.			
Water quality and aquatic ecology	Impact on water quality of Buna and Bunica and other ground sources in the area	Impacts on water quality and aquatic ecology as result of construction works are possible in case of major accidents, such as leakage of oil mechanization at the construction site, as well as uncontrolled discharge of wastewaters from the camp and direct construction works in the riverbed. Cumulative effects on water quality from motorway construction are observed in conjunction with municipal wastewater discharge from surrounding settlements/ individual houses, as well as run-off discharge from M17 and M6.1. Discharges or leakages from the construction site are not expected to be large in quantities, they are reversible and unlikely to occur. And while impacts on aquatic ecology are limited to the place of construction works in vicinity of Buna an Bunica, it should be also noted that the construction is taking place in karst area and that impacts on water quality are not restricted to project area. It is not possible to prescribe measures for already existing impacts from local roads and settlements. Therefore, this study will propose appropriate mitigation measures to reduce likelihood of occurrence and minimize impact on	Moderate	Medium	Moderate/Significant

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance / Impact evaluation*
		aquatic ecology and water quality from construction activities and thus, reduce cumulative impacts.			
Transportation and access	Limited road access during the construction works	As a part of this project, local road infrastructure will be reconstructed to enable better access to local residents. The cumulative effects of these works will limit but not fully restrict the movement in the project area. Cumulative impacts would largely depend on whether any (re)construction activities would overlap. A coordinated approach to planning of transportation and access to take account of multiple construction projects should be undertaken. The phased construction approach will be proposed to mitigate the impact upon transportation and access.	Moderate	Low	Negligible/ Not Significant
Community health and safety	Impact on local residents and road users (incl. visitors to the airport)	Should there be overlap in construction programmes related to the motorway and the local roads reconstruction then increased traffic could potentially occur along some access roads, should the same ones be used, which could increase the risk to local communities and traffic and transport incidents. Stretches of road for which cumulative impacts on community health and safety could occur include nearby residential properties and houses in Malo Polje and Kosor, as well as traffic to and from the airport and military zone. The activities should be coordinated, and appropriate traffic management plans and H&S plans produced and aligned to manage possible cumulative impacts to community health and safety which could occur during construction.	Moderate	Low	Negligible/ Not Significant

During the operation phase of the motorway, the impacts generated are very similar to impacts from other existing infrastructure projects in the project area and are likely to produce cumulative effects. Table 95 below provides a summary of cumulative impacts in the operation phase.

Table 95: Summary of cumulative impacts resulting from operation activities and their assessment

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance/ Impact evaluation*
Air Quality	Exhaust gasses from vehicles will adversely impact the air quality	Cumulative effects on air quality from motorway operation are observed in conjunction with the air emissions from existing roads and air traffic. The identified cumulative effects originate from exhaust emissions from local and motorway traffic including carbon dioxide, nitrogen dioxide, and $PM_{2.5}$. GHG assessment also showed significant increase of GHG emissions during operation of the motorway. The operation phase (vehicle movement) contributes about 80% of the emitted gases in the project scenario. Here is to be noted that traffic intensity on M17 will be reduced and transit vehicles will be using the motorway. Nevertheless, according to the Traffic study, the traffic on M17 and M6.1 will be increased every year by 2%. On the other hand, the current air quality in Mostar is satisfactory, the fluctuations in the parameters are present during winter. Strong winds coming from Adriatic Sea along the Neretva valley help in dispersing pollutants and preserving air quality. It is difficult to assess the impact on climate change as a result of GHG emissions because the baseline state is available only for BiH. Since the climate impacts are assessed to be moderate in magnitude and medium in sensitivity, the overall cumulative impact from air emissions is assessed as significant.	Moderate	Medium	Moderate / Significant
Waste generation	Waste collection and disposal	During the operation phase, small amounts of municipal and special categories waste will be generated at the location of tool station and general maintenance activities. The cumulative impact can be expected in conjunction with other infrastructure and settlements in the project area whose users are also generating municipal waste and other special categories of waste. Since the amount of waste is not considered to be excessive this impact is also considered to be insignificant.	Negligible	Negligible	Negligible/ Not significant
Noise	GHG emissions	Noise level will be increased compared to the present state due to the general increase of the number of vehicles and	Moderate	Medium	Moderate/Significant

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance/ Impact evaluation*
		together with existing noise from the main road M17and main road M6.1 to Nevesinje. From Interchange Mostar South, the northern section is passing close to the industrial area including the Mostar Airport which produces significant noise level. Existing noise from the main roads and Mostar Airport together with increased number of vehicles on planned motorway will pose adverse effects to local population of closest settlements. Partially this impact may be mitigated with noise barriers.			
Biodiversity	Disturbance of species and potential collision	Cumulative impacts on biodiversity are possible due to existing disturbance of species and edge effect caused by existing infrastructure such as roads, air traffic and railway. Specific mitigation measures are planned to protect biodiversity and proposed in BMP. It is expected that likelihood of occurrence of these impacts is low and limited to the project area. It is expected that species under impact have some capacity to absorb impacts. Therefore, when assessed in cumulative context, this impact is determined to be not significant.	Minor	Low	Negligible/ Not significant
Water quality and aquatic ecology	Surface runoff and communal discharge	During the operation phase of the motorway both municipal communal wastewater at the location of the toll station and surface run-off will be generated. These two impacts can be observed in conjunction from pollution caused by surface-runoff discharge from M17 and M6.1 as well as communal wastewater discharge from individual houses directly in Buna and Bunica. However, all wastewater generated as a result of motorway construction will be properly collected and treated, therefore, it is considered that no cumulative impacts will occur.			No impact
Amenity	Visual impacts	Constructed motorway will permanently alter the landscape. Visual cumulative impacts are possible since the location is already intersected with existing infrastructure such as roads, Mostar Airport and railway. A motorway is a linear	Major	Negligible	Minor/ Not significant

VEC	*Impact*	*Description of cumulative impacts*	*Assessment of cumulative impact*		
			Magnitude	*Sensitivity*	*Significance/ Impact evaluation*
		infrastructure project which does not accompanying visual effects (e.g. shadows, tall objects, smoke from the chimneys, etc.). The changes that will occur are detectable to the specific conditions on the site that will result in permanent change. However, it is very difficult to assess the sensitivity to the impact because it is mostly based on the subjective feeling of the observer. In assessment of this impact prevail the significance of this project for citizens of BiH. There are no applicable mitigation measures.			

Concerning the **mitigation measures**, a flexible approach to managing cumulative impacts is proposed, due to uncertainties associated with lack of spatial documentation and information about future projects in this area. Good inter-project communication between developers and contractors will be a key to manage cumulative impacts which result from construction impacts. The key construction phase mitigation measures identified in the assessment are:

- assurances that all construction vehicles' engines operate to national standards and are fully maintained (this implies that machines and vehicles to be used in construction activities must have use/operation permits and installed filters to reduce emission) and good construction practices, such as: water spraying on roads and excavated material stockpiles, covering vehicles carrying raw materials, speed limits in areas of the construction site which have unmade road surfaces to limit dust, the equipment and machinery need to be shut down when not in use, etc.
- implementation of best practice visual mitigation measures during construction, particularly near sensitive receptors where cumulative impacts could occur from overlapping construction activities
- coordinated traffic management plans and community health and safety plans to take account of local populations schedules, project construction and operational schedules

In terms of operational measures, the following have been identified:

- increased noise level may be mitigated with noise barriers; all the necessary noise panels and noise barriers will be installed in accordance with Main Design for Noise Management to ensure that noise levels at the closest receptors do not exceed national limits.

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

Mitigation is the stage of the ESIA process when measures are identified to avoid, minimise or remedy impacts. These measures are implemented as part of the process of impact management, together with any necessary adjustments to respond to unforeseen impacts. Both elements are integral to ensuring that the EIA process leads to practical action to offset the adverse environmental impacts of proposed developments. **Only the impacts assessed to be significant in the previous chapter will be treated with this management and monitoring plan.**

Where feasible the following hierarchy of mitigation measures will be applied:

- Avoidance and reduce impacts through design (embedded mitigation),
- Moderate impacts at source or at receptor,
- Repair, restore or reinstate to address temporary construction effects,
- Compensation for loss or damage.

In addition to the above, community engagement and disclosure activities will play a key role in managing the extent of impacts.

Consideration has also been given to the identification of enhancement measures. Enhancement measures are actions and processes that:

- Create new positive impacts or benefits,
- Increase the reach or amount of positive impacts or benefits,
- Distribute positive impacts or benefits more equitably.

Each specialist section identifies relevant mitigation and enhancement measures. All the mitigation, management and monitoring measures to address likely project impacts are reported in the ESMMP.

8.1 Habitats, flora and fauna[154]

The detailed overview of the mitigation and monitoring measures for biodiversity protection and restoration are elaborated in Biodiversity Management Plan (BMP) separately for preconstruction, construction and operational phase. This document is submitted as technical annex of this ESIA report, including roles and responsibilities as well as the time schedule for proper implementation of proposed measures.

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
Habitats						
8.1.1	Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements Lack of information on baseline for diagnostic species *Scorzonera villosa* on dry grasslands and chasmophytic vegetation	▪ Undertake detailed surveys of the diagnostic species *Scorzonera villosa* on dry grasslands in the project area and the calcareous rocky slopes with chasmophytic vegetation in Hodbina Hill ▪ Include in the Main Design the requirement for revitalization of habitats after the construction is finalised with planting autochthonous plant species characteristic for the area (e.g. Oak trees on slopes) and prevent growing and spread of invasive species. ▪ Prepare the manual for construction workers and other personnel on important species and habitats and their identification, as well and guidelines for their preservation and actions if encountered during their work.	JPAC or JPAC to transfer the responsibility to the contractor per Contractual Agreement	Mapping of habitats and species done before the commencement of the construction activities to include all findings from the additional vegetation survey into project planning phase	Baseline reports on habitats updated prior to construction Main Design includes the requirement for revitalization of habitats after the construction with planting autochthonous plant species Manual on possible sensitive habitats in place, prior to construction commencement
8.1.2	Construction	▪ Habitat loss due to preparation of	▪ During the vegetation clearance and earthworks, the disposal of the material is to	Contractor	The monitoring of cleared vegetation areas is to be	No additional habitat disturbed, outside

[154] Detailed list of mitigation measures is given in BMP (July, 2020)

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
		construction site and during the performance of construction works, fragmentation of habitats	be well managed, in order to prevent the degradation of natural vegetation and invasion of non-native species into the natural habitats. ▪ Motorway route only needs to be used for construction activities and organisation of construction site. Should any need for additional areas to be used occur, e.g. access roads to the motorway route, natural areas such as woodland, meadows and grassland need to be avoided and only already modified areas may be used (e.g. existing roads or degraded non-natural habitats).		regularly performed during the construction phase. Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer	the project area
8.1.3		▪ Potential additional disturbance of habitats	▪ Motorway route only needs to be used for construction activities and organisation of construction site. Should any need for additional areas to be used occur, e.g. access roads to the motorway route, natural areas such as woodland, meadows and grassland need to be avoided and only already modified areas may be used (e.g. existing roads or degraded non-natural habitats). ▪ Implement pollution prevention measures at construction site, e.g. spill containment bunds to prevent any leakage from the oil tanks.	Contractor	Monitoring of vegetation at undisturbed woodland areas of Hodbina. Monitoring of implementation of pollution and control measures. Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and	No or low additional woodland disturbed, outside the project area

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
					effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	
8.1.4	Operation	▪ Chemical pollution of nearby habitats caused by motorway traffic which can result in increasing concentrations of heavy metals in habitats and food chains	▪ Avoid the use of herbicides and hazardous substances and materials, as to protect the environment from their potentially harmful impacts ▪ Undertake regular maintenance and cleaning of the drainage structures and oil separators	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities.	The monitoring of status of invasive alien species is to be continued and regularly performed during the operational phase. Monitoring of adherence to measures	Decrease in the number of invasive species of the project area where invasive species are found No chemical pollution events noted. Reports on regular cleaning of the pollution control equipment. Monitoring of effluent quality from the oil separators
Vegetation and flora						
8.1.5	Pre-construction	Adverse impacts due to inadequate planning of works	▪ Prepare **Invasive Species Management Plan** with measures regarding how to control the	JPAC or JPAC to transfer the	Quality of the Invasive Species Management Plan	Invasive species Management Plan

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
		and Main Design requirements Lack of up-to-date information on baseline for endemic flora	spreading of invasive species (focus on the following invasive species: *Ailanthus altissima* (Tree of heaven), *Robinia pseudoacacia* (Black locust), *Broussonetia papyrifera* (Paper mulberry), *Ambrosia artemisiifolia* (Common ragweed), *Conyza canadensis* (Canadian horseweed), *Erigeron annuus* (Annual fleabane) and *Sorghum halepense* (Johnson grass) ▪ Undertake additional field surveys preferably during the spring period with the aim of finding Balkan subendemic species as given in Updated ESIA document and BMP (July 2020). The survey needs to be performed from early spring to mid-summer, in order to record presence of early-flowering geophytes.	responsibility to the contractor per Contractual Agreement	Monitoring of potential endemic flora in line with the list of species as given in ESIA document.	prepared prior to construction commencing Compliance with timing and undertaking of measures Additional field surveys completed with the aim of confirming/excluding some species prior to construction commencing
8.1.6	Construction	▪ Vegetation removal and clearance of flora species in the phase of preparation of construction site and during the performance of construction works ▪ Destruction of vegetation and deforestation will lead to water runoff and soil erosion.	▪ Clearly mark areas for vegetation clearance, with biodegradable paint or high visibility, undertake temporary fencing to prevent unnecessary loss of vegetation in the Project area. ▪ Recultivate the Construction Waste Landfill Rotimlja by using autochthonous plant species in order to preserve the domestic gene pool. ▪ The excess construction waste must be re-used to level the road route and the remaining material shall be disposed at designated Landfill Rotimlja in Municipality of Stolac, in order to prevent degradation of other natural vegetation and no temporary landfills are to be formed elsewhere, as these act as focal points	Contractor	During the construction phase, the monitoring of the status of invasive species into natural habitats (at Hodbina Hill) should be undertaken. Inspection by ecologist during construction. Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the	Zero invasive species present at Hobdina hill No increase in invasive species coverage compared to the level detected in Baseline of the Updated ESIA report Forestation of slopes of Hodbina Hill as anti-erosion works, compensated for the

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			for dispersion of invasive species. ▪ Undertake forestation as part of the anti - erosion works to preserve slope stability and reduce erosion ▪ Open cuts need to be re-vegetated as soon as possible which is also desirable to prevent soil erosion. ▪ Install proper drainage infrastructure to prevent erosion. ▪ Prevent possibility of fire occurrence to preserve vegetation. Mechanisms to prevent fire will be detailed within the Construction Site Organization Plan, (OHS and Fire and Explosion Management Plan and Emergency Preparedness and Response Plan). ▪ Implement pollution prevention control measures at construction site, e.g. spill containment bunds to prevent any leakage from the oil tanks ▪ Continuously implement the mitigation measured as given in Invasive Species Management Plan.		implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	mixed thermophilous woodland that will be directly affected (1.45 ha) by the construction of the motorway In addition to the reforestation of the woodland areas, revegetation of the Construction Landfill Rotimlja must be undertaken (18.15 ha) with plant species Afforested same or larger area than the degraded one in the Project area Success of revegetation (to have at least 50% vegetation coverage within 3 months of cessation of works. If this is not achieved remedial actions are required to achieve

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
						this goal.) Pollution prevention control plan implemented
8.1.7		▪ Dusting of nearby flora species due to performance of construction works	▪ Prevent unnecessary movement of vehicles outside of area designated for implementation of construction activities to preserve surrounding vegetation from dusting. This measure to be set out within the Construction Site Organization Plan. ▪ Spraying and wetting of the temporary traffic lanes to prevent generation of dust and sedimentation of dust on nearby vegetation. This measure to be set out within the Construction Site Organization Plan.	Contractor	Inspection by ecologist during construction. Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	Sediment dust not evident on plants 30 m away from the motorway route
8.1.8	Operation	▪ Chemical pollution in soil could have negative impact on vegetation and flora species	▪ Avoid the use of herbicides and hazardous substances and materials, as to protect the environment from their potentially harmful impacts ▪ Undertake regular maintenance and cleaning of the drainage structures and oil separators	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities	Monitoring of adherence to measures	Decrease in the number of invasive species of the project area where invasive species are found No chemical

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
						pollution events noted Reports on regular cleaning of the pollution control equipment Monitoring of effluent quality from the oil separators
Fauna						
8.1.9	Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements Lack of up-to-date information on baseline for migratory birds, bats, invertebrates	▪ Conduct pre-construction surveys for a range of fauna, as follows: - 1-year monitoring of bats using echolocation recording and identification, mist-net research, speleological objects research, roost sites examination and winter hibernation sites, - monitoring of the presence of *Vipera amodytes, Platyceps najadum, Dalmatolacerta oxycephala* and *Algyroides nigropunctatu*s species along the motorway route should be expected, - monitoring of birds from March to April to cover early spring bird migrations with regard to Falconiformes species, Charadriformes and Anseriformes species, as well as to sensitive species Short-toed Lark (*Calandrella brachydactyla*) and Calandra lark (*Melanocorypha calandra*),	JPAC or JPAC to transfer the responsibility to the contractor per Contractual Agreement	Monitoring to be done before the beginning of the construction to include all findings from the additional fauna surveys into project planning	Baseline reports on fauna updated prior to construction Main Design includes the requirement for two open channels for fauna (at areas of Malo Polje and Hodbina) Protection strategy for the protection of underground habitats in place prior to construction commencement Manual on possible

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			- at least once prior to construction phase (preferably in May, until July) undertake additional monitoring of invertebrates in order to determine populations of identified species of conservation (focus on the southern section of the project area (Buna and Bunica Streams, woodlands between streams and south of Buna to Kvanj). ▪ Include in BMP and undertake additional mitigation measures if required in accordance with the survey results. ▪ Should additional bat surveys determine important roosting sites, BMP must be updated to include adequate mitigation measures to avoid any destruction of roosts, and the changes need to be included in the Main Design to avoid of roosts, winter hibernation sites or migration corridors (e.g. micro-alignments of the motorway) ▪ Plan at least two open channels for fauna (at areas of Malo Polje and Hodbina) as part of the changes to be implemented to the Main Design ▪ Prepare a protection strategy for the protection of underground habitats which should be applied if they are found during excavations at Kajgin Kicin and Hadzajlica Kicin ▪ Plan construction works during the non-breeding period of birds i.e. from beginning of April to the end of June, to avoid impacts on nesting birds ▪ Undertake changes to the Preliminary Design			sensitive fauna species in place, prior to construction commencement

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			(e.g. to introduce the following changes in the Main Design: no construction activities in the river bed of Buna and Bunica, no stream training of Stream Buna and Stream Bunica and its shoreline are allowed, in order to prevent disturbance of aquatic species. ▪ Include in the Main Design protective bird panels for Bee-eater and Sand martin in total length of 1,600 m on both sides of the road to prevent side collisions of birds with cars, from chainage 3+400+000 km up to 5+000+000 km in line with instruction given in BMP ▪ Plan mitigation measures for otter (*Lutra lutra*) and other mammals and undertake changes to the design of bridges and forbid stream training ▪ Monitoring of the areas where bridge crossings are to be sited should be checked for the presence of otter, prior to works commencing. If an otter holt or lie-up is found, a suitably qualified ecologist should be sought, to seek advice on the actions to be taken. Micro-alignments of the motorway route must be done to avoid any impact ▪ Project bridges and planned construction activities should be designed in a way to avoid destruction of river bed, heavy machinery in river bed, or changing of water courses			
8.1.10	Construction	Disturbance of fauna species due to increased levels of noise, vibration and light in	▪ Motorway route only needs to be used for construction activities and organisation of construction site. Should any need for	Contractor	Inspection by ecologist during construction.	Construction site well management reported

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
		the zone of construction activities	additional areas to be used occur, e.g. access roads to the motorway route, natural areas such as woodland, meadows and grassland need to be avoided as shown on Figure 46 and Figure 50 and only already modified areas may be used (e.g. existing roads or degraded non-natural habitats). ▪ Transport of machinery and construction materials must be performed via already existing access roads ▪ Areas where bridge crossings are to be sited should be checked for the presence of otter, prior to works commencing. If an otter holt or lie-up is found, then further advice from a suitably qualified ecologist should be sought, to advise on the actions to be taken ▪ At the places where bridges are constructed ensure safe passages for animals, particularly along the both sides of rivers dry passages bellow bridges should be preserved (that are above the water at highest water levels to enable safe movements of terrestrial species). ▪ All surplus material that will not be used in construction works must be stored on previously planned locations as part of the CSOP and construction waste must be systematically transported to Rotimlja Landfill prevent fatalities of fauna due to inadequate material management ▪ A safety fence shall be placed along construction site and construction site well		Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	Disposal of spoil on Rotimlja landfill

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			organized (e.g. inorganic waste (that could trigger possible injuries) and organic waste (because of accessible food source, this represents a threat of possible diseases) need to be adequately managed, as given in Waste Management Plan and Construction Management Plan ▪ While constructing at least two open channels for fauna (at areas of Malo Polje and Hodbina) it is necessary to preserve surrounding flora in order to lead the animals naturally towards the passage			
8.1.11		Potential disturbance of nests/roosts of species that have a seasonally variable vulnerability due to breeding, feeding times or seasonal migrations, such as Short – toed Lark (*Calandrella brachydactyla*) and Sand Martin (*Riparia riparia*) or sensitive bat species in the project area	▪ Undertake vegetation clearance outside of the bird nesting period (from beginning of April to the end of June). ▪ Protective bird panels need to be opaque and e.g. 3-4 m high to cover the height of trucks. Since erecting these panels may cause significant landscape impact for local population and block the view to e.g. houses, on such specific areas near houses transparent bird panels may be used, but with strips and graphics over transparent surfaces. In the case the Main Design for Noise shows that noise barriers need to be planned on the same sections of the motorway as protective bird panels, noise barriers may be planned as a combination of noise barriers and transparent bird protective panels of plexiglass with graphics and strips to avoid collision of avifauna with these facilities. These panels will	Contractor	Inspection by ecologist during construction. Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	No nests/roost affected Construction site well management reported Presence of alternative roost sites

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			indirectly act as noise barriers for the species Short-toed Lark (*Calandrella brachydactyla*) and for Calandra lark (*Melanocorypha calandra*) if found during additional surveys. ▪ In addition to these measure, specific mitigation measures will need to be applied for the Short-toed Lark (*Calandrella brachydactyla*) and Calandra lark (*Melanocorypha calandra*) during the construction phase, e.g. to **preserve the existing grassland habitats (Figure 50).** In order to preserve the species, it is necessary to avoid the movement of heavy machinery outside of the motorway route (e.g. transport of materials that will be used for the construction of the motorway to be conducted only on existing access roads, to prohibit the formation of new access roads through the habitats of a given species and to organise the construction site by using only the area of the motorway route without disrupting surrounding grasslands). Only the motorway route can be used for construction activities. Grass habitats that are assessed as appropriate habitat for of the species need to be strictly avoided (location indicated in Updated ESIA report on Figure 50 and BMP). ▪ Micro-alignments of the motorway route must be done to avoid any potential roosts that could be found during preconstruction surveys. ▪ Should any roosts will be accidentally disturbed by negligence of the Contractor or as the result			

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			of an accidental situation, habitat restoration should be done after the construction phase is finished. Alternative roost sites in the vicinity should be built in case of any being destroyed by the construction works.			
8.1.12		Potential fatalities or injuries of fauna species due to vegetation removal and movement of heavy machinery	▪ Fencing of the construction sites with a 2m-high fence will be undertaken as part of CSOP, along the whole route that is under construction. This fence should also prevent ingress of a range of fauna to the construction areas. ▪ The fence (to be used as protection during operation phase) along the motorway should be constructed properly (2m-high wire fence which in the lower parts (at least 50 cm from the ground) has a diameter of 2cm or less), to ensure there would be no collision of the species. The use of a dense net in the lower part of the fence will prevent the passage of fauna to the motorway route. ▪ If suitable areas for amphibians are found during construction, such areas shall be not disturbed (e.g. near streams) ▪ If suitable areas for amphibians, especially species *Hyla arborea* and *Rana dalmatina* are identified by a suitably qualified ecologist employed by the Contractor, then these areas should be avoided during construction. ▪ Ensure no loss of species *Hyla arborea* (European tree frog) and *Rana dalmatina* (Agile frog) individuals. If found the species should be	Contractor	Inspection by ecologist during construction. Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	No fatalities of fauna recorded on site Construction site well management reported

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			relocated to unaffected suitable habitats nearby. Relocation to be supervised by a suitably qualified ecologist employed by the Contractor. ▪ Daily inspection and removal of the Hermann's Tortoise - *Testudo hermanni* individuals as part of the construction section under construction needs to be undertaken and if species found, safely removed ▪ During the construction period sites will be managed so that they do not provide suitable habitat for reptiles (shelter and hibernation). Measures would involve not stockpiling rubble and only undertaking works to move rubble, where reptile presence is expected, when temperatures are above 7^{o}C. i.e. when reptiles are not in hibernation/torpor.			
8.1.13	Operation	▪ Potential collision of fauna species due to high speed of vehicles (bird species e.g. Sand Martin and Bee-eater, bat species, other small mammals, amphibians and reptiles)	▪ Undertake regular maintenance of protective bird panels ▪ Undertake regular maintenance of fence along the motorway route ▪ As part of the regular visual observations of the road, undertake inspection of potential damage to the fence. All damage to the fence are to be promptly repaired, therefore regular inspections are required ▪ The motorway maintenance service is obliged to record mammals injury cases in order to respond timely with additional protection measures, during first three years ▪ In case the number of run over individuals is	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities	Monitoring of adherence to measures	Panels and fence with no observed damages Register in place for registering of potential road kill No fatalities of species registered, zero road kill

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			high and frequent, it is necessary undertake additional measures (e.g. to set the live traps for individuals in order to move the individuals to another suitable habitat in a safe and acceptable manner, and/or install the more dense safety fence at least 50 cm from the ground. Ensure that the denser part of the fence has a diameter of 2 cm or less. The dense net in the lower part of the fence will prevent the passage of young tortoises and other reptiles, amphibians and small mammals to the motorway route.			
8.1.14		▪ Negative impacts of increased light and noise levels on sensitive fauna species such as bats	▪ Avoid placing the artificial street lights and unnecessary lightened traffic signs, auxiliary facilities, such as gas stations, resting places, billboards etc. near Buna and Bunica streams and near Hodbina Hill	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities	Monitoring of adherence to measures	No auxiliary facilities, such as gas stations, resting places, billboards etc. near Buna and Bunica streams and near Hodbina Hill present
Aquatic ecology						
8.1.15	Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements	▪ Introduce the following changes in the Main Design (compared to the Preliminary Design): - no construction activities in the bed of Buna and Bunica streams. The three bridges, Bridge Buna and Bridge Bunica, as well as the access bridge over Stream Buna for local population of Malo Polje, shall be constructed without any disturbance of the river bed - piles and pylons, that will be used for support of the bridges, shall be designed in a manner to	JPAC or JPAC to transfer the responsibility to the contractor per Contractual Agreement	Monitoring of the changes to the Main Design by the PIU	Main Design includes the required changes

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			be founded outside of both watercourses. This also implies for the additional bridge to be constructed for the local population in Malo Polje - no training of Buna and Bunica streams and their shorelines are allowed - install two additional oil separators at Bridge Buna and Bridge Bunica ▪ Main Design to be developed in the way to retain natural flow rate of Buna and Bunica streams ▪ Oil separators to be selected in the Main Design in line with EN 858-1 and EN 858-2, as well as the controlled drainage, so freshwater white-clawed crayfish – *Austropotamobius pallipes* and endemic an sensitive fish species will not be disturbed by chemical pollution ▪ Retain riparian vegetation adjacent to the water courses			
8.1.16	Construction	▪ Aquatic habitat loss due to removal of river banks vegetation in the phase of construction site preparation and during the performance of construction works ▪ Aquatic environment alternation due to performance of construction works	▪ It is necessary to ensure **sustainable long term protection of aquatic habitats**. Implement the suggested Main Design measures as follows: - no construction activities in the bed of Buna and Bunica streams. The three bridges, Bridge Buna and Bridge Bunica, as well as the access bridge over Stream Buna for local population of Malo Polje, shall be constructed without any disturbance of the river bed - piles and pylons, that will be used for support of the bridges, shall be designed in a manner to	Contractor	Monitoring of implementation of the proposed mitigation measures Visual monitoring of the erosion processes around rivers Inspection by ecologist during construction.	No level of disturbance of aquatic habitat or river banks No construction works in the rivers

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
		▪ Degradation of the riverbed ▪ Negative impacts on critically endangered and intolerant ichthyofauna species, endangered aquatic invertebrates and their habitat due to degradation of the aquatic habitats	be founded outside of both watercourses. This also implies for the additional bridge to be constructed for the local population in Malo Polje - no training of Buna and Bunica streams and its shoreline are allowed - install two additional oil separators at Bridges Buna and Bridges Bunica ▪ Construction works along the Buna and Bunica streams should be prohibited to a certain distance from the shore in order to prevent water pollution with suspended matter ▪ The removal of trees along river banks must be avoided in order to preserve the hydrological regime, the diversity of habitats of hydrobionts, water temperature and ensure prevention of erosion of the river banks. Micro-alignments of the motorway route must be done to avoid any impact to riparian vegetation ▪ Avoid destruction of habitats of the species of national or international conservation concern, e.g. wet meadows along Buna and Bunca streams as important habitats of *Z. cerisy, Z. polyxaena* and *L. dispar*, as shown on Figure 46. ▪ Avoid unnecessary cutting of trees and removal of dead wood, particularly oak, from habitats as they are important for sapryxylic species, including saproxylic beetles: *Lucanus cervus* or *Cerambyx cerdo* that occur in the wider area. ▪ Pollution prevention and control measures		Environmental supervision of the contractor's work: weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer.	

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
			need to be implemented as detailed within the CSOP. This should include: - Prevent any potential chemical leakage to avoid contamination of water and adverse impacts to aquatic species. - Implement pollution prevention and control measures at construction site, e.g. spill containment bunds at the construction site to prevent any leakage from the oil tanks) to prevent water pollution in nearby streams, Buna and Bunica and thus prevent adverse impacts on fish species - Implement soil erosion control measures (can be achieved through construction phasing to minimise activities which cause disturbance e.g. during the wettest periods of the year). - Where relevant, control measures such as silt fences, fibre rolls and berms should also be used to prevent temporary erosion and sediment erosion to rivers. - Disposal of materials should be prohibited in river bed and on/near the river banks - Install drainage infrastructure to prevent erosion - The ends of the bridges should be embanked and secured against erosion during construction phase - Prohibit direct discharges of any pollutants to the streams			

No	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*Key Performance Indicator (KPI)*
8.1.17	Operation	▪ Potential pollution of rivers in case of accidental situations in motorway traffic and leakages due to e.g. failure of oil separators	▪ Adequate maintenance of drainage structures and oil separators (EN 858-1 and 858-2) to ensure their efficiency regarding the pollution prevention ▪ Avoid the use of chemicals as much as possible near the rivers	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities.	Monitoring of adherence to measures	No Reports on regular cleaning of the pollution control equipment. Monitoring of effluent quality from the oil separators
8.1.18		▪ Potential negative impacts on sensitive aquatic species and degradation of their habitats in case of accidental situations in motorway traffic and leakages due to e.g. failure of oil separators	▪ Adequate regular cleaning and maintenance of drainage structures and oil separators by engaging an authorised third party to ensure their efficiency regarding the pollution control.	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities.	Monitoring of adherence to measures	Reports on regular cleaning of the pollution control equipment. Monitoring of effluent quality from the oil separators

8.2 Water

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Water						
8.2.1	Pre-construction	▪ Limited up-to-date information on baseline	Repeat baseline analysis and include additional parameters measured an analysed before works	JPAC or JPAC to transfer the	Standard physical chemical analysis of	Environmental baseline report

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
		water quality in the project areas	commence. Perform the analysis of Chemical Oxygen Demand (COD) using method based on $KMNO_4$ consumption. Include analysis of nitrates together with analysis of ammonia and total nitrogen Include analysis of dissolved oxygen, in order to assess the risk of eutrophication Use the Regulation on Hazardous and Harmful Substances in Waters (Official Gazette of FBiH, No. 43/07) to compare obtained concentrations for iron, lead, manganese and fats and oils with the limit values Carry out the water quality analysis in at least two hydrological cycles (low and high waters).	responsibility to the Contractor as per Contractual Agreement	surface waters with addition of analysis of mineral oils. Include analysis of COD based on KMNO4 consumption, nitrates and dissolved oxygen.	on water quality prepared
8.2.2		▪ Design solution for the bridges that requires construction activities in the river bed	▪ No construction in the riverbed. Change the proposed solution for bridges in the Main Design.	JPAC to transfer the responsibility to the Contractor through Contractual Agreement	Revision of the Main Design for Bridges	Revision report Design of the two bridges adopted
8.2.3		▪ Number of oil and grease separators for motorway drainage is not sufficient to ensure protection of the water quality in Buna and Bunica streams	▪ Keep the same solution for drainage and sanitary system from the preliminary design but increase the number of oils separators to specifically cover the two bridges.	JPAC to transfer the responsibility to the Contractor through Contractual Agreement	Revision of the Main Design for drainage and sanitary systems	Revison report Design of the drainage and sanitary systems adopted
8.2.4	Construction	Reduction in water quality in river systems due to: ▪ temporary localised diversion of drainage paths around construction camps and site workings ▪ Maintenance of construction	▪ Develop a **Construction Site Organisation Plan (CSOP)** to include proper design of collection and treatment of drainage water and sanitary water inside the camp ▪ Construct sanitary and drainage facilities within the camp ▪ Construct sanitary and drainage facilities along the	Contractor	Engineer supervision of the contractor's work based on CSOP, RCMP, CESMP, CWMP, DCWMP: visual supervision of (a) sanitary and drainage facilities and (b) work of	Plans and method statements prepared, reviewed and approved by the Supervising Engineer.

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
		vehicles at the site ▪ sediment release during bridge construction in river bed and on the banks ▪ depositing of construction waste, municipal waste and other special waste categories into the rivers ▪ localised discharges from construction facilities including concrete batching plant and workers camp	motorway as per the Main Design. ▪ Develop and implement a **Construction Environmental and Social Management Plan (CESMP)**[155]**.** The CESMP is to include at least the following water related measures: - Provide spill kits in worksites around rivers. - Ensure no generators and vehicle refuelling occurs within 50 meters of any surface water course. - Provide silt fences, sediment barriers or other devices to prevent migration of silt during - construction within streams. - Ensure no waste materials are dumped in the river, including re-enforced concrete debris. - Ensure that no concrete waste from concrete mixers is dumped in the river. - Provide areas where concrete mixers can wash out leftover concrete without polluting the - environment. - Ensure that no hazardous liquids are placed within 10 meters of the river. - Provide portable toilets at bridge construction site ▪ Include a **River Crossing Management Plan (RCMP)** in the CESMP**. The RCMP shall**: - Outlines the key policies, legislation and standards relating to waste management; - Defines roles and responsibilities; - Outlines actions and measures necessary for the effective management of water crossings; - Covers both accidental and intended impacts due to water crossings;		concrete batching plant (c) waste management practices (d) construction works on streams Buna and Bunica (e) disposal of spoil on Rotimlja landfill. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer. Monitoring of water quality of Buna and Bunica in line with the Environmental Permit. Reports to be checked by engineer supervision.	Completion of weekly inspections. Quality of water in Buna and Bunica No direct discharge of untreated wastewater to rivers No inappropriately disposed waste in and around the site No works in the river bed or on the banks Disposal of spoil on Rotimlja landfill Proofs of waste delivery to licenced operators

[155] CESMP is the upgraded version of the legally required Environmental Protection Plan inclusive of social aspects as per EBRD requirements.

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			- Details specific control measures to be implemented by the Company and its contractors (and subcontractors); - Incorporates the requirements of the ESIA findings, international standards, FBIH legislation, Lenders requirements and Project-specific construction permits. - Considers the Company's general approach to water crossings management procedures and methodologies. ▪ Include a **Concrete Batching Management Plan in the CESMP.** Obligatory measure to include is the installation of the settling tanks at the concrete batching plant and treatment of wastewater prior to discharge. ▪ Develop and implement a **Detailed Construction Waste Management Plan** and put in operation waste management procedures to avoid inappropriate deposition of construction waste in and around the construction site. ▪ Implement **the Waste Management Plan** and put in operation appropriate waste management procedures to segregate, store and transfer responsibility for waste management to licenced operators in order to avoid inappropriate deposition of all category wastes in and around the construction site.			No community grievances raised relating to water pollution or waste disposal.
8.2.5	Construction/ Operation	Reduction in water quality in river system resulting from: ▪ direct release of intercepted surface run-off ▪ direct release of sanitary water from toll station	▪ Properly operate and regularly maintain sanitary and drainage facilities. Regularly clean the separators and manage the sludge in cooperation with licenced operator. ▪ Develop an **Operational Environmental and Social Management Plan (OESMP)** and include an	Contractor / JPAC to include in the contractual agreement	Procedures for operation of the sanitary and drainage facilities. Monitoring of effluent discharge	Procedures for operation and maintenance of sanitary and drainage facilities set up.

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
		▪ accidental spill of hazardous material resulting from traffic accidents.	**Emergency Preparedness and Response Plan (EPRP).** The EPRP shall include procedures to prevent contamination of waters from accidental spills		in line with the OESMP and the Water Permit. Setting up preparedness and response procedures in line with the EPRP	Procedures for emergency preparedness and response set up. Effluent quality in line with the Federal regulations for effluent discharge. Annual report on effluent quality to be submitted to relevant ministry/agency at federal level in line with issued Environmental and Water Permits. No spills affecting water quality.

8.3 Air Quality

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Air quality						
8.3.1	Pre-construction	▪ Lack of up-to-date information on baseline air quality in the project areas	▪ Perform the analysis of air quality in the project area, possibly in four seasons.	JPAC	Standard set of parameters to include CO, SO2 O3, NO, NO2. NOx, PM_{10}.	Environmental baseline report on air quality prepared
8.3.2	Construction	Reduction in air quality due to: ▪ Emissions of construction dust ▪ Emission of the dust from concrete batching plant ▪ Emission of exhaust gases from combustion processes in generators and other construction equipment /vehicles.	▪ Include an **Air Quality Management Plan (AQMP)** in the CESMP. The AQMP shall include: - calculated likely emissions from concrete and asphalt production facilities and other emissions generating facilities - details of mitigation measures, - specific location and schedule where such measures shall be implemented to minimise impacts to sensitive receptors due to the presence construction works, - sourcing and transport of construction materials, - and other project-related activities. ▪ Include a **Traffic Management Plan (TMP)** and **Materials Management Plan (MMP)** in the **CESMP.** At least the following measures shall be included: - Obtaining environmental permit for asphalt plant (if planned to run own facility); - Ensure proper state of maintenance machinery and vehicles to minimise - exhaust emissions. Smoke emitting vehicles and equipment shall not be allowed and shall be	Contractor	Engineer supervision of the contractor's work based on CESMP (AQMP, TMP, MMP): weekly visual inspections throughout the construction phase to monitor the implementation and effectiveness of prescribed mitigation measures. Records should be kept of these visual inspections and submitted in the monthly reports prepared by the external supervising engineer	Plans and method statements prepared, reviewed and approved by the Supervising Engineer. Completion of weekly inspections. Implement a regular vehicle maintenance and repair program. No community grievances raised relating to construction

No.	Phase	Impact to be addressed	Management/ Mitigation/ Enhancement	Responsibility	Monitoring	KPI
			repaired or removed from the project. - Undertake immediate repairs of any malfunctioning construction vehicles and equipment. - Use construction equipment and vehicles that meet national emission standards. - Wherever possible, use electrically-powered equipment rather than gas or diesel-powered equipment. - Give priority to fuel efficient machinery. - Ensure that all diesel and petrol running machinery use equipped with catalytic convertors. - Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors. - Provide truck-washing facilities at tunnel portal and bridge construction sites to prevent truck-out of mud and dust. Above ground option is deemed to be the priority. - Rock crushing plant equipment shall be fitted with water sprinklers that will run - continuously while the plant is operational. - If the sprinklers stop working, the plant shall also cease operation until the sprinklers are functioning. - Water run-off from the sprinkler system shall not discharge directly to surface water courses without first passing through a silt trap or any other suitable device to prevent siltation of surface waters. - Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered: - Regardless of the size or type of vehicle, owners / operators should implement the manufacturer			dust.

No.	Phase	Impact to be addressed	Management/ Mitigation/ Enhancement	Responsibility	Monitoring	KPI
			recommended engine maintenance programs. - Drivers should be instructed on a routine basis by the Contractors Health and Safety - Specialists on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits. - Implement a regular vehicle maintenance and repair program. - Conveyor belts (e.g. at batching plants and rock crushing plants) shall be fitted with windboards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimise dust emissions. - All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins. - Carry out watering for dust control at least three times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°, or in windy weather. - Avoid overwatering as this may make the surrounding muddy. - Earthwork operation to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community. - Provide vegetation planting along roadsides to limit air quality impacts.			

8.4 Land

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Land						
8.4.1	Pre-construction	▪ Limited up-to-date information on baseline soil quality in the project areas	Carry out the baseline soil quality analysis before the construction start. Decision on number of samples and location should be made by the soil expert based on the soil types found in the project area.	JPAC or JPAC to transfer the responsibility to the Contractor as per Contractual Agreement	Standard physical chemical analysis of soil quality.	Environmental baseline report on soil quality prepared
8.4.2	Construction	Reduction in soil quality due to: ▪ Damage to topsoil ▪ Deforestation ▪ Soil dewatering ▪ Direct discharge of wastewater from maintenance of construction vehicles at the site and sanitary waters from construction camp ▪ Inappropriate waste disposal	▪ Include a **Topsoil Management Plan (TMP)** in the CESMP. The TMP plan shall describe topsoil stripping procedures and rules, topsoil stripping depth and volumes, topsoil stripping supervision, transportation and stockpiling requirements, stockpile location, topsoil stockpile design, stockpile management, erosion hazard and erosion control, runoff drainage/diversion, soil protection measures at the storage area, maintenance of the stockpile and topsoil application procedure. ▪ Include a **Recultivation/Land Restoration Plan (RLRP)** in the CESMP. This plan will be read and implemented in combination with the Topsoil Management Plan and Waste Management Plan. This plan will include restoration of the borrow pits and their surroundings, if any, and recultivation of the Rotimlja Landfill. ▪ Include a **Spill Management Plan (SMP)** in the CESMP. The plan shall provide details of procedures, responsibilities, resources, documentation and reporting requirements, training provisions for relevant staff, etc. to avoid spills of hazardous substances and to effectively	JPAC to transfer the responsibility to the Contractor through Contractual Agreement	The same as under *Water and Waste*. Include TMP and RLRP and SMP in the engineer supervision of the contractor's work.	The same as under *Water and Waste*.

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			respond to such incidents. ▪ Implement the same measures as under *Water and Waste*.			
8.4.3	Operation	Reduction in soil quality along the route as a result of: ▪ direct discharge of surface run-off ▪ accidental fuel and oil spills	▪ Include and implement the following measures in the **Operational Environmental and Social Management Plan (OESMP):** - Maintenance and clean up the drainage system to prevent impact on erosive sliding of the soil or flooding; - Monitoring of slopes, in particular after strong rains and snowmelt for identification of possible traces of erosion; - Implementation of mitigation measures defined for works during road repair/maintenance works; - Analysis of soil for identification of the impact caused by ice breaking salt (after the snow melt – in spring) with subsequent organic amendment and/or amendments to adjust pH or nutrient deficiencies. ▪ Implement the same measures as under *Water*.	JPAC Management and Maintenance Department as well as selected Contractors for operation and maintenance activities.	Monitoring of adherence to measures	No records on land contamination

8.5 Climatic factors

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Climatic factors						
8.5.1	Pre-construction / construction	Low resilience to climate variability and climate change	▪ Review of the detailed design to review design measures and materials specification in light of the anticipated climate change forecasts and projections over the lifetime of the project ▪ Additional mitigation measures to address climate resilience risks will be specified in the contract	JPAC/Contractor	Main design to include measured to increase climate resilience Engineer supervision to review Construction Management Plan for	Increased resilience of the motorway structures.

No.	Phase	Impact to be addressed	Management/ Mitigation/ Enhancement	Responsibility	Monitoring	KPI
			specification and if appropriate the Contractor will be required to prepare a **Climate Resilience Construction Management Plan**		resilience increasing measures.	
8.5.2	Operation	GHG emissions from vehicle transport	▪ Develop the **Recultivation/Land Restoration Plan** (RLRP) and where possible reforest land within the project area of influence ▪ Encourage drivers with motivational messages on electronic displays to maintain a consistent speed of 110 km/hr for the benefit of reducing GHG emissions.	JPAC	Reforested surfaces Speed monitoring	% of reforested area Traffic reports

8.6 Existing material assets including cultural-historical and archaeological heritage

No.	Phase	Impact to be addressed	Management/ Mitigation/ Enhancement	Responsibility	Monitoring	KPI
Existing material assets including cultural-historical and archaeological heritage						
8.6.1	Pre-construction	▪ Damage to visible and buried cultural, archaeological and architectural heritage during execution of construction works and movement of machines/vehicles around the construction site	Undertake preventive archaeological surveys as required by the Federal Institute for Protection of Monuments and notify the Institute of survey results. Develop **Chance Find Procedure** prior to any site preparation and construction works. Chance Finds Procedure needs to contain as a minimum the name of responsible contact person, monitoring of works procedure, stopping of works procedure, procedures for appropriate handling of chance finds, procedure for notification to authorities, procedure for temporary storage and protection of finds, procedure for handing over any chance finds to responsible institutions, etc. Share with Contractor	JPAC	Record of use of chance finds procedure	Preventive archaeological surveys conducted, the Institute for Protection of Monuments and EBRD notified of survey results Chance Find Procedure developed and shared with EBRD and Contractor.

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			to implement during construction works. Ensure relevant staff and Contractor are trained in its chance finds requirements.			

8.7 Noise

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Noise						
8.7.1	Pre-construction	Impact on residents from increased levels of noise from motorway traffic	Development of noise modelling and proposal for noise barriers in the main design.	Contractor	Revision of the Main Design	Main design to include appropriate number of noise barriers
8.7.2	Construction	Impact on workers and residents from increased levels of noise during construction works	Include the following measures in the CESMP to avoid the exceeding of permitted values in accordance with the Law on protection against noise: - Restriction of works to day-time only (period of day: 06:00 to 22:00, period of night: 22:00-06:00) - On unpaved roads, maximum speed of vehicles should be restricted to 20 km/h to minimise load-rattle - Haul routes should avoid passing dwellings at distances closer than 2 metres - Equipment and machinery to be shut down when not in use - In case of noise increase complaints by residents (e.g. from transport of materials), simultaneous use of machines that generate noise over 70 dB should be limited. All noise complaints shall be investigated. - All equipment and vehicles will be maintained	Contractor	Monitoring of ambient noise in accordance with the provisions of the issued Environmental Permits. Weekly site walkover inspections to consider if noise mitigations being appropriately implemented	Noise control measures implemented and recorded as implemented in monthly reports prepared by the external Supervising engineer. No noise related complaints received. Equipment maintenance and repair program implemented.

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			in good working order - implement a regular equipment maintenance and repair program - Machines and vehicles to be used in construction activities must have use/operation permits.			
8.7.3	Operation	Impact on residents from increased levels of noise from motorway traffic	Installation of noise barriers based on the results of noise modelling done in the pre-construction phase	Contractor JPAC	Engineering supervision of construction works Periodical monitoring of the ambient noise in accordance with the provisions of the issued Environmental Permits. Monitoring of the ambient noise should be performed by engagement of an authorized company (a third party) once a year during the first three years of operation of the motorway. After that, if the monitoring shows that the measured values are below the limit values specified by the Law on Protection Against Noise, then the monitoring can be performed once in three years.	Noise barriers installed Engineering revision approved the installation Noise control measures implemented and recorded Annual report to be submitted to environmental ministry at federal level in line with issued Environmental Permit. No complaints received.

8.8 Waste and materials management

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Waste and materials management						
8.8.1	Construction	Contamination of environment due to leakage and spillage of wastes associated with poor spoil and waste handling and storage/disposal arrangements	Develop and implement Detailed Construction Waste Management Plan (CWMP) based on the already developed Preliminary Construction Waste Management Plan (annex to this ESIA). Both plans are based on best practices for waste handling and final treatment options (i.e. reuse, recycling, recovery or disposal) for each waste stream and contain list of mitigation measures to be implemented. Implement Detailed CWMP and already prepared Waste Management Plan (annex to this ESIA). These plans should be read and implemented in conjunction with Recultivation/Land Restoration Plan, Topsoil Management Plan and Spill Management Plan.	Contractor	Engineering supervision of construction works Keeping record on waste types and quantities Keeping waste shipment documentation	Engineering supervision reports Annual report on waste types and quantities to be submitted to environmental ministry at federal level in line with issued Environmental Permit. No complaints received.
8.8.2	Construction	Environmental damage caused by illegal material sourcing	Borrow pits may not be opened in protected areas and appropriate environmental assessments to be carried out for them and all the necessary Permits obtained. If Contractor decides to purchase materials from the market, it is allowed to subcontract only licenced material providers that have valid environmental, water and working permits.	Contractor	Engineering supervision of construction works Contractor to ask copies of the permits from the material provider. Keeping record on material purchase	Engineering supervision reports Copies of the purchase documentation

8.9 Community impacts

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Worker influx						
8.9.1	Construction	▪ Worker influx	▪ Include in CESMP provisions on workers' accommodation (camps) in accordance with PR provisions and the EBRD/IFC Guidance Note "Workers' accommodation: processes and standards" 2009 referred to in PR 2, including the requirements for developing disease prevention measures by the Contractor, including communicable diseases and Sexually Transmitted Diseases (STD) - or Sexually Transmitted Infections (STI), as well as with EBRD Briefing Note on Workplace Risk Assessment including provisions for Covid-19 (2020). ▪ At all times maintain the health and safety of its personnel, in collaboration with local health authorities ▪ Ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the site and at any accommodation (camps) for Contractor's personnel as well as ensure that all suitable arrangements are made in line with necessary welfare and hygiene requirements enabling prevention of epidemics. ▪ Follow the FBiH legislation on labour and OHS, as well as PR 2 provision on grievance mechanism for workplace concerns. ▪ Throughout the contract: - conduct Information, Education and Communication (IEC) campaigns on the workers' code of conduct vis-a-vis the	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	Supervising engineer to random check at least once per week during construction activities	Workers' accommodation provisions included in CESMP Provisions implemented during construction works Periodic checks including site visits and reports on contractors performed Provisions on applying the relevant requirements of FBiH legislation and PR2 incorporated into contracts with Contractor Training and campaigns on workers' code of conduct, STDs, STI and HIV/AIDS,

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			local community, at least every other month, addressed to all the Site staff and labour (including all the Contractor's employees, all Subcontractors and any other Contractor's or Employer's personnel, and all truck drivers and crew making deliveries to Site for construction activities), - provide education/awareness raising activities in form of online presentation and brochure for communicable diseases and STDs, STI and HIV/AIDS on screening, diagnosis, counselling as well as including provisions for Covid-19, - provide education/awareness raising activities in form of online presentation and brochure for protective measures from COVID 19, - provide education/awareness raising activities in form of online presentation and brochure for the workforce about refraining from unacceptable conduct toward local community members, specifically women, - inform workers about local laws that make sexual harassment and gender-based violence and harassment a punishable offence which is prosecuted, - cooperate with law enforcement agencies in investigating complaints about gender-based violence and harassment.			COVID 19 performed
Community health and safety and road safety						
8.9.2	Construction	▪ Community health and safety ▪ Road safety	▪ Develops and implement an Emergency Preparedness and Response Plan for construction (as part of the CSOP) to identify and address all major hazards for workers and the local	Contractor for construction / JPAC to include in the contractual agreement with the	JPAC to review Contractor's TMP to ensure continuity with commitment in this ESMMP	Emergency Preparedness and Response Plan for construction (as part of the CSOP)

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			community during the motorway construction. ▪ Prevent unauthorised access of the public to construction sites and contact with dangerous locations and equipment and hazardous materials by establishing a fenced safety zone around the facilities during construction of Project infrastructure. ▪ Develop and implement a Traffic Management Plan (TMP) for construction phase (as part of the CESMP) containing traffic measures. ▪ Provide information (at least weekly) to the public about the scope and schedule of construction activities and expected disruptions and access restrictions. Report these activities in monthly progress report to JPAC. ▪ Place a panel with all relevant data about the construction (names of investor, contractor and designer; name and type of structure; time of commencement and completion of construction works). Panel to include information regarding contact details for environment, safety and community matters. ▪ Implement awareness raising activities in form of brochure for the local community about local laws that make sexual harassment and gender-based violence and harassment a punishable offence which is prosecuted, and encourage local community to cooperate with and report to law enforcement agencies in case of any gender-based violence and harassment.	Contractor	Supervising engineer to random check at least once per week during construction activities	developed and implemented Documented TMP (as part of CESMP) TMP implemented throughout construction phase Information (at least weekly) to the public about the scope and schedule of construction activities disclosed publicly A panel with all relevant data about the construction placed near to the construction site
			▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on	JPAC	Development of quarterly monitoring reports on SEP	Reports on SEP implementation developed and

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			providing timely information to local communities on the extent of works and duration prior to the commencement of construction works		implementation Monthly review of external grievances	submitted to EBRD (containing indicators on stakeholder engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry
8.9.3	Operation	▪ Community health and safety	▪ Develops and implement an Emergency Preparedness and Response Plan for operation (as part of the OESMP) to identify and address all major hazards for workers and the local community during the motorway operation. ▪ Develop and implement a TMP for the operation phase (as part of the OESMP) to identify and address all major hazards for workers and the local community during the motorway operation. The Plan should also include details on safety and stakeholder engagement measures relating to road safety to be applied. ▪ Provide information to the public about the scope and schedule of maintenance activities and expected disruptions and access restrictions. Report these activities in monthly progress report	Contractor for maintenance / JPAC to include in the contractual agreement with the Contractor	JPAC to review Contractor's TMP to ensure continuity with commitment in this ESMMP	Emergency Preparedness and Response Plan for construction (as part of the CSOP) developed and implemented Documented TMP (as part of OESMP) TMP implemented throughout construction phase

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			to JPAC. ▪ Place signalisation in case of maintenance activities.			Information to the public about the scope and schedule of maintenance activities disclosed publicly Signalisation in case of maintenance activities placed
			▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on providing timely information to local communities on the extent of works and duration prior to the commencement of construction works	JPAC	Development of quarterly monitoring reports on SEP implementation Monthly review of external grievances	Reports on SEP implementation developed and submitted to EBRD (containing indicators on stakeholder engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry
Job creation /Loss of employment						

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
8.9.4	Construction	▪ Job creation	▪ Hiring guidelines for recruitment will be in place to promote transparency of the recruitment process ▪ Equal opportunities and non-discrimination will be guaranteed in the recruiting process ▪ There will be no distinction, exclusion or preference in the recruitment made on the basis of "race, colour, gender, religion, political opinion, marital status, national extraction or social origin, disability, age, sexual orientation, and/or HIV status" ▪ Selection criteria will include minimum age and skills requirements ▪ All job vacancies will be listed clearly with skills and experience required to fill the position, as well as the duration of the employment contract ▪ Clear information on the recruiting process and the selection criteria will be publically available and easy to access to promote transparency of the process and ensure workers are fully aware of short term nature of contract during construction period.	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	JPAC	Hiring guidelines in line with this ESMMP developed and implemented by all contractors
8.9.5	Operation	▪ Loss of employment of temporary engaged workers	▪ Provide advance information to temporary engaged workers from settlements near to motorway section on job opportunities through local institutions, trade chambers, and local business organizations in the region (such as the Regional Development Agency for Herzegovina – REDAH). ▪ Seek to employ local personnel residing in Project affected area also on other sections or other	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	JPAC	Hiring guidelines in line with this ESMMP developed and implemented by all contractors

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			construction activities.			
Disruptions to water and sanitation, electricity and telecommunication						
8.9.6	Construction	▪ Disruptions to water and sanitation, electricity and telecommunication	▪ Implement mitigation measures for identified collision points contained in approvals from competent authorities and public utility companies, responsible for transport, communications and infrastructure. Measures to be implemented for identified collisions with electricity OTLs are as follows: - Measure for the collision with OTL 10(20) SFOR (Zracna Luka) at chainage 0+420.00: the existing medium voltage cable shall be laid under the motorway in protective concrete pipes with a diameter of 200 mm, at a depth of 1.2 m; - Measure for the collision with OTL 10(20) SFOR (Zracna Luka) at chainage 0+700.00 to 1+020.00: it is necessary to relocate the existing route of the medium voltage cable and lay it in the channel at a depth of 0.8 m. It is also necessary to relocate the substation 10(20)/0.4 kV-160kVA STS Zracna Luka on a steel-lattice pole with all equipment to a new location; - Measure for the collision with OTL 10(20) SFOR (Zracna Luka) at chainage 1+600.00: it is necessary to replace the existing concrete pole with tension reinforced concrete pole 10/1600 and medium-voltage cable should be laid under the motorway in protective concrete pipes with a diameter of 200 mm, at a depth of 1.2 m;	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	Supervising engineer to random check at least once per week during construction activities	Implemented all mitigation measures for identified collision points contained in approvals from competent authorities and public utility companies, responsible for transport, communications and infrastructure

No.	Phase	Impact to be addressed	Management/ Mitigation/ Enhancement	Responsibility	Monitoring	KPI
			- Measure for the collision with OTL 10(20) Hodbina at chainage 5+380.00: the existing medium voltage cable shall be laid under the motorway in protective concrete pipes with a diameter of 200 mm, at a depth of 1.2 m; - Measure for the collision with OTL 10(20) Hodbina at chainage 8+240.00: it is necessary to install two steel-lattice tension poles on which the transition of the tension network to the cable line will be performed. Install new poles in place of existing poles. Between the newly installed poles, at the intersection with the future motorway, lay new cable lines. Cabling of medium voltage network 10 (20) kV should be performed with medium voltage cables type XHE 49-A 3x (1x150 / 25) mm2, which should be laid under the motorway in protective concrete pipes with a diameter of 200 mm, at a depth of 1.2 m. Connections from the new poles to the existing overhead lines should be made with existing conductors with the same maximum operating strain as the conductors were installed before the reconstruction. - Develop detailed project documentation to be submitted to electricity supply company for revision. - During the execution of works on the above-mentioned collisions, JPAC is obliged to inform in writing the sector for electricity delivery of the electricity supply company as well as to appoint a supervisory authority that will			

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			coordinate all activities with this sector. - JPAC needs to issue all necessary permits for the above-mentioned activities. - JPAC is obliged to resolve all property-legal relations during the relocation and construction of the mentioned electric power facilities. - JPAC will cover all costs for relocation and protection of the electricity network in the above collisions, all costs for technical acceptance and commissioning of relocated and constructed power facilities, as well as all costs incurred in the midst of damage to the above power facilities as well as damages that may arise from possible damage to the power distribution network. - If the investor, during the construction works, notices the power lines that are not the subject of the issued consent, the investor is obliged to suspend the works and inform the sector for electricity delivery of the electricity supply company. ▪ Develop a Utility Conflict/Collision Matrix to provide management tool to deal with conflicts, organize relevant information on conflicts and alternatives and allow tracking of conflict resolution progress. ▪ Ensure emergency and prompt reaction in case of disruption.			

8.10 Land acquisition and physical displacement

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Land acquisition and physical displacement						
8.10.1	Pre-construction	▪ Land acquisition ▪ Physical displacement	▪ Implement the LALRP for the section Mostar South-Tunnel Kvanj (which include compensation entitlements for different categories of eligible persons and assets). ▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on providing timely information to local communities on the extent of works and duration prior to the commencement of construction works ▪ Set up a Project-specific grievance mechanism as elaborated in LALRP and SEP	JPAC	Biannual reports on the progress achieved with the implementation of the LALRP Development of quarterly monitoring reports on SEP implementation Report on LALRP and SEP implementation in AESR to EBRD Monthly review of external grievances	Reports on LALRP and SEP implementation developed and submitted to EBRD (containing indicators on land acquisition and physical displacement, and stakeholder engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry

8.11 Economic displacement

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Economic displacement						
8.11.1	Pre-construction	▪ Loss of place of business ▪ Loss of business income ▪ Loss of livelihoods of the land owners	▪ Implement the LALRP for the section Mostar South-Tunnel Kvanj (which include compensation entitlements for different categories of eligible persons and assets). ▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on providing timely information to local communities on the extent of works and duration prior to the commencement of construction works ▪ Set up a Project-specific grievance mechanism as elaborated in LALRP and SEP	JPAC	Biannual reports on the progress achieved with the implementation of the LALRP Development of quarterly monitoring reports on SEP implementation Monthly review of external grievances	Reports on LALRP and SEP implementation developed and submitted to EBRD (containing indicators on payments that restore livelihood loss and loss of income, and stakeholder engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry
8.11.2	Construction	▪ Temporary losses of business income during construction works	▪ Implement the LALRP for the section Mostar South-Tunnel Kvanj (which include compensation entitlements for different categories of eligible persons and assets). ▪ Implementation of SEP for the section Mostar	JPAC	Same as above	Same as above

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			South-Tunnel Kvanj, in particular the provisions on providing timely information to local communities on the extent of works and duration prior to the commencement of construction works ▪ Set up a Project-specific grievance mechanism as elaborated in LALRP and SEP			
			▪ Develop and implement a Traffic Management Plan (TMP) for construction phase (as part of the CESMP) containing traffic measures. The TMP will need to consider phasing of the works to ensure local access is retained, as access restrictions may cause temporary losses of business income during construction works.	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	JPAC to review Contractor's TMP to ensure continuity with commitment in this ESMMP Supervising engineer to random check at least once per week during construction activities Complaints relating to traffic and transport	Documented TMP (as part of CESMP) TMP implemented throughout construction phase Log of complaints relating to traffic and transport

8.12 Restrictions on land use and damage to private property

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Restrictions on land use and damage to private property						
8.12.1	Construction	▪ Land use restrictions ▪ Damage to private properties	▪ Implement the LALRP for the section Mostar South-Tunnel Kvanj (which include compensation for temporary land occupation and losses of land owners (both households and businesses). ▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on	JPAC	Biannual reports on the progress achieved with the implementation of the LALRP Development of	Reports on LALRP and SEP implementation developed and submitted to EBRD (containing

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			providing timely information to local communities on the extent of works and duration prior to the commencement of construction works		quarterly monitoring reports on SEP implementation Monthly review of external grievances	indicators on temporary land occupation and losses of land owners, and stakeholder engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry
			▪ Undertake consultations with the representatives of local communities and residents in order to agree on the location for temporary disposal of excavation materials and heavy machinery parks, ▪ Implement Detailed Construction Waste Management Plan (DCWMP), and put in operation waste management procedures to avoid inappropriate deposition of construction waste in and around the construction site, ▪ Re-use of excavated material on site, where possible.	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	Supervising engineer to supervise the implementation of DCWMP and re-use of excavated material at least once at week	Documented DCWMP DCWMP implemented throughout construction phase Records on consultations for temporary disposal of excavation materials Records on

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
						excavated material and material disposed on the landfill

8.13 Access restrictions

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Access restrictions						
8.13.1	Construction	▪ Access restrictions on local roads	▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on providing timely information to local communities on the extent of works and duration prior to the commencement of construction works	JPAC	Development of quarterly monitoring reports on SEP implementation Monthly review of external grievances	Reports on SEP implementation developed and submitted to EBRD (containing indicators on stakeholder engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry
			▪ Develop and implement a TPM for construction phase (as part of the CESMP) containing traffic	Contractor for construction / JPAC	JPAC to review Contractor's TMP to	Documented TMP (as part of

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			measures. The TMP will need to consider phasing of the works to ensure local access is retained, including public transport.	to include in the contractual agreement with the Contractor	ensure continuity with commitment in this ESMMP Supervising engineer to random check at least once per week during construction activities Complaints relating to access restriction	CESMP) TMP implemented throughout construction phase Log of complaints relating to access restriction
			▪ Construct new local roads for enabling local inhabitants to reach their land plots in case local roads are interrupted by the motorway section	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	Supervising engineer to random check at least once per week during construction activities	New local roads constructed

8.14 Road damage and impacts on local traffic

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Road damage and impacts on local traffic						
8.14.1	Construction	▪ Local road damage ▪ Traffic congestions	▪ Implementation of SEP for the section Mostar South-Tunnel Kvanj, in particular the provisions on providing timely information to local communities on the extent of works and duration prior to the commencement of construction works	JPAC	Development of quarterly monitoring reports on SEP implementation Monthly review of external grievances	Reports on SEP implementation developed and submitted to EBRD (containing indicators on stakeholder

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
						engagement) Project-specific grievance mechanism in place Grievance Registry established and all received grievances recorded in the Registry
			▪ Develop and implement a TPM for construction phase (as part of the CESMP) containing traffic management measures.	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	JPAC to review Contractor's TMP to ensure continuity with commitment in this ESMMP Supervising engineer to random check at least once per week during construction activities Complaints relating to road damages and traffic congestion	Documented TMP (as part of CESMP) TMP implemented throughout construction phase Log of complaints relating to road damages and traffic congestion
			▪ All local roads used for purpose of construction machines and vehicles movement should be fully restored to at least pre-project state, if traffic during the construction phase caused any damage	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	Supervising engineer to random check at least once per week during construction activities	Local and main road restored to at least pre-project state

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
8.14.2	Operation	▪ Traffic congestions	▪ Develop and implement a TMP for the operation phase (as part of the OESMP) to identify and address all major hazards for workers and the local community during the motorway operation. The Plan should also include details on safety and stakeholder engagement measures relating to road safety to be applied.	Contractor for maintenance / JPAC to include in the contractual agreement with the Contractor	JPAC to review Contractor's TMP to ensure continuity with commitment in this ESMMP Complaints relating to road damages and traffic congestion	Documented TMP (as part of OESMP) TMP implemented throughout operation phase Log of complaints relating to traffic congestion

8.15 Health and safety risks for workers

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Health and safety risks for workers						
8.15.1	Construction	▪ Direct impacts (falling from heights, traffic accident, power stroke, injuries from construction machinery, excavations and working in confined spaces etc.); ▪ Indirect impacts (emissions, soil and water contamination, etc.).	▪ Develop and implement a Fire and Explosion Management Plan and HS Plan (as part of CSOP) and implement specific HS measures (both occupational and community H&S) with special focus on (but not limited to): unexploded ordnances, installing safety fences and warning signs at all critical work areas (e.g. open trenches, excavations, material and equipment staging areas, etc.), movement of vehicles and traffic	Contractor (development and implementation of CSOP) Sub-contractors (implementation of CSOP)	JPAC to review Contractor's CSOP to ensure continuity with commitment in this ESMMP Supervising engineer to random check at least once per week during	Fire and Explosion Management Plan and HS Plan (as part of CSOP) developed and implemented Hazardous Materials Safety Plan as part of the H&S Plan

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
			management, influx of workers into the local area including general measures, health surveillance, code of conduct of workers etc.; sufficient provision of medical care facilities and resources for workforce; working at heights, working in confined spaces, working with hazardous material (e.g. explosives). management of electrical hazards, prevention of unintended ground movements and collapse, and biological hazards (poisonous snakes). ▪ Develop and implement a Hazardous Materials Safety Plan as part of the H&S Plan.		construction activities	developed and implemented OHS statistics reported monthly
8.15.2	Operation	▪ Direct impacts (falling from heights, traffic accident, accidents); ▪ Indirect impacts (air emissions and exhausted gasses).	▪ Include in OESMP and implement specific health and safety requirements for both the Company and the sub-contractor's personnel during the road operation and maintenance. It should include (but not be limited to): hazardous materials management, traffic accidents, traffic management, working at heights, working in confined spaces, electrical hazards, etc.	JPAC (development and implementation of OESMP) Contractor for maintenance / JPAC to include in the contractual agreement with the Contractor	JPAC to review contractual conditions of all sub-contractors to ensure continuity with commitment in this ESMMP	OESMP containing specific health and safety requirements for both the Company and the sub-contractor's personnel during the road operation and maintenance developed and implemented OHS statistics reported monthly

8.16 Danger from UXOs

No.	*Phase*	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
	Danger from UXOs					
8.16.1	Pre-construction	▪ Danger from UXOs	▪ Finalise the demining activities on land plots along the motorway section at chainage 8+950.00 to 9+125.00 ▪ Demine the land plots in Kajgin Kicin.	BHMAC	JPAC to obtain the approval/verification that the field does not have suspected areas and mine risks	Demining activities at chainage 8+950.00 to 9+125.00 and Kajgin Kicin finalised Approval/verification that the field does not have suspected areas and mine risks issued by BHMAC
			▪ Arrange the execution of construction works upon JPAC receives the approval/verification that the field does not have suspected areas and mine risks	Contractor	JPAC to submit a copy of the approval/verification that the field does not have suspected areas and mine risks to the Contractor	
8.16.2	Construction	▪ Danger from UXOs	▪ Pay special attention during the earth moving works and blasting works. ▪ In case of any doubt, stop the works and send the notification to BHMAC for consultations and further instruction	Contractor for construction / JPAC to include in the contractual agreement with the Contractor	Supervising engineer to random check at least once per week during construction activities	Construction works performed carefully in Kajgin Kicin and at the end of road section Works stopped in case of doubt related to potential UXOs presence on construction site

8.17 Cumulative impacts

Phase	*Impact to be addressed*	*Management/ Mitigation/ Enhancement*	*Responsibility*	*Monitoring*	*KPI*
Cumulative impacts					
Construction	Cumulative increase in noise level: Considering the noise generated by Airport Mostar, and existing noise caused by movement of vehicles on the main road M17and main road M6.1 to Nevesinje, and occasional noise from the railway, it can be expected that ambient noise levels will be increased compared to the present state.	▪ Implement the same measures as under *Noise*.	Same as under *Noise.*	Same as under *Noise.*	Same as under *Noise.*
Construction	Impact on water quality of Buna and Bunica and other ground sources in the area: cumulative effects on water quality from motorway construction are observed in conjunction with municipal wastewater discharge from surrounding settlements/ individual houses, as well as run-off discharge from M17 and M6.1.	▪ Implement the same measures as under *Water*.	Same as under *Water.*	Same as under *Water.*	Same as under *Water.*
Operation	GHG emissions	▪ Implement the same measures as under *Climatic factors*.	Same as under *Climatic factors.*	Same as under *Climatic factors.*	Same as under *Climatic factors.*
Operation	Increase in noise level	▪ Implement the same measures as under *Noise*.	Same as under *Noise.*	Same as under *Noise.*	Same as under *Noise.*

9 RESIDUAL IMPACTS

Residual impacts refer to those environmental and social effects predicted to remain after the application of mitigation measures, either in construction or operation phase. The following table summarise the **identified significant environmental and social impacts** and their assessment after implementation of mitigation measures.

Table 96. Assessment of impacts after mitigation

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
Habitats					
Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements	Moderate/ Significant	8.1.1	This impact will be fully mitigated, if the: ▪ Main Design is developed to include revitalisation of habitats after the construction is finalised with planting autochthonous plant species characteristic for the area (e.g. Oak trees on slopes) and prevent growing and spread of invasive species. ▪ Mitigation measures given in BMP are implemented.	No
	Lack of information on baseline for diagnostic species *Scorzonera villosa* on dry grasslands and chasmophytic vegetation	Moderate/ Significant	8.1.1	This impact will be fully mitigated, if the monitoring and mitigation measures given in BMP are implemented.	No
Construction	Habitat loss due to preparation of construction site and during the performance of construction works, fragmentation of habitats	Moderate/ Significant	8.1.2	With implementation of the proposed measures it is not possible to fully mitigate this measure. This impact is considered to be the project permanent impact.	Yes
	Potential additional disturbance of habitats	Moderate/ Significant	8.1.3	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No
Vegetation and flora					

Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements	Moderate/ Significant	8.1.5	This impact will be fully mitigated, if the: ▪ Main Design is developed to include Invasive Species Management Plan to prevent growing and spreading of invasive species. ▪ Mitigation measures given in BMP are implemented.	No
	Lack of up-to-date information on baseline for endemic flora	Moderate/ Significant	8.1.5	This impact will be fully mitigated, if the monitoring requirements and mitigation measures given in BMP are implemented.	No
Construction	Vegetation removal and clearance of flora species in the phase of preparation of construction site and during the performance of construction works	Moderate/ Significant	8.1.6	With implementation of the proposed measures it is not possible to fully mitigate this measure. This impact is considered to be the project permanent impact. However, the compensation tree planting and revegatation is proposed as part of the BMP.	Yes
	Destruction of vegetation and deforestation will lead to water runoff and soil erosion	Moderate/ Significant	8.1.6	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No
Fauna					
Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements	Major/ Significant	8.1.9	This impact will be fully mitigated, if the: ▪ Main Design is developed to include protective bird panels ▪ Main Design is developed to avoid any possible roosts, hibernations sites, migration routes for bats ▪ Mitigation measures given in BMP are implemented.	No
	Lack of up-to-date information on baseline for migratory birds, bats, invertebrates	Major/ Significant	8.1.9	This impact will be fully mitigated, if the monitoring requirements and mitigation measures given in BMP are implemented.	No
Construction	Disturbance of fauna species due to increased levels of noise, vibration and light in the zone of construction activities	Major/ Significant	8.1.10	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No

	Potential disturbance of nests/roosts of species that have a seasonally variable vulnerability due to breeding, feeding times or seasonal migrations, such as Short – toed Lark (*Calandrella brachydactyla*) and Sand Martin (*Riparia riparia*) or sensitive bat species in the project area	Major/ Significant	8.1.11	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No
	Potential fatalities or injuries of fauna species due to vegetation removal and movement of heavy machinery	Moderate/ Significant	8.1.12	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No
Operation	Potential collision of fauna species due to high speed of vehicles (bird species e.g. Sand Martin and Bee-eater, bat species, other small mammals, amphibians and reptiles)	Moderate/ Significant	8.1.13	If the Main Design is changed to include protective bird panels as given in this ESIA and BMP, the impact will be fully mitigated. Regarding the fencing of the motorway, the fence is considered at all technical standard at Corridor Vc sections. Recommendation regarding the type and maintenance of the fence given in BMP	No
Aquatic ecology					
Pre-construction	Adverse impacts due to inadequate planning of works and Main Design requirements	Major/ Significant	8.1.15	This impact will be fully mitigated, if the: ▪ Main Design is changed to avoid construction in the river bed, to avoid river training and to avoid any disturbance of rivers ▪ Mitigation measures given in ESAP and BMP are implemented.	No
Construction	Aquatic habitat loss due to removal of river banks vegetation in the phase of construction site preparation and during the performance of construction works	Major/ Significant	8.1.16	This impact will be fully mitigated, if the: ▪ Main Design is changed to avoid construction in the river bed, to avoid river training and to avoid any disturbance of rivers ▪ Mitigation measures given in BMP are implemented.	No

	Aquatic environment alternation due to performance of construction works Degradation of the riverbed	Major/ Significant	8.1.16	This impact will be fully mitigated, if the: ▪ Main Design is changed to avoid construction in the river bed, to avoid river training and to avoid any disturbance of rivers ▪ Mitigation measures given in BMP are implemented.	No
	Negative impacts on critically endangered and intolerant ichthyofauna species, endangered aquatic invertebrates and their habitat due to degradation of the aquatic habitats	Major/ Significant	8.1.16	This impact will be fully mitigated, if the: ▪ Main Design is changed to avoid construction in the river bed, to avoid river training and to avoid any disturbance of rivers ▪ Mitigation measures given in BMP are implemented.	No
Operation	Potential pollution of rivers in case of accidental situations in motorway traffic and leakages due to e.g. failure of oil separators	Moderate/ Significant	8.1.17	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No
	Potential negative impacts on sensitive aquatic species and degradation of their habitats in case of accidental situations in motorway traffic and leakages due to e.g. failure of oil separators	Moderate/ Significant	8.1.18	This impact will be fully mitigated, if the mitigation measures given in BMP are implemented.	No
Water					
Pre-construction	Lack of up-to-date information on baseline water quality in the project area	Moderate/ Significant	8.2.1	With adequate baseline monitoring carried out according to the recommendation in this Study this impact will fully be mitigated.	No
	Design solution for the bridges that requires construction activities in the river bed	Moderate/ Significant	8.2.2	If the Main Design is changed to avoid construction in the river bed, this impact will be fully mitigated	No
	Number of oil and grease separators for motorway drainage is not sufficient to ensure protection of the water quality in Buna and Bunica streams	Moderate/ Significant	8.2.3	With increase the number of oils separators to specifically cover the two bridges, this impact will be fully mitigated	No

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
Construction	Reduction in water quality in river systems due to: ▪ temporary localised diversion of drainage paths around construction camps and site workings ▪ Maintenance of construction vehicles at the site ▪ sediment release during bridge construction in river bed and on the banks ▪ depositing of construction waste, municipal waste and other special waste categories into the rivers ▪ localised discharges from construction facilities including concrete batching plant and workers camp	Moderate/ Significant	8.2.4	With development of CSOP, RCMP, CESMP, CWMP, DCWMP and implementation of all proposed measures that also include good practice construction, this impact will be fully mitigated	No
Construction/ Operation	Reduction in water quality in river system resulting from: ▪ direct release of intercepted surface run-off ▪ direct release of sanitary water from toll station ▪ accidental spill of hazardous material resulting from traffic accidents.	Moderate/ Significant	8.2.5	With development of OESMP that include Emergency Preparedness and Response Plans and implementation of all included measures, this impact will be fully mitigated	No
Air quality					

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
Pre-construction	Lack of up-to-date information on baseline air quality in the project areas	Moderate/ Significant	8.3.1	With adequate baseline monitoring carried this impact will fully be mitigated.	No
Construction	Reduction in air quality due to: ▪ Emissions of construction dust ▪ Emission of the dust from concrete batching plant ▪ Emission of exhaust gases from combustion processes in generators and other construction equipment /vehicles.	Moderate/ Significant	8.3.2	With development of CESMP that include Air Quality Management Plan, Topsoil Management Plan, Materials Management Plan, and implementation of all included measures, this impact will be fully mitigated	No
Land					
Pre-construction	Lack of up-to-date information on baseline soil quality in the project areas	Moderate/ Significant	8.4.1	With adequate baseline monitoring carried this impact will fully be mitigated.	No
Construction	Reduction in soil quality due to: ▪ Damage to topsoil ▪ Deforestation ▪ Soil dewatering ▪ Direct discharge of wastewater from maintenance of construction vehicles at the site and sanitary waters from construction camp ▪ Inappropriate waste disposal	Moderate/ Significant	8.2.4 8.4.2 8.8.1	With development of CESMP that includes Topsoil Management Plan and Recultivation/Land Restoration Plan and Spill Management Plan, and implementation of all included measures, including those foreseen for water and waste management, this impact will be fully mitigated	No
Operation	Reduction in soil quality along the route as a result of: ▪ direct discharge of surface run-off ▪ accidental fuel and oil spills	Moderate/ Significant	8.2.5 8.4.3 8.8.1	With development and implementation of OESMP that includes proposed measures from this ESMMP, and implementation of all measures that are proposed for waste and waste management, this impact will be fully mitigated	No

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
Climatic factors					
Pre-construction / Construction	Low resilience to climate variability and climate change	Moderate/ Significant	8.5.1	With review of detailed design to include climate resilient construction measures as well as the construction of resilient structure this impact will be fully mitigated.	No
Operation	GHG emissions from vehicle transport	Moderate/ Significant	8.5.2	With implementation of the proposed measures it is not possible to fully mitigate this impact. This impact is considered to be the project life-long impact but its significance will decrease with continuous improvements on the car engine technology	Yes
Existing material assets including cultural-historical and archaeological heritage					
Construction	Damage to visible and buried cultural, archaeological and architectural heritage during execution of construction works and movement of machines/vehicles around the construction site	High/ Significant	8.6.1	With preventive archaeological surveys and proper Chance Find Procedure in place this impact will be fully mitigated.	No
Noise					
Construction	Impact on workers and residents from increased levels of noise during construction works	Moderate/ Significant	8.7.1	With implementation of CESMP that includes proposed noise reduction measures from this ESMMP, this impact will be fully mitigated	No
Operation	Impact on residents from increased levels of noise from motorway traffic	Moderate/ Significant	8.7.2	With appropriate modelling of noise propagation and installation of the noise barriers based on the modelling result this impact will be fully mitigated.	No
Waste and materials management					
Construction	Contamination of environment due to leakage and spillage of wastes associated with poor spoil and waste handling and storage/disposal arrangements	Major/ Significant	8.8.1	With full implementation of Detailed CWMP and Waste Management Plan this impact will fully be mitigated.	No
Construction	Environmental damage caused by illegal material sourcing	Major/ Significant	8.8.2	With appropriate environmental assessments and permitting / or subcontract the licenced	No

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
				material providers this impact will be fully mitigated	
Community impacts					
Construction	Worker influx	Moderate / Significant	8.9.1	With implementation of the proposed measures to reduce the potential for impacts from worker influx such as awareness raising activities on communicable diseases and GBVH and implementation of provisions on workers' accommodation (camps) in accordance with PR provisions and the EBRD/IFC Guidance Note "Workers' accommodation: processes and standards" 2009, this impact will be fully mitigated.	No
	Community health and safety and road safety	Moderate / Significant	8.9.2	With implementation of the proposed measures to reduce the potential for impacts on community health and safety and road safety, among which development and implementation of Emergency Preparedness and Response Plan and Traffic Management Plan, this impact will be fully mitigated.	No
Operation	Loss of employment of temporary engaged workers	Moderate / Significant	8.9.5	As a result of the temporary employment during the construction period is the loss of employment upon the end of construction works. This impact will be fully mitigated if mitigation measures are fully implemented.	No
Land acquisition and physical displacement					
Pre-construction	• Land acquisition • Physical displacement	Major / Significant	8.10.1	Land take and loss of land plots and houses represent a residual impact due to the land acquisition activities which will be performed during the pre-construction phase. This impact is not significant taking into consideration all measures foreseen and compensation entitlements contained in the LALRP for the Section Mostar South-Tunnel Kvanj. The compensations are in line both with the local legislation and	Yes

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
				with EBRD PR 5.	
Economic displacement					
Pre-construction	• Loss of place of business • Loss of business income • Loss of livelihoods of the land owners	Major / Significant	8.11.1	Loss of place of business and loss of livelihood represent the residual impacts due to the economic displacement. This impact is not significant taking into consideration all measures foreseen and compensation entitlements contained in the LALRP for the Section Mostar South-Tunnel Kvanj. The compensations are in line both with the local legislation and with EBRD PR 5 and according to LALRP livelihoods and standards of living of affected persons shall be improved or at least restored. In addition to monetary compensation measures LALRP foresees that JPAC will cooperate with Regional Development Agency for Herzegovina (REDAH) which provides assistance to local and regional partners in designing, implementing and preparing projects with regard to entrepreneurship, rural development and agriculture.	Yes
Construction	Temporary losses of business income during construction works	Moderate / Significant	8.11.2	LALRP for Mostar South-Tunnel Kvanj contains mitigation measures proposed to mitigate the potential for impacts from temporary losses of business income during construction works. If LALRP and its mitigation measures are implemented this impact will be fully mitigated.	No
Health and safety risks for workers					
Construction	• Direct impacts (falling from heights, traffic accident, power stroke, injuries from construction machinery, excavations and working in confined spaces	Moderate / Significant	8.15.1, 8.2.4, 8.2.5, 8.3.2, 8.7.2	Several mitigation measures are proposed for mitigate any possible impact on workers health and safety during construction phase. Among the measure are also the ones oriented at mitigating impacts on air quality, noise and water. If all mitigation measures are implemented the residual impacts will be fully mitigated.	No

Phase	*Identified impact*	*Impacts evaluation/ significance before mitigation*	*Proposed mitigation measures*	*Assessment of impacts after mitigation*	*Residual Impact after mitigation (yes/no)*
	etc.); • Indirect impacts (emissions, soil and water contamination, etc.).				
Danger from UXOs					
Pre-construction	Danger from UXOs	Moderate / Significant	8.16.1	Adequate mitigation measures are proposed for mitigate any possible impact related to the danger from UXOs during pre-construction phase. It will be necessary to arrange the execution of construction works upon JPAC receives the approval/verification that the field does not have suspected areas and mine risks. Upon the completion of demining activities and obtaining the approval that the field does not have suspected areas and mine risks, the residual impacts of the pre-construction phase will be fully mitigated.	No
Construction	Danger from UXOs	Moderate / Significant	8.16.2	As for the pre-construction phase, mitigation measures are proposed for mitigate any possible impact related to the danger from UXOs during construction phase. Upon the implementation of such measures (such as, stopping works in case of any doubt regarding possible UXOs and notifying to BHMAC) the residual impacts of the Project construction phase will be fully mitigated.	No

As a conclusion, the residual impacts of the project are mainly related to permanent increase of air emissions from motorway traffic, especially GHGH emissions, permanent land take, landscape changes. Concerning the biodiversity loss, it is considered that after applying specific mitigation measures as given in BMP (i.e. avoiding of planning of access roads over the area of identified colonies and roost sites (if found) and installation of protective panels as well as proposed changes to the design of the bridges, avoiding the planned training of both watercourses to avoid any disturbance to watercourses during construction) and avoiding any bat roost sites (if found) no residual impacts are expected, except the terrestrial habitat loss.

Residual impacts are not expected to be significant taking into consideration climate characteristics in the area, climate change prognosis for the country, willingness of resident to receive compensation for the land taken and significance of the project for the country and its citizens.