



Infrastructure Projects Facility in the Western Balkans TA-BiH-03 Plava Voda Regional Water Supply System



Environmental Impact Assessment and Social Impact Assessment Report

June 2011



Document Control Sheet

Client: European Commission
European Bank for Reconstruction and Development
Council of Europe Development Bank

Project: Infrastructure Projects Facility in the Western Balkans

Assignment Title: Plava Voda Regional Water Supply System
Draft Environmental Impact Assessment and Social Impact Assessment

Contract Number CN 2008/157-799, 2008/157-807, 2008/158-121 and CN 2010/241-182

Task No TA – BiH – 03

	Prepared by	Reviewed by	Approved by
ORIGINAL	NAME	NAME	NAME
	Irem Silajdžić Erna Zildžović	Aleksandra Ploco Sohail Hassan	Sohail Hassan
DATE	SIGNATURE	SIGNATURE	SIGNATURE
July 2010			

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE
April 2011			

REVISION	NAME	NAME	NAME
DATE	SIGNATURE	SIGNATURE	SIGNATURE



Contents

1	INTRODUCTION	3
1.1	STUDY BACKGROUND	3
1.2	THE NEED FOR THE PROJECT	3
1.3	ENVIRONMENTAL AND SOCIAL GOALS AND OBJECTIVES.....	4
1.4	METHODOLOGY.....	4
1.5	NATIONAL LEGAL REQUIREMENTS.....	5
2	DESCRIPTION OF THE PROPOSED PROJECT	6
2.1	INTRODUCTION.....	6
2.2	TRANSPORT PIPELINE ROUTE	6
2.2.1	Short review of the route.....	6
2.2.2	Main transportation pipeline route	7
2.2.3	Branches.....	10
2.2.4	Transitions	12
2.3	OBJECTS ABOVE THE GROUND	16
2.3.1	Objects on Plava Voda spring	16
2.3.2	Pumping stations	17
2.3.3	Water tanks.....	18
2.4	CONSTRUCTION WORKS	20
3	BASELINE DATA OF ENVIRONMENTAL AND SOCIAL CONDITIONS.....	22
3.1	POTABLE WATER SOURCE, SUPPLY AND DISTRIBUTION	22
3.1.1	Travnik	22
3.1.2	Novi Travnik	28
3.1.3	Vitez.....	32
3.1.4	Busovača	38
3.1.5	Zenica	42
3.2	SOCIO-ECONOMIC PROFILE	48
3.2.1	Demographic data Demographic Profile.....	48
3.2.2	Ethnic mix	49
3.2.3	Population projections	54
3.2.4	Population projections available from Municipal Spatial Plans	56
3.2.5	Household size	64
3.2.6	Structure of Employment	64
3.2.7	Employment and Wages	65
3.2.8	Consumer Affordability	66
3.2.9	Public health	68
3.2.10	Identification of directly affected and vulnerable groups	69
3.2.11	Public amenities	72
4	DESCRIPTION OF THE ENVIRONMENT	73
4.1	CLIMATE	73
4.2	GEOLOGY	74
4.2.1	Introduction	74
4.2.2	Litostratigraphic characteristics	74
4.2.3	Tectonic characteristics	76
4.3	HYDROLOGICAL DATA AND QUALITY OF SURFACE WATERS	78
4.3.1	Introduction	78
4.3.2	“Plava voda” spring.....	79
4.3.3	Lašva River.....	80
4.3.4	Bosna River	86
4.4	FLORA	88
4.5	FAUNA.....	89



4.6	AIR QUALITY.....	90
4.7	SOIL AND AGRICULTURAL LAND	90
4.8	PROTECTED NATURAL AREAS.....	94
4.9	CULTURAL-HISTORICAL HERITAGE	95
4.10	INFRASTRUCTURE	96
4.11	NOISE	96
4.12	MINES	96
5	ANALYSIS OF ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS OF THE PROJECT...97	
5.1	ENVIRONMENTAL IMPACT ASSESSMENT	97
5.1.1	<i>Stability of the terrain.....</i>	97
5.1.2	<i>Water quality.....</i>	99
5.1.3	<i>Impacts on flora and fauna</i>	102
5.1.4	<i>Impact on air quality.....</i>	105
5.1.5	<i>Impact on soil quality</i>	105
5.1.6	<i>Impact on infrastructure</i>	108
5.1.7	<i>Level of noise.....</i>	109
5.2	SOCIAL IMPACTS ASSESSMENT.....	110
5.2.1	Impact on affected people and vulnerable groups	110
5.2.2	<i>Impacts on public health</i>	112
5.2.3	<i>Impact on public amenities</i>	113
5.2.4	<i>Economic Impact</i>	115
5.3	PROJECT RISKS.....	117
5.4	CONSULTATION REQUIREMENTS.....	118
6	ENVIRONMENTAL AND SOCIAL ACTION PLAN (ESAP)..... 120	
6.1	ENVIRONMENTAL MITIGATION MEASURES	120
6.2	SOCIAL IMPACTS MITIGATION MEASURES	130
6.3	MONITORING PLAN	133
6.4	MONITORING AFFORDABILITY	140
6.5	FEASIBLE AND ACHIEVABLE INSTITUTIONAL COVENANTS	141
6.6	MECHANISMS FOR ANCHORING THE COMPANY INTO SOCIETY.....	142
6.7	CAPACITY BUILDING PROGRAMS	142
7	ALTERNATIVES	144
7.1	“No PROJECT” OPTION.....	144
7.2	ALTERNATIVE ROUTES	144
8	DIFFICULTIES DURING PREPARATION OF THIS PROJECT	150
9	LAND ACQUISITION ISSUES	151
9.1	LEGAL FRAMEWORK FOR EXPROPRIATION IN FBiH	151
9.2	OTHER FBiH LEGISLATION RELEVANT FOR EXPROPRIATION	151
9.3	FBiH EXPROPRIATION PROCEDURE	152
9.4	EBRD EXPROPRIATION PROCEDURES	155
9.5	GAP ANALYSIS AND PROPOSED RESPONSE	156
9.6	LAND ACQUISITION ISSUES RELATED TO “PLAVA VODA” SYSTEM	157
	COMPARISON OF FBiH LEGISLATION AND EBRD PROCEDURES	157
10	APPENDICES	161



1 INTRODUCTION

1.1 Study background

This EIA study is prepared within the context of a major investment project of the Plava Voda Regional Water Supply, which is being considered for financing by a parallel loan from the European Bank for Reconstruction and Development ("EBRD") and Council of Europe Development Bank ("CEB").

The main purpose of these loans would be to finance eligible costs for the construction of the water intake structures at the Plava Voda spring in the Municipality of Travnik, the construction of the main transport pipeline from the spring to Zenica Municipality (approx. 33 km), and facilities to enable connections to the existing water distribution networks in these municipalities. The pipeline would be designed to be able to service other municipalities along its route, namely Novi Travnik, Vitez and Busovača.

EBRD and the State of Bosnia and Herzegovina ("the State") have agreed to finance priority investment projects in municipal infrastructure under a sovereign guarantee framework. To this effect, a protocol called Municipal Infrastructure Finance Facility (MIFF) was signed between the Bank and the State representatives in December 2004, defining intentions of the parties as well as the selection and eligibility criteria for project selection. A preliminary list of priority investment projects was enclosed to the MIFF including Plava Voda Regional Water Supply project that is of interest to five municipalities: Travnik, Novi Travnik, Vitez, Busovača and Zenica ("the municipalities").

Pursuant to the MIFF, the loan agreement will be signed between the State of Bosnia and Herzegovina and the EBRD. The State shall then enter into subsidiary loan agreement with the Federation of Bosnia and Herzegovina and the Federation of Bosnia and Herzegovina shall enter into subsidiary loan agreement with the "Special Purpose Company Plava Voda" ("the Company") in order to lend the proceeds of the loan to the Company under the same terms and conditions as set forth in the loan agreement.

According to current agreements, the existing Utilities from each of the five municipalities shall enter into Off-take agreements with the Company, in form and substance satisfactory to the Bank, to enable the Company to achieve full cost recovery (including financial costs and a margin to meet financial ratios to be agreed with the Bank) throughout the lifespan of the project.

The municipalities shall enter into a Project Support Agreement (PSA) with the EBRD and make a cash contribution to the project to cover the costs that are not eligible for the Bank's financing (such as VAT, land acquisition, operating expenditures of the Company until completion). The PSA shall, among other things, guarantee the payments under Off-take agreements to the Company from their respective Utilities.

1.2 The need for the project

The purpose of "Plava Voda Regional Water Supply" project is to extend water exploitation from the Plava Voda spring, located in the town of Travnik (which currently uses it to a limited extent for local water supply), to serve other three municipalities in the Central Bosnia Canton (Novi Travnik, Vitez and Busovaca), as well as the municipality of Zenica, in the neighbouring Zenica-Doboj Canton. There is a high demand for clean and efficient supply of water in the above-mentioned municipalities.



Thus, the ultimate aim of the “Plava Voda Regional Water Supply System” project is to satisfy the needs of concerned population by providing reliable long term water supply through joint effort of the involved Municipalities.

1.3 Environmental and social goals and objectives

The EBRD is committed to promoting “environmentally sound and sustainable development” in the full range of its investment and technical cooperation activities. All EBRD-financed projects undergo environmental and social appraisal both to help the EBRD decide if an activity should be financed and, if so, the way in which environmental and social issues should be addressed in planning, financing, and implementation. EBRD categorises proposed projects as A/B/C/FI based on environmental and social criteria.

The main objective of this environmental and social due diligence is to assess the environmental and social impacts and risks associated with the proposed project and recommend measures to ensure compliance with national and/or European Union standards. The investigation is also to result in recommendations on measures to mitigate the negative impacts and enhance the environmental and social benefits.

The environmental and social goals were identified as follows:

- Installation, operation and maintenance of the Plava Voda water supply system will be conducted in a safe, efficient, environmentally sensitive and cost effective manner;
- Stringent control of emissions to the environment during construction phase will be performed;
- The environment along the route used will be restored to previous condition after construction phase;
- The project will avoid damage to natural protected areas or protected historical and archaeological resources;
- The project will avoid resettlement of local population;
- The project will avoid permanent disruption to the livelihoods of the local population.

1.4 Methodology

The main tasks undertaken in the assessment process were:

- Collection of baseline data on environmental and social conditions including collection of documents, site visits, and consultations with stakeholders;
- Data analysis and description of existing situation;
- Analysis of environmental and social impacts;
- Development of Environmental and Social Action Plan (ESAP).

Baseline data was collected from previous relevant studies done for Plava Voda regional water supply system, spatial plan and other development documents from the municipalities and water utilities, as well as Preliminary Design Study of main transport pipeline and its branches.

Site visits were conducted to screen the route and to determine environmental and social conditions in the region. Local consultations have taken place with officials from the municipalities, representatives of water utilities, fisherman associations as well as restaurant owners along “Plava Voda” watercourse in Travnik Municipality.



With regard to the impact assessment methodology, environmental and social impacts were assessed in the phase of construction, operation and decommissioning and appropriate mitigation measures proposed in form of ESAP. Impact analysis is done using best practice documents and legislation on emission standards.

1.5 National legal requirements

National legislation in Federation B&H is enforcing Environmental Impact Assessment (EIA) as a part of environmental permitting procedure for installations that have or might have negative impact on environment. The EIA procedure is detailed in the *Law on Environmental Protection* (Official Gazette of FB&H, No. 33/03) and *Law on Amendments to the Law on Environmental Protection* (Official Gazette of FB&H, No. 38/09), Articles 53-64 and 16-24. The list of installations for which EIA and environmental permit are obligatory is found in the *Rulebook on Plants and Installations for which the Environmental Impact Assessment is Obligatory and the Plants and Installations which may be Constructed and Put into Operation only if Entitled the Environmental Permit* (Official Gazette of FB&H, No. 19/04”).

According to the article 4 dž) of the Rulebook “Groundwater abstraction activities or artificial groundwater recharge schemes in cases where the annual volume of water to be abstracted or recharged amounts to 3 million cubic metres or more” is considered a project for which EIA is obligatory.

According to the Long-term Water Supply Program (Institute for Water Management, 1987), Balance of Ground Waters (Institute for Geology, 1985) and Draft Water Management Strategy (Institute for Water Management Sarajevo and Institute for Water Management Mostar, 2010) Plava Voda is considered to be a karst aquifer and current water intake is referred to as overflow spillway from the underground accumulation. According to interpretation of responsible Ministry of Environment and Tourism this project foresees abstraction of groundwater of more than 3 million cubic meters. EIA procedure with the responsible ministry was initiated in September 2010.

According to the Article 109 of the *Law on Water* (Official Gazette of FB&H, No. 70/06) water abstraction for the purpose of domestic water supply is considered as a project that needs to obtain relevant water acts including preliminary water agreement, water agreement and water permit.



2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 Introduction

Plans for implementing the “Plava voda regional water supply system” project have existed for many years. Hydrological investigations were performed in 1972, a detailed design was prepared in 1988, and “Special Purpose Company Plava Voda” was founded in 1990.

The war brought implementation to an end and activities have been restarted in 2004 following signing of Municipal Infrastructure Finance Facility protocol. In 2007, EC founded preparation of Feasibility Study that analysed current conditions in Public Utilities concerned, water balance and participation scenarios, financial and economic issues, legal and institutional issues as well as environmental impacts on Plava Voda and Lašva watercourses.

Following the completion of Feasibility Study, in 2009 EC approved funding for project “Plava voda regional water supply system” (“ the EC project”) that works on preparation of all necessary background documents needed to operate the loan and start construction of Plava Voda regional water supply system including economics of the project, environmental and social due diligence, development of design, legal advice and assistance with establishment of the Company, and permits and licences. While Municipality of Zenica is unquestionably taking part in this project, Municipal Councils of municipalities Novi Travnik, Busovača, and Travnik on their meetings held in April 2010, as well as Mayor of Vitez Municipality, once again confirmed their need for water and participation in the project.

All municipalities confirmed that maximum water need in the planning period till 2022 is 550 l/s, divided between municipalities as follows:

- 80 l/s for Travnik Municipality (40 l/s for Dolac n/l and 40 l/s for Nova Bila),
- 40 l/s for Novi Travnik Municipality,
- 40 l/s for Vitez Municipality,
- 40 l/s for Busovača Municipality,
- 350 l/s for Zenica Municipality.

The Preliminary Design of Regional Water Supply System is finalised in July 2010 when this Study was prepared.

2.2 Transport pipeline route

2.2.1 Short review of the route

The following description of water supply system route and accompanying structures is taken from “Preliminary Design of Regional Water Supply System Plava Voda” prepared in July 2010 in the framework of the EC project.

The route of the transport pipeline begins at the Plava Voda spring in Travnik Municipality, and it then passes through the parts of Travnik, Vitez, Busovača and Zenica Municipalities. In the Municipalities of Travnik, Vitez and Busovača, the route is largely located along the old railroad “Jajce - Donji Vakuf”. In the area of Zenica Municipality, the route is in one part



passing along the “Šamac-Sarajevo” railroad, and “Doboj-Kaonik” road, up to the Janjići village, where it crosses the M17 trunk road and the Bosna River, and goes up toward the “Putovići” water tank in Zenica Municipality. The diameter of the transport pipeline is d 700 mm for the 21,901.22 m and d 600 mm for the 11,096.33 m, of its length, while nominal pressures are NP10, NP 16 and NP 20. The plan is for polyester pipes (GRP- glass-reinforced plastic) to be used for the transport pipeline. Layout of the route is given in Annex 1.

2.2.2 Main transportation pipeline route

Section from the Plava Voda spring to the connection for Dolac n/l

The length of the section of transport pipeline from the Plava Voda spring to the connection for Dolac na Lašvi is 1,427.6 m. One crossing over the M5 trunk road has been foreseen here and one crossing over the Lašva River, by suspension onto the existing bridge.

From the outlet at the dam of the Plava Voda spring, the pipeline goes along the local road in the length of 202 m, in the concrete trench, from where it is passing along the pedestrian path up to the bridge over the Lašva River (Figure 1). After crossing over the bridge, the pipeline is entering the local road by the madrasah in Travnik, and then it comes to the M5 trunk road, it crosses over it, and goes along the Mostarska Street, at the end of which there is a connection for the Dolac na Lašvi.



Figure 1. Crossing over the Lašva River with suspension in Travnik

The section from the connection for Dolac n/l to the connection for Novi Travnik and Nova Bila

The length of the section of transport pipeline from the connection for Dolac na Lašvi to the connection for Novi Travnik and Nova Bila is 3246.87 m and 3296.27m respectively. One crossing over the Lašva River has been foreseen here, by suspension onto the existing bridge, and one crossing of the M5 trunk road.

After the connection for Dolac na Lašvi, the transport pipeline is crossing over the Lašva River, by suspension onto the existing bridge (Figure 2), where it crosses the M5 trunk road. After crossing over the M5, the pipeline goes along the gullies of the M5 trunk road, up to the turning point for Guća Gora. From this point, the pipeline is going along the route of the old “Jajce-Donji Vakuf” railroad, passing through the Puticevo and Prahulje settlements, where the connection for Novi Travnik is located, followed by the connection for Nova Bila, which is

located 50 m further. On this section, there is an old railroad, along which the route of the transport pipeline is passing, which is in some places turned into the local roads.



Figure 2. Bridge over the Lašva River, after the connection for “Dolac na Lašvi”

Section from the connection for Nova Bila to the connection for Vitez

Length of the section of transport pipeline from the connection for Nova Bila to the connection for Vitez is 10,466.09 m. The route is mainly located on the old railroad. One crossing over the Bila River is foreseen on this section, by suspension of the pipes over the bridge on the M5 trunk road. From the connection for Nova Bila, to T139, the route is crossing over several smaller culverts or bridges of the old railroad.

On the reach from T139 to T157, the route of the pipeline is bypassing the route of the old railroad, as different structures have been built on it, and their yards are located by the M5 trunk road. The route is passing behind these structures, in one part along the asphalted areas, and in the other along the arable areas.

On the reach T 157 – T 158 the pipeline is crossing over the Bila River by suspension of the pipes onto the bridge on the M5 trunk road (Figure 3), from where, in a short section, it continues along the M5 trunk road, and by means of a local road, it enters the Grbavica settlement, from which it returns to the old railroad.

From T166, the pipeline route goes along the old railroad route up to the connection for Vitez, which is located near the underpass of the old railroad, at the point T213 (Figure 6).



Figure 3. Crossing of the pipeline over the Bila River by suspension

Section from the connection for Vitez to the connection for Busovača



The length of the transport pipeline from the connection for Vitez to the connection for Busovača is 6,711.23 m and 676.15 m. On this section, crossing over the M5 trunk road has been foreseen, one crossing over the Lašva River, and one over the Kozica River.

After the connection for Vitez, the transport pipeline of the regional water supply system continues along the route of the old railroad, along the M5 trunk road, and then it crosses over it within section T219 -T220 and reaches the fence of the complex of “Impregnacija” company. Afterwards, it crosses the Dubrovački stream by suspension, and then it extends through the arable areas toward the Ahmići settlement, reaches the Lašva River and crosses it by suspension onto the existing bridge (Figure 4).



Figure 4. Crossing over the Lašva River in Vitez Municipality

After this crossing, the route of the transport pipeline continues along the railroad through the settlements of Selišta and Sajtovići to the road leading to Busovača. The pipeline route crosses this road, then the Kozica River, by suspension onto the existing steel bridge of the old railroad (Figure 5), after which the connection for Busovača is located.



Figure 5. Crossing over the Kozica River in Busovača Municipality

Section from the connection for Busovača to the water tank in Putovići (Zenica Municipality)



The length of the transport pipeline from the connection for Busovača to the water tank in Putovići is 10,420.16 m. One crossing over the Lašva River has been foreseen on this section, as well as one crossing of the M17 trunk road and one crossing below the Bosna River by means of inverted siphon.

From the connection for Busovača, the alignment continues along the old railroad through the settlements of Sajtovići, Katići and Merdani. On the Lašvanska intersection, the route is crossing over the Lašva River by suspension onto the existing bridge structure, and it continues parallelly with the existing railroad Šamac – Sarajevo, to the point T380. The pipeline branches off the railroad and continues along the local road “Doboj – Kaonik” to the Janjići settlement. From the Janjići settlement, at points T402 - T403 (the route is passing below the railroad, over the M17 trunk road, and on the reach T406-T407 it passes through the inverted siphon below the Bosna River, which will be the subject of further geodetic surveys within the Detailed Design.

On the section of the pipeline route, two route alternatives have been proposed. More favourable alternative will be adopted after finalisation of the geodetical and geotechnical study. Alternative 1 is using the existing earth road which is located within a cutting over the steep slope. Alternative 2 is the preferred alternative, as the excavations in the cutting over the slope would be avoided, and the existing earth road could, after certain works, be used as the access road. After this section, the pipeline route enters the Putovići settlement, through the arable areas, and, going along the local asphalted road, it enters the Putovići reservoir.

2.2.3 Branches

The total length of the branches (connections for the local water supply systems) for Dolac n/l, Novi Travnik, Nova Bila, Vitez and Busovača, is approx. 15,330.36 m. It has been foreseen for these branches to use the polyethylene pipes (PE).

For all branches, the pumping to the existing or new distribution water tanks (new water tank Dolac – Dolac n/l, new water tank Pribilovići – Novi Travnik, the existing water tank Kula – Nova Bila, existing water tank Hrastova Glavica - Busovača, new water tank Kula - Busovača) has been foreseen, except for the branch for Vitez, where the pumping toward the existing, Gradina water tank has been planned.

The total length of the branch for Dolac n/l is 509.36 m. The first section up to the pumping station is 186.68 m long while the second section behind the pumping station is 301.9 m long.

Branching begins in Mostarska Street in Travnik Municipality, from where the pipeline is passing between the existing car repair shop and the concrete elements plant. Behind the concrete elements plant, the location for the pumping station has been foreseen. Immediately behind the pumping station, the pipeline is climbing up the Gradac Hill, to the location foreseen for the new “Dolac na Lašvi” water tank, which is located behind the plateau of the Gradac Hill.

According to the information obtained from the representatives of Water Utility Company in Travnik, the plan is to connect the new water tank with the existing distribution network in the Dolac na Lašvi settlement, using the 2,075 m long pipeline.

The total length of the branch for Novi Travnik is 6737,54 mm, of that first section is 3311,06 m, the second section behind the pumping station is 2322,05 m long, while the third section is 1104.43 m long.



On this section, one crossing over the M5 trunk road has been foreseen, and one crossing over the Lašva River by suspension over the existing bridge.

Branching begins with turning from the main route of the old railroad in the Prahulje settlement in Travnik Municipality, from where the route is crossing over the M5 trunk road, and it is entering into the Nevića Polje. Going along the Gornji Vakuf - Travnik road, it reaches the bridge on the Lašva River, which it crosses by means of suspension. The next section of the pipeline is going through the pedestrian path along the road through Stojkovići settlement, in which the pumping station has been foreseen, up to the Budišići settlement on the entrance into the town of Novi Travnik. In Budišići, it crosses the Gornji Vakuf – Travnik road, and it is passing by the local road in the settlement. On the exit from Budišići, it branches off the local road toward the Pribilovići Hill, up to the location foreseen for the water tank. From the Budišići settlement up to the foreseen water tank, the route is located partially along the old railroad, and partially along the local road.

According to the information from the representatives of Water Utility Company in Novi Travnik, the connection of the new water tank with the existing distribution network in Novi Travnik has been foreseen, using the pipeline approximately 480m long.

The total length of the branch for Nova Bila is 777.9m, where the first section to the pumping station is 392.12m long and the second section behind the pumping station is 385.78m long.

Connection for Nova Bila is located in the Prahulje settlement. The route of the branch mostly extends through the arable areas to the location of newly constructed water tank Kula, which was not in use during development of this design. Location of the foreseen pumping station is marked in Annex 1.

The length of the branch for Vitez is 2, 080.85m, where the first section is 1,752.11 m long and the second section, which reaches the reservoir is 328.74 m long.

Within this section, the crossing of the main road has been foreseen in two locations in the town of Vitez, and one crossing over the Lašva River by suspension over the existing bridge.

The connection for Vitez is located at the point T213 (Figure 6). From the location of branching from the transport pipeline, the connection pipeline continues below the underpass of the old railroad and the M5 trunk road. For a short section, the route goes along the M5 trunk road and enters the road that leads to the town of Vitez. Going along the road, the route is crossing the bridge over the Lašva River by means of suspension. The route is further laid along the macadam road next to the stadium, and then, through the green areas, it reaches the main road, crosses it, and continues along the pedestrian path in the Žrtava Fašizma Street. Further on, the route is climbing up to the existing Gradina water tank. No pumping station has been foreseen here.



Figure 6. Place of the connection for Vitez

It is planned for the **branch for Busovača** to contain one branch to the existing Hrastova Glavica water tank, from which, in the location of the nursery garden, one branch leads to the location of the new Kula water tank.

The total length of the branch to the Hrastova Glavica water tank is 3,805.19 m, where the first section is 627.66m long, second section, up to the nursery garden, is 1632.23 m long, third section, up to the pumping station, is 1,422.93m long, and fourth section, from the pumping station to the Hrastova Glavica water tank is 122.37 m long.

The total length of the branch from the nursery garden to the location of the new Kula water tank is 1,419.51m, where the first section up to the pumping station is 217.45 m long, second section, behind the pumping station is 966.11m long, and third section that is entering the Kula water tank is 235.95 m long.

On the section toward Hrastova Glavica, one crossing below the Kozica River has been foreseen.

From the nursery garden toward the Hrastova Glavica, the route is passing through the arable areas, then below the Kozica River. Afterwards, it continues along the arable areas, and then enters the town of Busovača where it crosses the Ivica Marušića Street on the entrance into the town. Passing through the Kadića Strana settlement, it climbs toward the hill and the Hrastova Glavica water tank.

From the nursery garden, the route for the Kula water tank is passing through the arable land and forest in the Kula settlement, and reaches the location foreseen for the Kula reservoir.

On the pipeline for Hrastova Glavica and Kula water tanks, the pumping stations have been foreseen.

According to the information obtained from the representatives of Busovača Water Utility Company, the connection of the new Kula water tank with the existing distribution network, by means of the approx. 1384m long pipeline has been foreseen

2.2.4 Transitions

The short review of significant transitions is given in the table below



Table 1. Main Transitions

MAIN TRANSPORT PIPELINE		
Chainge	Barrier	Type of crossing
ch 0+326,90+355,57	river Lašva	suspension on the bridge
ch 1+455,69	river Lašva	suspension on the bridge
ch 1+455,69 – 1477,51	trunk road M5 Busovača Travnik	digging of the trench below the road
ch 1+487,78 – 1500,43	trunk road M5 Busovača Travnik	digging of the trench below the road
ch 3+771,52 - 3+779,48	Nameless intermittent stream	suspension on the culvert
ch 4+085,1 - 4+090,63	Nameless intermittent stream	suspension on the culvert
ch 5+218,87 - 5+228,05	Nameless intermittent stream	suspension on the culvert
Ch 6+088,25 – 6+096,74	Gučanski stream	suspension on the culvert
ch 6+324,25 - 6+429	local road in settlement Trgovišća	digging of the trench below the road
ch 6+553,99 - 6+627,19	local road in settlement Trgovišća	digging of the trench below the road
ch 7+458,08 -7+469,90	local road for Stara Bila	digging of the trench below the road
ch 7+805,53 -7+818,53	Nameless intermittent stream	suspension on the culvert
ch 8+010,4 – 8017,70	local road	digging of the trench below the road
Ch 8+050,77 – 8+062,88	Nameless intermittent stream	suspension on the culvert
Ch 8+396,75 – 8+412,69	Nameless intermittent stream	suspension on the culvert
ch 8+598,51 – 8+607,24	local road for Nova Bila	digging of the trench below the road
ch 8+725,48 – 9+194,45	local road in Nova Bila	digging of the trench below the road
ch 9+781,87 – 10+101,0	local road in Nova Bila	digging of the trench below the road
Ch 10+101,0 – 10+134,00	river Bila	suspension on the bridge
Ch 10+326,70 – 10+494,70	local road in settlement Grbavica	digging of the trench below the road
Ch 11+880.959	Nameless intermittent stream	digging of the trench in the stream bed
ch 12+334,52 – 12+344,83	Preoški stream	digging of the trench in the stream bed
ch 12+881,86 – 12+895,27	Jordalski stream	suspension on the culvert
Ch 13+542,15- 13+553,16	Nameless intermittent stream	suspension on the culvert
Ch 13+911,06 - 13+922,20	Nameless intermittent stream	suspension on the culvert
ch 14+382 – 14+395,77	Tolovički stream	suspension on the culvert
Ch 14+949,64 – 14+961,02	local road in settlement Lugovi	digging of the trench below the road



MAIN TRANSPORT PIPELINE		
Chainage	Barrier	Type of crossing
Ch 15+641,66 – 15+652,66	trunk road M5 Busovača - Travnik	digging of the trench below the road
ch 15+823,54 – 15+842,45	Dubravički stream	digging of the trench in the stream bed
Ch 16+402.92	Nameless intermittent stream	digging of the trench in the stream bed
Ch 17+297.792	Banovac stream	digging of the trench in the stream bed
Ch 17+660,41 – 17+676,80	local road in settlement Ahmići	digging of the trench below the road
Ch 17+869,64 – 17+875,42	local road in settlement Ahmići	digging of the trench below the road
Ch 18+065.55	Nameless intermittent stream	digging of the trench below the below stream
Ch 18+119,52 – 18+126,85	local road in settlement Selište	digging of the trench below the road
Ch 18+338,78 – 18+343,25	local road in settlement Selište	digging of the trench below the road
Ch 18+26,66 – 18+895,11	river Lašva	suspension on the bridge
ch 19+132,82 – 19+140,67	local road E 442	digging of the trench below the road
ch 19+334,47 – 19+344,53	Nameless intermittent stream	digging of the trench below the below stream
Ch 20+608.19	Lučica stream	suspension on the culvert
Ch 21+936,68	Nameless intermittent stream	digging of the trench below the stream
ch 22+437 – 22+450,46	road for Busovača	digging of the trench below the road
ch 22+479 – 22+506	river Kozica	suspension on the bridge
Ch 23+094.78	Nameless intermittent stream	suspension on the culvert
Ch 23+919.95	Nameless intermittent stream	digging of the trench below the stream
Ch 24+301.685	Nameless intermittent stream	digging of the trench below the stream
Ch 26+021.13	Stream Mali Do	digging of the trench below the stream
Ch 26+166.98	Stream Veliki Do	digging of the trench below the stream
Ch 26+779.96	Nameless intermittent stream	digging of the trench below the stream
ch 27+775 – 27+933	river Lašva	suspension on the bridge
Ch 27+969.28	Stream Vran Do	digging of the trench below the stream
Ch 28+298.48	Stream Marčetić	digging of the trench below the stream
Ch 28+726.784	Stream Gradion	digging of the trench below the stream
ch 28+872 - 28890.70	Railroad Šamac-Sarajevo	passage below the railroad line
Ch 28+872.42	Stream Suha	digging of the trench below the stream
Ch 29+147.07	Stream Blatišta	digging of the trench below the stream
Ch 29+574.97	Nameless intermittent stream	digging of the trench below the stream



MAIN TRANSPORT PIPELINE		
Chainge	Barrier	Type of crossing
Ch 29+834.225	Nameless intermittent stream	digging of the trench below the stream
ch. 30+069,72 – 30+079+54	Local road Doboj- Kanonik	digging of the trench below the road
ch 30+063	Railroad Srajevo – Šamac	digging below railroad
ch 30+063	Local road Doboj- Kaonik	digging of the trench below the road
Ch 30+106.84	Nameless intermittent stream	digging below stream
ch 30+552,42 – 30+562,88	Local road Doboj- Kanonik	digging of the trench below the road
Ch. 31+080,40	Local road	digging of the trench below the road
Ch. 31229.77 - 31246.38	Railroad Šamac - Sarajevo	digging of the trench below the road
ch 31246.38 - 31257.64	Truck the road M-17 Zenica-Sarajevo	digging of the trench below the road
ch 31+595 – 31+685	river Bosna	inverted siphon
Ch 32+180.125	Nameless intermittent stream	digging of the trench below the stream
ch. 32+208,61 – 32+686,87	Local road	digging of the trench below the road
ch. 32+785,74 – 32+793,70	Local road	digging of the trench below the road
BRANCHES		
Branch for Novi Travnik		
Chainge	Barrier	Type of crossing
0+365	Trunk road M5	digging of the trench below the road
ch 0+834	Bridge on the river Lašvi	suspension on the bridge
Ch 0+266.9225	Nameless intermittent stream	digging of the trench below the below stream
Ch 0+346.975	Nameless intermittent stream	digging of the trench below the below stream
Ch 0+650.9725	Stream Trebišnjica	digging of the trench below the below stream
ch 0+697.58	Nameless intermittent stream	digging of the trench below the below stream
ch 5+400.98	Gorki stream	suspension on the culvert
ch 6+579.07	Nameless intermittent stream	digging of the trench below the below stream
Branch for Vitez		
Chainge	Barrier	Type of crossing
ch 0+523.59	Bridge on the river Lašva	Suspension on the bridge
ch 1+294,07 – 1303,77	Digging below city's road	digging of the trench below the road
Ch 1+359,32 – 1+370,91	Digging below city's road	digging of the trench below the road
Branch for Busovača Kula		
Chainge	Barrier	Type of crossing
ch 0+210,40- 0+220,10	Village road	digging of the trench below the road
ch 1+129.03	Hadžija stream	digging of the trench below the stream
Branch for Busovaču Hrastova Glavica		
Chainge	Barrier	Type of crossing
Ch 0+650,15 –	Local the road	digging below road



MAIN TRANSPORT PIPELINE		
Chainage	Barrier	Type of crossing
0+654,03		
Ch 1+605,15 – 1+610,14	Local the road	digging of the trench below the road
ch 2+678.43	River Kozica	digging of the trench below the below stream or syphon
ch 3+072 – 3+088,72	Local road in Busovača town	digging of the trench below the road
Ch 3+545,90 – 3+561,29	Local road in Busovača town (Kadića strana)	digging of the trench below the road

2.3 Objects above the ground

2.3.1 Objects on Plava Voda spring

The structures currently found on Plava Voda spring are water intake structure, chlorination station and pumping station.

Plava Voda is composed of two main springs, one of them already used for water supply of the town of Travnik (Figure 7) while the remaining spring will be abstracted for the purposes of regional water supply system. The source has been dammed and behind the dam there are two springs, therefore, one structure covers all the springs. It is planned for the water intake to be constructed of the 700 mm steel pipe that will be penetrated through the dam body. At the upstream part of the pipeline the basket strainer has been protected with a screen in order to prevent entry of unnecessary items. At the second end of the steel pipeline there is a butterfly valve in the planned manhole.

By the analysis and review for the design, from the sanitary point of view, a conclusion has been reached that it is necessary to roof the structure in order to fulfil the drinking quality conditions. Around the source, a perimeter wall has been foreseen, which, on the lower side, connects with the dam, as well as with the existing structure. Behind the perimeter wall, a concrete drainage channel has been foreseen, the purpose of which is collection of surface water from structures as well as surface water flowing toward the very spring. Within the structure, the communication is possible through the access paths – ramps that are connected with the substrate of the source area. On the roof of the structure there are ventilation openings.



Figure 7. Water intake structure

Within the water intake for water supply of the town of Travnik there is also a pumping and chlorination station. Part of the space in the abovementioned structures will be used for placement of one additional chlorination station to serve regional water supply system.

The automatic chlorination station with gas chlorine has been foreseen. Clean water is conducted to the chlorination station on the ground floor (which is now used as a storage room for chlorine), where it is mixed with chlorine via the control room of the chlorination station, which is located on the first floor (planned in the existing tool room), and afterwards returned to the distribution pipeline. After the chlorine has been injected into the pipeline, water sampling is performed in order to determine its residual concentration which must not exceed the maximum limit (**Error! Reference source not found.**). In case of a better quality water (depending on the pH value), approx. 0.5 mg/l is injected, in order to attain residual chlorine reaching the consumer to 0.2 mg/l (max. 0.3 mg/l).

2.3.2 Pumping stations

Within the “Plava Voda” regional water supply system, the construction of Dolac na Lašvi, N.Travnik, N. Bila, and two pumping stations for Busovača – toward Hrastova Glavica and Kula reservoirs has been foreseen.

The pumping stations Dolac na Lašvi, N.Travnik, N. Bila have been designed as two-floor structures with the layout dimensions 6.1 x 6.1 m. The basement floor of the structure is fully under ground, and the entire hydromechanical equipment is located there including high-voltage cabinets, control boxes for unobstructed operation of the pumps, as well as the cabinet for home consumption and electricity meter. The construction of the filtration drainage system for collection and drainage of possible water filtering through the foundation slab, aiming at protection of foundation soil and reducing the risk to the stability of the structure, has been planned around the structure.

Pumping stations in the area of Busovača Municipality – toward the Hrastova Glavica and Kula reservoirs, have been designed as a vault-type reservoirs with vertical pumps. The underground part has the layout dimensions of 3.0 x 3.0 m and height of 2.7 m. The part above the ground has the layout dimensions of 1.5x1.5 m, with height 2.5 m, with flat roof the thickness of which is 10 cm and covering made of corrugated sheeting.



Construction of the filtration drainage system around the structure has been foreseen, as well as the protective fence with entrance gate.

The pumping station has been designed and planned without permanent staff.

2.3.3 Water tanks

The connections of regional water supply system to existing municipal water supply networks will be performed through existing and planned water tanks:

- Connection for municipality Dolac n/l through planned water tank on hill Gradac,
- Connection for municipality Novi Travnik through planned water tank on hill Pribilovići,
- Connection for municipality Nova Bila through newly built water tank „Kula“,
- Connection for municipality Vitez through existing water tank „Gradina“,
- Connection for municipality Busovača through existing water tank „Hrastova Glavica“ and planned water tank „Kula“,
- Connection for municipality Zenica through existing water tank „Putovići“.

Planned water tanks are subject to construction while existing are inspected to determine scope of the reconstruction works.

The „Kula“ water tank is located in the immediate surroundings of Nova Bila. Its volume is 500 m³. The structure is composed of two water chambers with the volume of 250 m³ each, and the closing chamber (Figure 8). Recently, the construction works and commissioning of this structure were carried out. The remaining works include connection of chlorinating equipment, instalment of level meters that regulate the operation of the pump for feeding of the reservoir, connect electricity and do the exterior finishing works.



Figure 8. „Kula“ water tank – Nova Bila

„Gradina“ water tank is located in the immediate surroundings of the town of Vitez, and it is at the same time the main reservoir for water supply of the wider area of Vitez. The reservoir is made of two water chambers, 200 m³ each, and a closing chamber. In the immediate surroundings of the reservoir, there is a small structure for maintenance staff. Larger degree of damage may clearly be observed in construction and hydromechanical equipment (Figure 9).



Figure 9. „Gradina“ water tank

Water tank “Hrastova Glavica” belongs to the existing water supply system of Busovača Town. In construction terms, the reservoir is made of two water chambers each having volume of 1000 m³ and one closing chamber without constructive connection as it was constructed in phases. Water chambers have layout dimensions of 20.0x14.30 m, their clear height of 4.50 m, where the foreseen depth of water is H_{max}=4.00m. Although the reconstruction of the reservoir has been done in 1996, larger degree of damage may clearly be observed in construction and hydromechanical equipment (Figure 10).



Figure 10. „Hrastova Glavica“ water tank

Putovići water tank was built in 1991, however technical acceptance procedure has not been organised and it is not in operation today. The water tank reservoir was designed as a structure with two water chambers, 2000 m³ each, and corresponding closing chamber. Putovići water tank has not been constructed fully in accordance with the design. Numerous damages and defects are identified concerning building structure itself and hydromechanical equipment (Figure 11).



Figure 11. „Putovići“ water tank

Based on the visually identified damage it may be concluded that the structures have not been heavily damaged. The damage to the structure is a consequence of its age, and it is manifested through the damage of the waterproofing layer and its protection, the reinforcement bearing bare and its exposure to corrosion, peeling and damage of mortar, appearance of corrosion on all steel elements (doors, windows, stairs, fence and the like), presence of corrosion on hydromechanical equipment, as well as age of the equipment, and difficult access to the structures.

2.4 Construction works

Works related to construction of main transport pipeline, branches, and accompanying facilities include preparatory works, construction works, concrete works, installation works, asphalt works and final works. The selected route will cross asphalt roads, railroads and pass under or over the watercourses as described in chapter 2.2.4. The short description of necessary works for each stage is given below:

Preparatory works:

- geodetic survey out of the route;
- clearing the pipeline route in the area of construction (2x 5m in relation to the axis of the route), which involves removing small plants and weeds, clearing of trees, and transport of material to a specialized landfill (local or temporary);
- cutting of asphalt and concrete on crossings over asphalt or concrete surfaces and transport of material to a specialized landfill;
- construction of a access roads;
- bringing machinery on site.

Civil engineering works:

- removing the humus in layer of 15-20 cm, depending on the quality of humus, and its disposal at a temporary landfill for backfilling;
- excavation of trench with average depth of 2 m on the main route, or an average of 120 cm at the local branches, and disposal of excavated materials at a temporary landfill for later backfilling;



- regulating the bottom of the trench and making bed for laying of pipes, 15 cm thick at the main route and 10 cm on the branches;
- laying the pipes with backfilling in the middle (connections are left unfilled);
- installation of fittings;
- creation of manholes by outpouring on the site;
- backfilling with sand of defined granulation to 30 cm above the pipe with compacting to required compaction;
- backfilling by selected material from excavation;
- humusing with existing humus with additional grass seeding.

Transition over watercourses will be performed by:

- Construction of siphon by trench excavation in waterstreams with the necessary preparations in accordance with the method of making siphons, which is defined by the main design (tunnel digging or by barriers);
- Hanging over the waterstream alongside the existing bridge construction or independently as a self-supporting pipeline.

Concrete works:

- Construction of shafts;
- Construction of fixation knots;
- Construction of pump station;
- Rehabilitation of existing reservoirs;
- Construction of new reservoirs.

Installation works:

- procurement, delivery and laying of pipelines;
- installation of fittings;
- installation of pipes for revision shafts;
- installation of hydro-machine equipment into pumping stations and reservoirs.

Asphalt works:

- Asphalting intersection parts of crossings of pipeline with asphalt route.

Finishing:

- pressure testing of pipelines;
- disinfection of pipelines with water and chlorine;
- staining and anticorrosion protection of metal parts in the pump stations and reservoirs;
- geodetic survey of as built state;
- dissembling the site by recovering its original condition;
- preparation of as built project and technical acceptance of the pipeline.



3 BASELINE DATA OF ENVIRONMENTAL AND SOCIAL CONDITIONS

3.1 Potable Water Source, Supply and Distribution

3.1.1 Travnik

Area served and service provided

Three water companies are in charge of the water supply in Travnik Municipality.

Public Water Utility Company “Bašbunar” is in charge of drinking water supply, sewage collection and public cleaning in Travnik, Turbe and surrounding settlements. Public Water Utility Company “Bašbunar” serve close to 10,000 connections, which is approximately 70% of population in the municipality. Of that, 1200 connections are for legal entities and 8743 for households. All legal entities and about 1000 households are equipped with water meters. As of August 2009, instalment of new water meters has begun. Around 1000 new water meters is already installed in some settlements surrounding Travnik town. The plan is to cover settlement Turbe with 1500 connections and then households in Travnik town. Apartment buildings do not have water meters and pay monthly lump sum according to the number of household members (6m³/capita/month).

Water distribution system of Nova Bila serves another 2,500 inhabitants, through 520 connections.

Public Water Utility Company “Vlašić” with 588 users (hotels and households), serves consumers on the Vlašić mountain plateau which has about 5000 inhabitants.

Water Sources

In the Vlašić Mountain massif, there is a large reservoir of groundwater that is mainly drained in the area of Travnik urban zone, and springs of “Plava voda” and “Bašbunar”. These water sources are used by Water Utility Company “Bašbunar” to supply water to Travnik and a few surrounding settlements.

The “Bašbunar” water source has much smaller yield, and it is located at larger altitude than the “Plava voda” source. Water from Bašbunar spring is directed to settlement Kalibunar, “Borac” Factory, and the Central and TBC hospitals which are located one next to the other in the same area (about 4500 inhabitants). The yield capacity of this spring is estimated at 65 l/s and all of it is used. In summer period, however, the spring yield decreases to about 22 l/s and it is not sufficient to cover the water demand of its consumers. For this reason, in 2006, a bypass for transfer of water from Plava Voda to Bašbunar spring is build to compensate for summer decrease in Bašbunar yield.

Based on the historical data available, the testing of the yield of “Plava voda” source was carried out several times. On this occasion it was estimated that the capacity ranges from approx. 0.7 to 0.95 m³/s during the minimum, to somewhat over 3.5 m³/s during the maximum water. The detailed analysis of available yield and environmental flow of Plava



Voda spring based on research done in 2009/2010 in the framework of the EC project is given in chapter 4.3.

Currently, Public Water Utility Company “Bašbunar” has concession to 200 l/s. According to saying by representatives of the Company, currently used flow is less then this value. The hydrological measurements carried out in the framework of the EC project show that the Company captures in average 190 l/s from “Plava voda” spring.

Turbe settlement has its own water springs Goleš and Runjići, where yield capacity of each one is estimated at 22 l/s and 8 l/s, respectively. Water Utility Company “Bašbunar” manages both of these sources. Water from all the sources is served by gravity. Settlement Nova Bila is also supplied by gravity from the Trebišnjica spring. Its yield is estimated at 11 l/s.

According to the latest information 18 industrial companies¹ are located in the territory of municipality Travnik and all are served by water from public water supply system.

Water Sources Quality

Physico-chemical and bacteriological analysis of water quality for all springs managed by WaterUtility Company “Bašbunar” is done by the Cantonal Institute for Public Health Travnik. Water samples are taken monthly at the source, and daily at three random water pipes in Travnik town, and two in Turbe. Cantonal Institute also performs analysis for presence of residual chlorine in water supply system. The analysis is done every day on both Plava Voda and Bašbunar supply systems.

The review of about 500 reports on analysis of raw and tap water quality from springs “Plava voda”, Bašbunar, Goleš, and Runjići from 2010 show that water is mainly of excellent quality with the following exceptions:

- Out of 250 reports on analysis of from “*Plava voda*” spring 13 reports show oscillation in presence of E. Coli in different periods of the year. Even two samples of disinfected water from November 2010 taken at the taps in DS Borac and “Šarena Džamija” mosque indicate the presence of E. Coli.
- Analysis of samples taken from the *tap* in front of the house in Dolac supplied from “*Plava voda*” spring indicates increased turbidity on December 6, 2010. Other water samples (for the all others periods of the year) meet requirements of the Rulebook on sanitary conditions for drinking water.
- Out of 200 bacteriological analyses of raw water from the “*Bašbunar*” source, presence of the temperature tolerant bacteria Escherichia Coli was found on samples taken in July 8 and July 28, 2010. Analysis from June 16, 2010 also shows the same bacterial ballast through the presence of Escherichia Coli on one sample taken from Waterworks “Bašbunar” Travnik network Bašbunar-Granov.
- It is also observed that test results from December 16, 2010 for standard physical-chemical analyses of *tap water* at TBC hospital supplied by water *fromspring Bašbunar* indicate absence of residual chlorine. Day before, on December 15, 2010, absence of residual chlorine was also determined in the sample taken elementary school in Turbe supplied by water from water spring Goleš.

¹ <http://opcinastravnik.com.ba/ba/stream.daenet?kat=164#>



The remaining reports indicate results that are in line with the parameters prescribed by the Rulebook on sanitary conditions for drinking water (Official Gazette of SFRJ no. 33/87 and 23/91) and Rulebook on Sanitary Conditions for Drinking Water (Official Gazette of BiH no. 40/10).

In order to determine current quality of water from “Plava Voda” spring, analyses of physical-chemical and bacteriological parameters were carried out in period January-April 2010 in the framework of the EC project. Samples were analysed for odour, taste, turbidity, pH, total volatile suspended solids, suspended solid, dissolved oxygen and oxygen saturation, conductivity, total carbonate and non-carbonate hardness, calcium, magnesium, manganese, iron, free carbon dioxide, sulphates, ammonia, nitrate and nitrite nitrogen, orthophosphates, silicium dioxide, sulphates, hydrogen sulphide, KMnO₄ consumption, biochemical oxygen demand (BOD₅), hydrocarbons, and bacteriological contamination. The analysis of the above mentioned parameters was conducted in accordance with the Standard Methods for Testing of Drinking and Waste Water. Results are presented in **Error! Reference source not found.** and compared with threshold values defined in Rulebook on Sanitary Conditions for Drinking Water (Official Gazette of BiH no. 40/10). It is to be emphasized that threshold values prescribed by the Rulebook are fully in accordance with threshold values prescribed by Annex I of the EU Directive 98/83/EC on the quality of water intended for human consumption.

Table 2. Result of six analyses of water samples taken at Plava Voda spring

Parameters	Threshold by the Rulebook	Water samples					
		07.01	26.01	09.02	24.02	29.03	26.04
Odour	Acceptable for consumers and no abnormal change	no	no	No	no	no	no
Taste	Acceptable for consumers and no abnormal change	no	no	No	no	no	no
Dissolved oxygen (mg O ₂ /l)	-	4.75	9.46	10.13	10.18	10.09	8.55
Saturation with oxygen (%)	-	57.0	100.5	120.8	125.1	112.4	102.3
Turbidity (NTU)	Acceptable for consumers and no abnormal change	1.33	0.76	0.70	1.69	0.78	0.65
pH	≥6.8 - ≤9.5	6.5	7.65	7.60	7.56	7.77	6.70
Total volatile solids 105 °C (mg/l)	-	242	130	178	260	216	166
Suspended solids (mg/l)	-	0.45	no	No	no	no	no
Conductivity at 20 °C (μS/cm)	2500	319	306	308	314	319	314
Total hardness (mg CaCO ₃ /l)	—	178	186	186	194	196	190



Parameters	Threshold by the Rulebook	Water samples					
		07.01	26.01	09.02	24.02	29.03	26.04
Carbonate hardness (mg CaCO ₃ /l)	–	160	160	166	170	172	158
Non-carbonate hardness (mg CaCO ₃ /l)	–	18	26	20	24	24	48
Calcium (mg/l)	-	66.53	65.7	63.1	62.5	72.1	62.5
Magnesium (mg/l)	-	2.92	14.6	6.32	9.2	3.9	8.3
Total iron (mg/l)	0.2	0.05	0.11	0.09	0.06	0.06	0.14
Free carbon dioxide (mg/l)	–	29.39	8.45	3.96	2.73	3.78	1.41
Chlorides (mg/l)	250	7.4	6.8	5.5	7.9	6.0	6.5
Ammonium (mg NH ₄ /l)	0.50	0.18	<0.01	<0.01	<0.01	<0.01	0.03
Nitrates (mg NO ₃ /l)	50	0.71	4.12	4.69	3.68	6.95	3.41
Nitrites (mg NO ₂ /l)	0.50	<0.001	<0.001	<0.001	<0.001	0.007	0.016
Ortho-phosphate (mg P/l)	-	0.04	0.034	0.031	0.04	0.027	0.056
Silicium dioxide (mg/l)	-	0.93	1.42	1.96	1.58	1.51	2.46
Sulphate (mg SO ₄ /l)	250	8.29	14.69	6.21	7.02	8.06	5.72
KMnO ₄ consumption (mgO ₂ /l)	5	1.82	0.49	0.79	1.31	0.28	0.95
Hydrocarbons (HCO ₃)	–	195.2	195.2	202.5	207.4	209.8	192.8
BOD ₅ (mg O ₂ /l)	–	2	0.39	1.01	1.46	2	0.42
Anion detergents (mg /l)	-			0.01			
Oil and greases	-			0.0			

The analysis of the samples indicates that this water is of excellent quality with exception of turbidity which is slightly increased but still around 1 however it considered to be acceptable to consumers. Bacteriological analysis of one out of six samples isolated *Streptococcus faecalis*. This confirms the fact that in the rainy period of the year occasional bacteriological contamination can be observed. The extensive pastoral farming is considered to be reason for change in hygienic quality of water.

“Plava Voda” catchment area is a karst watershed with grussified dolomites, where caverns are filled with grus that act as natural filter. The preliminary screening of “Plava Voda” catchment shows that no industrial polluters are present in the area. Part of the catchment area is covered by forest while other part is karst plateau with several individual katuns (graziers’ season houses) and extensive seasonal pastoral farming. Winter ski complex



Babanovac is positioned on the very edge of “Plava Voda” catchment areas and there is no valid information on whether this complex belongs to “Plava Voda” or Ugar catchment area.

The legal enforcements measures for the protection of springs Bašbunar and Plava Voda have not yet been implemented. However, development of Study on Protection of “Plava Voda” spring was undertaken under the current IPF 1 project. The Draft Study² from January 2011, included geology, hydrology and land use survey, including the analysis of potential polluters in the catchment area. The Study assessed the natural vulnerability, potential hazards and gave pollution risk assessment. Based on these inputs, a proposal for Action Plan for spring protection is prepared including proposal for protection zones and draft Decision on Protection that could be adopted by Municipal Council. The Decision contains list of all forbidden activities corresponding to each protection zone identified. It is confirmed that the main polluters in the areas are intensive pastoral farming, existence of commercial pasture storage and timber industry activities as well as the lack of sewage system in settlements located in protection zones.

The Action Plan proposes set of measures that would help to protect “Plava Voda” against occasional bacteriological pollution, including adoption of the Decision on Protection with zoning and adequate restriction measures, construction of sewage system for settlements in the Ib and II protection zone and removal of pasture storage form Ib and II protection zone, management of forest ecosystems, etc.

Consumer Demand

Data received from the Water Utility Company “Bašbunar” in Travnik for 2008 is given in the table below. Generally, water losses in majority of water supply systems in B&H are still very high demonstrating the overall inefficiency of the systems and the need for investments. The estimated total losses are higher than 70%.

Table 3. Water consumption in Travnik in 2008

Item	Water quantity (m ³)
Water intake	3,785 384.59
Water delivered to:	
households	580,391.30
non-industrial legal entities	77,325.50
industries	7,732.55
services	30,930.20
Total water delivered	696,379.55

Domestic water consumption per capita, according to estimations of the Water Utility Company “Bašbunar” is about 200 l/c/day. Comparing to other European countries where latest reported water consumption is between 70 l/c/d (Lithuania) and 260 l/c/d (Spain)³, this is considered to be relatively high level of consumption as recorded in e.g. the Netherlands and Norway.

Water Treatment and Distribution Network

There are no water treatment facilities in Travnik Municipality. There are automatic water chlorinators on all sources. According to representatives of Water Utility Company “Bašbunar”, in average 3 tons of gas chlorine is used in 1,5 month-period. The residual

² Study on Protection of Plava Voda Spring, Hydro-Engineering Institute Sarajevo, December 2010

³ Freshwater in Europe - Facts, Figures and Maps, UNEP/DEWA Europe 2004
http://www.grid.unep.ch/product/publication/freshwater_europe.php



chlorine measurement and analysis of water taken at the tap shows that the treatment with chlorine is sufficient to satisfy hygienic standards. Employees of the water utility company working on the chlorinators are equipped with rubber clothing.

As for water distribution, water from Plava Voda spring is pumped through a Ø400mm pressure line to the Kupilo water tank (2 x 600 m³) at 560m MSL, while the water flow from Bašbunar source is distributed on three water tanks: Bašbunar (2 x 250m³), Kalibunar (2 x 200m³) and Zulići (100m³) either by pumping (for Kalubunar) or by gravity for the two other settlements.

It has to be noted that part of the existing distribution network were built during Austro-Hungarian Monarchy. Information on pipes conditions, including length and materials, is shown in table below, with information collected by Water Utility Company in October 2005 for the purpose of Feasibility Study. The situation has not changed since.

Table 4. Water distribution network in Travnik (2005)

Material	Diameter (mm or as otherwise indicated)	Length (l.m.)	Age (years)
Steel	400	650	20
Cast iron	350	2200	10-30
	250	6500	
	200	3400	
	150	8200	
	100	6800	
	80	5400	
	50	3400	
HDPE	280	6200	15-20
	180	10200	
	140	8100	
	110	8200	
	90	10600	
	50	12400	
	1 ½ "	6500	
	1 ¼ "	4200	
	1 "	10500	
PVC	315	8200	10-15
	250	4100	
	200	3200	
	160	10200	
	125	1100	
	110	3400	
Asbestos Cement	250	2400	40
	200	6200	
	150	14500	
	100	18000	
	80	6200	
	50	4000	
Galvanized Steel	2 "	19400	10-15
	1 ½ "		
	1 "		
TOTAL		214,350	

Sewer system



According to information obtained from Water Utility Company “Bašbunar” currently 90% of the population in Travnik town and 30% of population in Turbe settlement is served by sewer system. As no cadastre information on underground installations is available, and therefore the exact length of sewer is unknown.

Travnik Municipality has no wastewater treatment plant. The sewerage is discharged through 54 individual discharge points to Lašva River, It is estimated that 60% of water supplied is discharged as wastewater, which is approximately 900,000 m³/month.

Settlement Nova Bila has no sewage system. All wastewater from individual houses and public buildings is discharged to septic tanks with open weir. No estimated of wastewater quantities could be obtained.

3.1.2 Novi Travnik

Area served and service provided

The Public Water Company “Vilenica Vodovod” is in charge for drinking water supply and sewage collection in Novi Travnik. It is estimated that about 10000 people are living in the area served by the company. The Company manages the water supply system for the town Novi Travnik and 3 surrounding settlements (Trenica, Rankovići, Stojkovići), and, according to the information collected from the Company, serves around 87% of the population in the served area, which is about 42% of the total population of the municipality. As far as the number of connections, records indicate that the Water Utility Company is dealing with a total number of 1476 connections distributed as follows: households 1163, legal entities 313.

Only about 2% of households and about 70% of legal entities in town Novi Travnik have water-meters. Users with no water meters are billed with a lump sum charge. Lump sum for households is 5 m³/capita/month. Legal entities which do not have meters are charged for water based on the average monthly consumption of some other legal entity of the same activity. Households in 3 other settlements which are covered by public supply system (Trenica, Rankovići, Stojkovići) are 70% covered with water-meters.

One of the former largest industrial consumers in the municipality, “Bratstvo”, now works with a reduced capacity, and currently is supplied with 10 l/s compared to the previous 60 l/s.

Water Sources

The Public Water Utility Company in Novi Travnik municipality supplies drinking water to its consumers from two water supply systems: *Oparac System* receiving water from six different water sources, and *Jaglenica System* receiving water surface water intake at Jaglenica stream.

Water supply system Oparac consists of springs Lupežovac, Dusina, Točak, Vrelo I and II, Oparac and Daličko vrelo, and the associated gravitational pipelines, relieving chamber and urban reservoir Lupeglava (Rosulje) V = 3 x 300 m³. The backbone of the system consists of water intakes at the sources Dusina and Lupežovac, and inlet pipelines which are connecting inside of relieving chamber I and continue through one pipeline to the consumers, into reservoir Lupeglava (Rosulje). Along this inlet pipeline is located the source Točak, which, on the location of relieving chamber II, connects to the system, the sources Vrelo I and II, which, on the location of relieving chamber III, also connects to the system, and the sources Oparac and Daličko vrelo, which, through separate shafts, are directly connected with the water inlet pipeline. All six connected sources are not equipped with flow



meter. Thus the information of water yields in Table 5 is based on estimations. The whole supply system is gravitational. There is no estimate of water losses in the system.

Table 5. Water sources Novi Travnik

N°	Name	Nominal	Observed	Elevation in	Connection
		Yield Capacity (l/s)	Yield Capacity (l/s)	m.a.s.l.	Pipe (mm)
1	Lupežovac	20	15	+942	Ø150
2	Dusina	50	40	+890	Ø150
3	Točak	10	10	+728	Ø125
4	Vrelo I & II	6	5	+698	Ø125
5	Oparac	30	25	+725	Ø150
6	Daličko Vrelo	20	10	+725	Ø220
7	Jaglenica stream	53	60	+628	Ø300
	TOTAL	169	145		

In 2009, source Daličko vrelo is completely disconnected from the system due to high turbidity which appears as a result of uncontrolled forest exploitation in the catchment area and the complex geological relations.

Along transmission lines of Oparac water supply system, water from five of six sources is disinfected by chlorination in a single chlorination station. Water from Oparac source, which is used occasionally, is added later and is not passing chlorination⁴.

Water supply system Jaglenica is recently added to the public water distribution system after the treatment in an existing water treatment plant and has become main source of water for Novi Travnik Municipality. Before capturing Jaglenica, Novi Travnik had problems with water shortages during dry season when water demand was 60% higher than water supplied.

This water supply system was built in 1951 and it primarily served factory "Bratstvo". Water supply system Jaglenica consist of the reservoir for water accumulation, drinking water treatment plant with rapid sand filters and disinfection, reservoir Jaglenica V = 2 x 400 m³ and inlet pipelines to the consumer area and reservoir Lupeglava (Rosulje) V = 3 x 300 m³, as the end or tangent point with water supply system Opara.

Water transport from this source is by gravity through separation shaft, which is places in front of the reservoir Jaglenica, using two pipelines with diameter 300 and 200 mm until the factory "Bratstvo", and with the pipeline diameter 300 mm to the reservoir Lupoglava (Rosulje). Jaglenica water intake is equipped with water meter but it is not in function. Currently, the water exiting from wastewater treatment plant is not used for domestic consumption due to the problems with chlorination station. Water is completely used as technological water in company "Bratstvo".

Water Sources Quality

Chemical and bacteriological analysis of raw water samples and samples from the tap are undertaken by the Cantonal Institute for Public Health in Travnik. Analysis of raw water at the sources is done only in case of need while bacteriological analysis of tap water is done weekly and physico-chemical analysis monthly. Samples are taken at three random places in the town.

⁴ Spatial Plan of Novi Travnik Municipality 2006-2026, Institute for Urban Planning Sarajevo, 2007



Latest data on physical-chemical and bacteriological quality of raw water obtained from Public Water Company "Vilenica" refer to several analyses done in 2010 by the Cantonal Institute.

Based on the analysis done on March 9th 2010, *raw water sample* from Dusina source meets requirements of the Rulebook on sanitary conditions for drinking water (Official Gazette of SFRJ no. 33/87 and 23/91). Bacteriological analyses of raw water from the Pavlovica and Lupežovac sources were done on July 15th 2010, while bacteriological analyses of raw water from the Oparac and Jaglenica sources were done on September 22nd 2010. The analyses showed that raw water samples from all sources meet requirements of the Rulebook on sanitary conditions for drinking water (Official Gazette of SFRJ no. 33/87 and 23/91).

The results also show that *tap water* is of good drinking water quality having no smell, colour, turbidity and with pH, KMnO₄ consumption, residual chlorine, chlorides, ammonia, nitrites, calcium, magnesium, volatile suspended solids, conductivity and alkalinity all being below maximum allowable concentrations given in Rulebook on Sanitary Conditions for Drinking Water (Official Gazette of SFRJ, 33/87 and 13/91) enforced at that time. The consultant is not able to discuss the results in light of EU Directive 98/83/EC, since the raw data were not available.

During 2007, decision on protection was voted by municipal council and Study of Jaglenica stream protection zones was prepared. The Study prescribe restrictions in terms of land use in the protection zones and measures to mitigate existing problems in order to ensure high quality water for drinking purposes. For other water springs, municipal council voted for decision on protection, however the actual preparation of the Elaborate is pending due to the financial reasons.

Watercourse Jaglenica is formed on the slopes of mountain Komar and total catchment area is about 40 km², of which the respective catchment area upstream of the water abstraction is about 10 km². The highest elevation in the basin is 1510 m.a.s.l., and spillway elevation on the water intake is 650m above sea level. The maximum path of water is about 5 km while the average longitudinal decline in river is about 10%.

Watercourse Jaglenica with water intake made in the open watercourse involves many potential pollutions of anthropogenic origin that occur as a result of activities in the basin, or some natural phenomena. Catchment area is very steep, so the time of its concentration and flow is very short and insufficiently for the processes of auto-purification to take place. Without treatment, water affected in this watercourse is not usable as drinking water, primarily due to increased turbidity, the presence of organic pollutants and microbial contamination. As potential contaminants are registered:

- population in settlements of Donja and Gornja Pećina, Rude and Dolovi, which directly discharge their wastewater and water from the farm buildings (stables, silos for cattle fertilizer, etc.) into surface watercourses. It is estimated that, in this area, there is a population of 220 inhabitants today, which, compared to 1991 when 1579 people lived here, is a significant reduction;
- wild dumping sites;
- cemetery in proximity of which is located the source of one stream.

Consumer Demand

Data received from the Water Utility Company "Vilenica" in Novi Travnik for 2009 is given in the table below. Information is based on the best estimate.



Table 6. Water consumption in Novi Travnik in 2009

Item	Water quantity (m ³)
Water intake	1,399 680
Water delivered to:	
households	419,000
legal entities	72,250
Total water delivered	491,250

Current consumption per capita can be calculated as approximately 114 l/c/d, however this number is based on estimated water consumption and population served and should be taken with reserve.

Table below shows the projections of specific water demand for Novi Travnik municipality taken from municipal Spatial Plan.

Table 7. Projections of water demand in Novi Travnik

Specific water demand (l/capita/day)			
Year	2005.	2010.	2026.
Novi Travnik town	290	300	310
Other settlement	250	260	290

It is to be noted that water demand per capita is rather high, even compared to European countries where consumption is ranging from 70 to 260 l/c/d⁵, and that the Company will not be able to provide this amount of water with existing sources. Having in mind that the water supply network is in bad conditions with significant losses in the system and the fact that the existing wells are not used to their maximum, it can be concluded that serious intervention in reconstruction of network and reduction of losses must be done as well as alternative sources such as Plava Voda found in order to provide adequate supply in the following years.

Water Treatment and Distribution Network

The raw water from the Jaglenica watercourse is diverted to primary settling tanks next to the diversion structure and later to three indoor type flocculating tanks and then to outdoor type sand filters before discharging into a distribution water tank of 800m³ capacity located at 5 km downstream the plant. Treatment is done by coagulation with aluminum-sulfate and 3 filters. Three employees are working in the plant. Sludge is disposed on the local landfill.

Water source Jaglenica is connected to the water treatment plant with a pipeline Ø300mm. Existing processes in the plant are: oxidation, coagulation, flocculation, settling, filtration and final disinfection. Oxidation is conducted with Natrium hypochlorite or gas chlorine. Coagulation is performed with Al₂(SO₄)₃ with the purpose of destabilization of ions that are preventing formation of flocks. Flocculation is performed with ECICHEMA-10PWG and it presents the extension of coagulation process. Time for settling is about 3h in standard type settling tanks. Water from the settling tanks flows gravitationally to filtration process, into adequately chosen filtration units (self-washing filters) filled with gravel. Filtration is performed in three filtration units. Each filter is projected for individual filtration flow of 20 l/s.

⁵ Freshwater in Europe - Facts, Figures and Maps, UNEP/DEWA Europe 2004
http://www.grid.unep.ch/product/publication/freshwater_europe.php



Due to possible presence of bacteriological pollution in raw water, as well as due to the possible need for extermination of algae, chlorination process with Natrium hypochlorite or gas chlorine is used.

Water from the filter, with previously completed disinfection, goes into the existing water tank of drinking water.

A Ø250mm/ Ø200mm primary line is the backbone of the water distribution system in the Town, while there is a Ø100mm line in Rankovici settlement and a Ø80mm line in Trenica settlement. Within the Town, main distribution lines are of 200, 150, 100 and 80mm diameter. The urban area served by the one pressure stage water distribution system is located between +502 and +542m MSL. Main pipes ranging between 225 and 300mm diameter are steel made but about 3,000 to 3,500 l.m. of the distribution lines is made of HDPE. These lines have been installed few years ago. Pipes length and size in Novi Travnik are shown in Table below.

Table 8. Water distribution network – Novi Travnik

Diameter (mm)	Length (l.m.)
80 and below	1700
100	3600
125	1000
150	7500
200	3800
225	2600
250	1000
300	10500
Total (m)	31700

Sewer system

According to information obtained from Water Utility Company “Vilenica Vodovod” currently 30% of population in Novi Travnik municipality is served with sewer system. Settlements having sewer system are Kasapovići, Pribilovići and Vodovod. The length of sewer is approximately 9000 m

Novi Travnik Municipality has no wastewater treatment plant. The sewerage is discharged directly into river Grlovnica in the settlement Novo naselje Ratanjska. It is estimated that 36,152 m³ of wastewater is discharged monthly to the river.

3.1.3 Vitez

Area served and service provided

The Water Utility Company “Vitkom” is in charge of several communal activities, including water supply and sanitation services for the town of Vitez.

According to data obtained in the Feasibility Study, the characteristics of the water supply in Vitez areas are as in the Table 9. The table refers to 2005 data while the representative of Water Utility Company “Vitkom” confirmed that number of consumers in 2009 increased to



7500. The consultant did not received updated information on other information presented in the table.

Table 9. Water Supply in 2005 – Vitez

N°	Description	Amount
1	Average Daily Water Production as billed to users	2,300 m ³ /day
2	Billed water for households with water meters	1,430 m ³ /day
3	Billed water on lump sum basis for households without water meter	350 m ³ /day
4	Billed water for legal entities with water meters	420 m ³ /day
5	Billed water on lump sum basis for legal entities without water meter	100 m ³ /day
6	Population living in the whole municipal area	27,728
7	Total number of connections for households	4,900
8	Total number of connections for legal entities	418
9	Total number of household connections with water meters	4,340
10	Total number of legal entities with water meters	343

The great majority of both domestic and legal entities have now metered connections. It is confirmed that 95% legal entities have water meters. Exact data on produced water as well as on unaccounted for water were not presented by the Company. Rehabilitation of both primary and secondary network has started and remote control of connection point is installed with electronic reading of water supplied.

Water Sources

Vitez Municipality is supplied with water from two sources: thermal spring Kruščica and spring Kremenik.

Thermal spring Kruščica is water source for inter-cantonal water supply system for Zenica and Vitez towns. The spring is located at the confluence of creek Lučevac with Vrioci that form river Kruščica, 8,5 km south-west from Vitez town. Water flows by gravity to distribution chamber "Romi" from where is going to two directions: toward water tanks "Zmajevac I" and "Zmajevac II" for Zenica town and water tank "Gradina" for narrow central zone of Vitez town. This supply system serves about 7500 consumers in Vitez. The spring has yield capacity of 520 l/s of which 23% is supplied to Vitez (about 80 l/s) and the remaining 77% to Zenica. This is typical karst spring with intense seasonal variations. Minimum yield in 20 years return period is 300 l/s, while minimum yield in 2 years return period is 350 l/s.

Kremenik spring is located 2,5 km from the Vitez town in the growing industrial and commercial area known as "FIS Vitez". On the north side from the spring, 100 m away, is the road Kaonik – Travnik, while on the south side is river Lašva. Two abstraction wells are constructed at the source, only one being currently in use. Water is pumped to water tank "Grbavica" and then to water supply network. The minimum yield of Kremenik source in 20 years return period is 160 l/s, of which 50 l/s is currently used. Water treatment plant with installed mechanical filters is built for this source, mostly due to precautionary reasons. There is currently no need for its usage, because the water is of excellent quality.

Kruščica and Kremenik water sources have *Studies of Water Source Protection*, with defined water protection zones (I, II and III zone), both prepared in 2003 by Hydro-Engineering Institute Sarajevo.



Within the watershed area of Kruščica spring there is no significant polluters of permanent character such as settlements or industrial polluters. Land is not cultivated and cattle raised in the area. The most important source of pollution is uncontrolled forest exploitation which also includes construction of forest roads. These activities intensified erosion processes in the catchment area which cause increased concentration of suspended matter and turbidity in spring water. Another aspect of pollution is log transport and servicing of transport trucks within the catchment area which poses threat by uncontrolled storage and discharge of petrol and mechanical oil and grease. Hunting of wild animals is also identified as another polluting activity which includes leaving dead animals as baits for large wild animals. The decomposition of baits can cause bacteriological and chemical pollution of spring water.

The main polluters in Kremenik watershed area are:

- permanent residential areas with around 4100 inhabitants that have no sewage system constructed and discharge wastewaters on land or surface waters. The most important polluters are settlements Divijak, Grbavica, Sadovače, Bukve, Putkovići, Jardol and area of Krčevina, with sewage waters being discharged to river Bila and Preoški creek;
- uncontrolled dumping sites;
- industrial, commercial and handcraft businesses at the territory of Municipality Vitez including extraction of dolomites, petrol stations, chemical industry "Vitezit" Vitez d.o.o as well as some other types of smaller food and wood processing industries;
- quarries located at the territory of Novi Travnik Municipalities;
- cemeteries in settlements Gornja Večeriska near river Večeriska and Mali Mošunj in zone of several temporary creeks.

According to the information from Study for Kremenik source (2003) the pollution load in the watershed areas is estimate to 23.276 PE (Population Equivalent) and is distributed as shown in Table 10.

The table shows that quarries are the most significant polluters in the catchment that contribute with 72 % of total load. Beside the industrial activity in the area, one important contributor to potential pollution is river Lašva which feed the aquifer of Kremenik spring.

Table 10. Estimation of polluters load in Kremenik spring catchment road (2003)

Polluter		Unit	# of units	Load (PE/unit)	Total load (PE)
Vitez Municipality					18,346
Permanent residential area		Capita	4,082	1	4,082
Industrial, commercial and handcraft businesses		employee	1,500+300	0.04	72
Quarry "Kalvarija Cop" d.o.o.		Ha	14	600	8,400
Other quarries		Ha	9	600	5,400
Cattle raising	Large cattle	Head	234	0.83	194
	Small cattle	Head	385	0.08	31
	Pig	Head	543+150	0.20	139
	Poultry	Bird	2,805	0.01	28
Novi Travnik Municipality					3,430
Permanent residential area		inhabitant	350	1	350



Polluter	Unit	# of units	Load (PE/unit)	Total load (PE)
Quarry in Bučići	Ha	5	600	3,000
Cattle raising	Large cattle	Head	50	0.83
	Small cattle	Head	50	0.08
	Pig	Head	150	0.20
	Poultry	Bird	400	0.01
Travnik Municipality				1,500
Permanent residential area	inhabitant	1,500	1	1,500
			Total	23,276

Table 11 gives estimation of pollution load that is infiltrating in Kremenik spring catchment area.

Table 11. Estimate of pollution load infiltrating from Lašva river (2003)

City	POLLUTION LOAD (PE)		
	Households	Industry	Total
Travnik	32,333	713	33,046
Novi Travnik	11,093	1,593	12,686
Total	43,426	2,306	45,732

Water Source quality

Water source Kruščica is under the control of Zenica Water Utility Company. Therefore, Zenica is responsible for analysis of water quality from this source. Water Utility Company "Vitkom" obtains reports in cases if water quality does not satisfy drinking water standards. However, water from Kruščica source that enters the supply system Ilidža, belonging to Vitez, is sampled and analyzed by the Health Institute in Vitez. This Institute also takes about 5 random samples from the tap.

Health Institute Vitez also takes samples from Kremenik source and also a few random samples from the tap. Water from the source is analyzed every day, whereas from the tap every 15 days.

The consultant could not obtain historical results of water quality sampling analysis for Kremenik source and water from Kruščica entering supply system Ilidža from the Water Utility Company in Vitez. However, information for Kruščica spring quality was obtained from Water Supply Company from Zenica which indicates occasional increase in turbidity and presence of bacteria bacteriological pollution.

According to the information presented in Studies of Water Sources Protection for Kremenik from 2003, water at source is of excellent quality determined by physical-chemical parameters with occasional bacteriological pollution and turbidity.

Consumer Demand



Tables below shows the past and future projections of specific water demand for Vitez municipality taken from municipal Spatial Plan⁶.

Table 12. Projections of water demand per capita

Year	Specific water demand (l/capita/day)			
	2005	2010	2020	2030
Vitez town	290	300	320	330
Other settlements	250	260	280	300

Table 13. Projections of water demand for domestic and industrial consumers in Vitez

Settlement	Population		Water demand Q _{max,d} (l/s)	
Year	2010	2020	2010	2020
AHMIĆI	529	590	2,55	2,86
BILA	2.529	3.070	12,18	14,92
BRDO	228	228	1,10	1,11
BUKVE	281	260	1,35	1,26
DIVJAK	1.523	1.796	7,33	8,73
DONJA VEČERISKA	863	898	4,16	4,37
DUBRAVICA	1.236	1.337	5,95	6,50
GAČICE	930	1.036	4,48	5,03
GORNJA VEČERISKA	514	553	2,47	2,69
JARDOL	949	1.031	4,57	5,01
KRATINE	22	13	0,11	0,06
KRČEVINE	846	930	4,07	4,52
KRTINE	81	78	0,39	0,38
KRUŠČICA	2.893	3.219	13,93	15,65
LUPAC	715	770	3,44	3,74
LJUBIĆ	173	156	0,83	0,76
MALI MOŠUNJ	1.246	1.339	6,00	6,51
NADIOCI	526	582	2,53	2,83
PIRIĆI	243	253	1,17	1,23
POČULICA	697	755	3,36	3,67
PREOČICA	1.421	1.513	6,84	7,35
PRNJAVOR	283	271	1,36	1,32
PUTKOVIĆI	119	104	0,57	0,51
RIJEKA	1.621	1.803	7,80	8,76
SADOVAČE	564	638	2,72	3,10
SIVRINO SELO	526	571	2,53	2,78
ŠANTIĆI	811	904	3,90	4,39
TOLOVIĆI	262	256	1,26	1,24
VELIKI MOŠUNJ	293	271	1,41	1,32
VITEZ	8.645	9.855	45,02	51,10
VRANISKA	423	417	2,04	2,03

⁶Spatial Plan of Vitez Municipality 2020, Institute for Urban Planning BiH, 2006



Settlement	Population		Water demand $Q_{\max.d}$ (l/s)	
Year	2010	2020	2010	2020
VRHOVINE	529	584	2,54	2,84
ZABILJE	867	949	4,17	4,61
ZASELJE	184	182	0,89	0,88
UKUPNO	33.572	37.212	165,02	184,06

Total of $80+50=130$ l/s of water is abstracted from two water sources used currently. Source Kremenik has one spare well with additional 50 l/s, or more, that can be included in the water supply system if needed. It seems that available water sources can cover water demand in the planning period till 2020.

Water Treatment and Distribution Network

Water at both Kruščica and Kremenik is treated with chlorine and is considered by Vitkom as water of a good quality.

From Kruščica spring, the water distribution is done at Mjerna Stanica (+420.00 m MSL) where a Ø700mm 7,700m long pipe arrives from Sabirni Water tank of “Kruščica” source located at +702.00m MSL. The water flow to Vitez is diverted from “Mjerna Stanica” to “Gradina” Water tank located at +463.87m MSL.

Water from Kremenik is directly pumped to a water tank on the right side of the main road and it is meant exclusively for future extensions of water service to the business area itself, and to the municipal area surrounding Počulica, which is currently not connected to municipal water supply. Works for the protection of the Kremenik source have started, but they are not completed yet.

Sewer system

According to information obtained from Water Utility Company “Vitkom” currently 3,500 inhabitants or 30% of population in Vitez Municipality is served with combined sewer system. The length of the sewer is 4601 m.

Vitez municipality has no wastewater treatment plant. The sewerage is discharged directly into river Lašva, location named Botrina, behind the MUP building. No estimate of the quantities was available.

Business complex PC Vitez has separate sewer system. Wastewater is collected from commercial buildings and treated on the wastewater treatment plant. Treated water is discharged to Lašva river, location named Botrina, next to the Beba's house.



3.1.4 Busovača

Area served and service provided

Busovača Communal Company “Komunalac” provides water supply and wastewater services for Busovača municipality. Number of population living in area served by “Komunalac” is about 8500. Approximately 1600 households are connected to the supply system or about 6000 inhabitants, which is 75% of the inhabitants living in the served area. About 150-200 legal entities are connected to the system. These are mostly commercial users because there is almost no industry. There are about 1030 households with water-meters, and almost all legal entities have meters. New water connections have a legal obligation to install water-meters.

Water Sources

Busovača town is supplied with water by gravity from two sources or open surface water-streams: Topoloviča and Duboki. There is also Crni potok water-stream which serves as alternative source. Yield capacity of these sources is the following: Topoloviča 12 l/s, Duboki Potok 30 l/s, and Crni Potok 20-25 l/s. Crni potok is just recently captured and will be introduced in the system in the near future. About 2000 m³ per day is produced and distributed to the supply network. The entire distribution network is gravitational. The Water Utility Company obtained water permit for all three water sources.

The main problem is the turbidity at water sources to a degree to cause disruptions in continuous water supply. In these cases, a water tank on location Hrastova Glavica with capacity of 1200 m³ is used. Considering the estimated water demand in the area served, the tank can store water to serve municipality 24 hours. However, the water is usually not sufficient to last even for 8 hours due to water losses in the distribution system that are estimated to be about 60%.

Sources Topoloviča and Duboki potok belong to the same catchment area and have no Elaborate of water source protection. Crni Potok has the Elaborate of water source protection with defined three protection zones. All three sources are exposed to pollution (mud formation in raw water) due to soil erosion exacerbated by deforestation in the area. Another threat to the water sources are winter ski recreational centers in Pridolci in Duboki potok area, and in Busovačke staje in Crni potok catchment area. They are both in the III water protection zone. These ski centers are in a phase of construction. In case they do not solve the issues of sewage systems, they will become threats to the water sources. There are about 100 newly built weekend houses in Pridolci and about 50 new houses in Busovačke staje, which already negatively affect catchment areas.

Source water quality

Chemical and bacteriological analysis of water quality is done twice a week by the Cantonal Institute for Public Health in Travnik. Analysis is done at the outlet of the treatment plant, sometimes at the water tank, and from the tap in town (institutions, private houses). Reports of the analysis are occasionally submitted to the water utility company.

Based on the approximately 100 reports on results of physical-chemical and bacteriological analyses done by the Cantonal Institute for the period January - December 2010 it can be concluded that water samples meet requirements of the Rulebook on sanitary conditions for drinking water (Official Gazette of SFRJ no. 33/87 and 23/91). The samples are taken at the tap on different locations in the town (schools, cafés, petrol station, city pool, church office,



etc.) and from the water tank “Hrastova glavica” and filter station “Tisovac”. Water that was sampled in all cases was treated and disinfected water. No raw water samples were taken in 2010.

Consumer Demand

Of about 1500 m³ of water that is produced per day, around 500-600 m³ per day is invoiced to the final consumers. Information about water consumption in 2009 received from “Komunalac” in Busovača is given in the table below.

Table 14. Water consumption in Busovača in 2009

Item	Water quantity (m ³ /year)
Water intake	525,600
Water delivered to:	
households	168,000
legal entities	72,000
Total water delivered	240,000

Table 15 and Table 16 below show the projections of specific water demand for Busovača municipality as presented in Municipal Spatial Plan⁷.

Table 15. Projections of water demand in Busovača municipality

Specific water demand (l/capita/day)				
Year	2005	2010	2020	2030
Busovača town	290	300	320	330
Other settlements	250	260	280	300

Table 16. Estimated water need for households and industry in Busovača Municipality

No.	Settlement	Population in 2026.	Specific demand (l/c/d)	Variation coefficient	Percentage served (%)	Water demand in 2026 Q _{max.d} (l/s)
1	Bare	337	290	1,5	65	1,10
2	Bukovci	497	290	1,5	65	1,63
3	Buselji	1.036	290	1,5	65	3,39
4	Busovača	5.442	310	1,4	100	27,34
5	Carica	513	290	1,5	65	1,68
6	Dobraljevo	628	290	1,5	65	2,06
7	Dolac	133	290	1,5	65	0,44
8	D. Rovna	360	290	1,5	65	1,18
9	G. Rovna	373	290	1,5	65	1,22
10	Grablje	199	290	1,5	65	0,65
11	Granice	169	290	1,5	65	0,55
12	Gusti Grab	299	290	1,5	65	0,98
13	Hozanovići	506	290	1,5	65	1,66

⁷Spatial Plan of Busovača Municipality to 2026, Institute for Urban Planning Sarajevo, 2008



No.	Settlement	Population in 2026.	Specific demand (l/c/d)	Variation coefficient	Percentage served (%)	Water demand in 2026 $Q_{max,d}$ (l/s)
14	Hrasno	432	290	1,5	65	1,41
15	Javor	-2	290	1,5	65	-0,01
16	Jazvine	445	290	1,5	65	1,46
17	Jelinak	450	290	1,5	65	1,47
18	Kačuni	2.616	290	1,5	65	8,56
19	Kaonik	728	290	1,5	65	2,38
20	Katići	93	290	1,5	65	0,30
21	Kovačevac	122	290	1,5	65	0,40
22	Krčevine	564	290	1,5	65	1,85
23	Krvavčići	35	290	1,5	65	0,11
24	Kula	402	290	1,5	65	1,32
25	Kupres	239	290	1,5	65	0,78
26	Lončari	361	290	1,5	65	1,18
27	Mehurići	93	290	1,5	65	0,30
28	Merdani	512	290	1,5	65	1,68
29	Mihaljevići	475	290	1,5	65	1,55
30	Milavice	208	290	1,5	65	0,68
31	Nezirovići	75	290	1,5	65	0,25
32	Očehnići	-1	290	1,5	65	0,00
33	Oselište	170	290	1,5	65	0,56
34	Podbare	105	290	1,5	65	0,34
35	Podjele	150	290	1,5	65	0,49
36	Podstijena	323	290	1,5	65	1,06
37	Polje	992	290	1,5	65	3,25
38	Prosje	-8	290	1,5	65	-0,03
39	Putiš	611	290	1,5	65	2,00
40	Ravan	639	290	1,5	65	2,09
41	Skradno	723	290	1,5	65	2,37
42	Solakovići	490	290	1,5	65	1,60
43	Strane	421	290	1,5	65	1,38
44	Stubica	17	290	1,5	65	0,06
45	Šudine	225	290	1,5	65	0,74
46	Turići	316	290	1,5	65	1,03
47	Zarače	169	290	1,5	65	0,55
TOTAL						87,03

Currently available water from sources Topalovića potok, Duboki potok, and Crni Potok (to be added soon) is $12+30+25 = 67$ l/s. It is clear that available water sources will not be able to satisfy future need and that water from regional water supply system will be alternative to provide continuous water supply to inhabitants of Busovača Municipality.

Water Treatment and Distribution Network

Topalovića and Duboki potok are treated by filtration before their distribution to beneficiaries. These two water-streams are joined together before entering a pressure filtering treating



system downstream at +480m MSL. Treatment plant consists of 3 storage tanks of 40 m³ capacity each. Water from tanks flows into a filter plant where there is a process of sedimentation, coagulation, filtering with 3 sand filters, and disinfection with automatic chlorinator. A 7 km of HDPE transmission line of Ø250mm size connects filters to the storage water tank of the water distribution system.

Water is distributed to users through a one pressure stage water distribution system located between +370 and +420m MSL. The network is constituted of 80km of lines of different size, material and age, a detailed description is provided in table below.

Table 17. Water distribution network - Busovača

Material	Diameter	Length (l.m.)	Age (Years)
Cast Iron	400mm	2,000	
Asbestos Cement	50 to 150mm	16,000	45
PEHD	25 (1/2") to 200mm	40,000	10
PVC	Up to 50mm or 2"	20,000	35
Galvanized Steel	Up to 50mm or 2"	10,000	

The project of reconstruction of water supply network started. Of total 14 km asbestos cement pipes, 6,5 km is replaced while 6,5 km is to be replaced yet.

The urgent projects related to improvement of water supply system, as defined by Municipal Development Strategy⁸ are:

- Development of project document and construction of water supply for Sport and recreation centers Busovačka planina and Pridolci;
- Construction of pump station and distribution network Donji Solakovići – Krčevac;
- Reconstruction of priority sections of city water supply network;
- Reconstruction of water supply network „Korita“ – Kačuni;
- Execute works on protection zone of town water supply system;
- Introduce water from „Crni potok“ to the water supply system.

Sewer system

According to information obtained from Water Utility Company „Komunalac“ currently 30% of population in Busovača Municipality is served with combined and separate sewer system. The town centre is mainly served with sewer system, while only 1 km of combined sewer is extended to settlement Kačuni. The length of combined sewer system is 7000 m and the length of separate sewer system is 3000 m.

Busovača municipality has no wastewater treatment plant. The sewerage is discharged in several places including:

- Discharge point of combined sewer outside the city is in settlement Kačuni on the right bank of Kozica river, next to the house of Luka Milinović.
- Discharge point of separate fecal sewer in the city is on the left bank of river Kozica in settlement Luka, next to the house of Ivan Stapić.

⁸ Revision and amendment of Busovača Municipality Development Strategy from January 2009, Municipality Busovača



- Discharge point of combined sewer in the city is on the left bank of river Kozica, in the company “PGM”, Silvija Strahimira Kranjčevića Street, b.b.
- Discharge point of separate storm water sewer in the city is on the right bank of river Ivančica, next to the cafe Planet, owned by Drago Ćosić, Nikola Šubić Zrinski Street.
- Discharge point of separate storm water sewer in the city is on the right bank of river Ivančica, next to the cafe Planet, owned by Drago Ćosić, Nikola Šubić Zrinski Street.
- Discharge point of combined sewer in the city is on the right bank of river Ivančica, next to the “Rasadnik”, Silvija Strahimira Kranjčevića Street.

It is estimated that 10 l/s of wastewater is discharged into the river.

3.1.5 Zenica

Area served and service provided

“Vodovod & Kanalizacija” Zenica is the public company entrusted with the management of the water supply and sewage in the Zenica municipality. Water supply services cover about 80.000 inhabitants in the municipality or about 63%. 90% of the consumers living in urban areas are connected to the water supply system.

Water Sources

Zenica uses four main water supply sources for its system, namely:

- Kruščica system with 5 facilities (one well, two cave sources, one hot spring and one surface water source – the smallest one in capacity). The maximum total capacity of this source is estimated at 520 l/s and its observed usage for the last three years is averaging at 255-300 l/s.
- Babina rijeka – a surface source with a maximum treatment capacity of its filtering plant estimated at 200 l/s. However, the last three years records indicate that only an average of 72 l/s flow has been used for Zenica water supply from this source. This usage actually depends on the needs; sometimes it's lower and sometimes higher even up to 100 l/s.
- Strmešnjak well, with a recorded capacity of 20 l/s, with an average flow as high as 26 l/s has been withdrawn during the last three years.
- Klopče, a natural spring of 5 l/s capacity, with the average flow used from this source is about 2 l/s.

Compared to the period before 2007, public water supply system in Zenica municipality does not have reductions of water. There are occasional difficulties with muddy water at Babina rijeka, or mud problems during rains in the surface spring belonging to Kruščica source system, but they do not lead to interruptions in water supply. In cases when there are problems on Babina rijeka, more water is taken from Kruščica source and vice-versa.

Table below shows water quantities produced in 2008 from different sources in Zenica municipality.



Table 18. Water production in Zenica Municipality in 2008

No.	Water source	Water produced (m ³)
1	Kruščica	8.300.204
2	Babina Rijeka	2.258.238
3	Strmešnjak	518.605
4	Klopče	37.765
5	Total	11.114.812

In Table 19 below are presented data on consumers who are supplied by the Water Utility Company "Vodovod & kanalizacija" Zenica. It has to be noted that apartment buildings have only one water-meter for the whole building.

Table 19. Number of water consumers/connections in Zenica in 2008

No.	Number of connections (water-meters)	
1	Apartment buildings	1.501
2	Private houses	7.144
3	Total households (1+2)	8.645
4	Legal entities	2.280
5	Total connections (3+4)	10.925

The Water Utility Company has prepared Elaborates of water protection for Kruščica and Babina Rijeka sources.

The description of the Kruščica spring catchment area and present polluters is given in chapter 0.

Babina Rijeka catchment area occupies 74,7 km² of land and consists of direct watershed of Babina Rijeka upstream from water intake, and several small sub-catchment areas of its confluents of which Sočka Rijeka and Markovac creek are the largest ones. Babina River is known for its richness and variableness especially in the time of rain and melting of snow. Water intake is located in settlement Kasapovići, cca 4 km east from Zenica and 13 km downstream from Babina Rijeka spring. Water is collected from open surface using Tyrolean weir. Being the surface water stream, Babina Rijeka and the water intake are highly vulnerable to pollution. It is exposed to several sources of pollution, such as discharging household sewage into the watercourse for approximately 8400 inhabitants in the catchment area, fertilizers used for fertilizing agricultural land, disposal of solid wastes, bottles and other waste into the riverbed⁹. In time of first autumn rains or melting of snow turbidity of water increases due to soil erosion. The abstracted water is treated as explained in chapter 10.5.4.

Information on the catchment areas and existing polluters of Strmešnjak well and Klopče was not available.

Water Source Quality

Water Utility Company in Zenica has its own laboratory for the physical, chemical and bacteriological analysis of the water at the source and along the water distribution network.

⁹Elaborate of Babina rijeka water source protection, Hydro-Engineering Institute Sarajevo, 2002



Physico-chemical and bacteriological analysis of the raw water are done for four main water supply sources: Kruščica, Babina Rijeka, Klopče and Strmešnjak. Chemical analysis of the raw water provides information about chemicals that must be removed to obtain the desired finished water quality. The chemical tests for Kruščica are made on the daily basis, while bacteriological tests are done approximately every six days. The chemical tests for other three water sources are made every 4 to 7 days as well as bacteriological analysis.

The analyses done in 2010 on raw samples for Babina Rijeka source show frequent increase in suspended solids and ammonia. This increase usually follows heavy rainy days. The maximal concentration of suspended solids was 163 mg/l as measured on September 16, 2010. There is no threshold for suspended solids in the Rulebook on sanitary conditions for drinking water, since suspended solids are normally discussed only for freshwater systems.

All bacteriological analyses of raw water from the source Babina Rijeka done in 2010 show contamination with *Escherichia Coli*, while in some analyses presence of *Streptococcus fecalis* is identified.

The results of the Klopče source analyses show frequent increase in turbidity and presence of suspended solids. The bacteriological analyses for this source show the occasional presence of *Escherichia Coli*, but not to the extent as in raw water for Babina Rijeka.

The results of raw water tests from Strmešnjak indicate occasional presence of *E. coli* bacteria to a lesser degree.

The results for Kruščica indicate occasional increase in turbidity and presence of bacteria to a lesser degree.

Consumer Demand

Data received from Water Utility Company in Zenica for 2009 is given in the table below.

Table 20: Water consumption in Zenica in 2009

Item	Water quantity (m ³ /year)
Water intake	10,266,576
Water delivered to:	
households	4,920,265
legal entities	1,691,106
Total water delivered	6,611,371

Table below shows water losses in Zenica public water supply system.

Table 21. Water losses in Zenica in 2006 and 2008

No.	Description	2006	2008
1	Water abstracted (m ³)	12.344.220	11.114.812
2	Water billed (m ³)	6.650.491	6.725.289
3	Unaccounted for water – losses (m ³)	5.693.729	4.389.523
4	Unaccounted for water – losses (%)	46,1%	39,5%



Based on the information given in Spatial Plan of Zenica-Doboj Canton¹⁰ specific water demand for Zenica Municipality is given in the following table.

Table 22. Specific water demand in Zenica Municipality

Consumer	2010 (l/c/d)	2020 (l/c/d)	2030 (l/c/d)
Households	200	210	220
Industry	50	60	70
Unaccounted for water	80	70	70
Total	330	340	360

It is evident that by 2030 Zenica Municipality will need additional water source as well as work on reduction of water losses that would significantly lower the water deficit. The unaccounted for water is estimated to be 40% because no valid data exists on water abstracted (no water meters installed).

Concerning additional water sources, the analysis of available water quantities per capita per day in the Canton (Table 23), it seems that available water is sufficient to cover the needs. However, available water sources are mainly surface watercourses of poor quality water and would require expensive treatments. This is the reason why regional water supply system Plava Voda is a project of strategic importance for Zenica-Doboj Canton.

Table 23. Available water resources in Zenica-Doboj Canton

Catchment areas	Specific average flow		Specific minimum flow		Available water per capita per day	
	Per area Qavg/F (l/s/km ²)	Per capita Qmin/capita (l/s/c)	Per area Qavg/F (l/s/km ²)	Per capita Qmin/capita (l/s/c)	Avg (l/s/c)	Min (l/s/c)
Bosna river catchment areas including Usora catchment area	18.10	0.35	2.58	0.0493	30.240	4.259
Canton only	15.05	0.129	3.20	0.0274	11.145	2.367

Water Treatment and Distribution Network

Water at Strmešnjak well and Klopče is chlorinated with automatic chlorinators. The surface water from Babina River undergoes water treatment by filtration in a 200 l/s capacity plant. The plant also has a laboratory which is attended 24 hours by a multi-shift staff. Water treatment is divided into two phases:

Phase I: system for rough water treatment in Kasapovići, with a capacity of 200 l/s. This system consists of:

- A grid on the pipe's entrance for receiving water,
- Grit chamber to capture suspended particles with a diameter larger than 10 mm to 1 mm.

¹⁰Spatial Plan of Zenica Doboj Canton 2009-2029, Official Gazette of Zenica Doboj Canton 4/09



- Horizontal settling tank, old and new, to stop the particles with smaller diameter, up to 0.1 mm.
- Colloid particles with a smaller diameter from 0.01 to 0.0001 mm, go to the distribution chamber from where are being transported by pipes (Ø500) to Crkvice (distance from Kasapovići to Crkvice is about 4300 m).

Phase II: system for final water treatment in Crkvice, with the usage of chemicals, consists of:

- Two accelerators for coagulation and flocculation with total capacity of 200 l/s, or 100 l/s per accelerator. Volume of one accelerator is cca 1000 m³.
- Filtering cell with 8 filters with treatment capacity of 25 l/s per filter in cases of water turbidity of 5-25 NTU. In cases of increased turbidity, the capacity decreases, and requires more often cleaning of filters.
- Chlorination and disinfection of water.

Processes used in the system:

- I process: coagulation and flocculation in accelerators, with adding $\text{Al}_2(\text{SO}_4)_3 \times 18\text{H}_2\text{O}$, which is stored beneath the sulphate station, in dry and adequate place. Process needs to run slow, so the settling time is from 1,5 - 4 hours, and the rising speed of water towards overflow is 0,5-1 m/h. The process depends on the flow, turbidity, water temperature, pH, process efficiency. Process reliability is 80-90%.
- II process: filtration through quartz sand "fast filters". Filter is consisted of the following filling: 70 cm of quartz sand 0,3-1,2 mm, 40 cm of gravel, and stone layer. This filter stands on load-bearing beams. There are 8 filters. Treatment capacity of one filter is up to 25 l/s in conditions of normal turbidity of 5-25 NTU. Maximal treatment capacity for that type of filter is 50 NTU. Appearance of sludge demands regular washing of the filters. Washing is done with chlorinated water from spare water tank of 100 m³ capacity which is places above the object.
- III process: chlorination and disinfection of water (with neutralization) uses gas chlorine which is dosed through semi-automatic chlorinators. Chlorine is stored right beside the chlorine station, with adequate ventilation. Between chlorine station and the storage there is a chlorine neutralizer which naturalizes chlorine from the air. For this purpose is used NaOH and $\text{Na}_2\text{S}_2\text{O}_3$. Efficiency and reliability of the chlorine system is up to 80%.

Throughout the year, water turbidity varies from 1500 NTU to 5 NTU on the accelerator outlet, and after treatment with coagulation water exits on the overflow with value 5.23 NTU. On the filter outlet, the water turbidity varies from 0.3-1.0 NTU, which proves efficiency of the system and reliability of the treatment.

Chlorination is monitored by the printer which records the operations of the chlorine analyser, making a diagram which shows chlorine concentrations varying between 0,50-0,60 mg/l. Considering the fact that water is taken from the surface stream, residual chlorine at the exit of the plant is kept at 0,6 mg/l to prevent possible contamination in the pipes.

Treatment of sludge from the accelerator is not done and there is no information on the quality of sludge that is washed out of accelerator and filters. Sludge thickness at the bottom of the accelerator, which is washed out every month or every other month, is of about 10-30 cm, composed of fine granules of clay and different hummus and hydroxides.

The water distribution system is on average over 30 years old, with some sections dating back 40 to 50 years. Current repair works along the system as well as at users' connections necessitate three to five interventions a day for an ordinary maintenance. The system is over 140 km long and is mainly made of iron and steel pipes, without the necessary internal and



external protection, except a cathode protection in some areas. House connections are mainly of galvanized steel but PVC material is more and more provided. In the old sectors of the town lead connections also exist.

Table 24. Water distribution network in Zenica Municipality

Diameter	Grey and ductile iron	Steel	Asbestos cement	Polyethylene	Steel (zinc coated)	Total
80	50,000			3,400		53,400
100	8,000					8,000
125	500					500
150	16,300					16,300
200	11,800					11,800
225	5,700					5,700
250	8,000					8,000
300	1,600					1,600
350	3,700					3,700
400	3,800	6,860	1,000			11,660
500	3,700	4,250				7,950
600		5,840				5,840
700		7,750				7,750
800		500				500
no info					27,600	27,600
Total	113,100	25,200	1,000	3,400	27,600	142,700

Sewer system

According to information obtained from Water Utility Company “Vodovod i kanalizacija d.o.o Zenica” currently 60% of population in Zenica Municipality is served with sewer system including Zenica City and surrounding settlements of Klopče, Tetovo, Mala Broda, Velika Broda, Podrbežje, Gradišće, Donja Gračanica, Ričice and Pehare, Hamida and Lukovo polje. Zenica City and settlements on the right bank of Bosna River are served with separate sewer system, while settlements on the left bank are served with combined sewer system. Total length of the system is 12000 m.

Zenica Municipality has no wastewater treatment plant. The sewerage is discharged to Bosna River on several places including:

- Sewer system of Blatuša settlements discharge wastewater along Bosna River bank, from settlement Blatuša up to Željeznički most bridge.
- Two large discharge points from industrial zone of Arcelor Mittal steel factory:
 - ✓ Arcelor Mittal sewer discharge wastewater next to the oil fuel station, present installation of “Linde gas”, on the other side of settlement Kanal
 - ✓ City sewer, so called “left bank sewer” discharge wastewater across the industrial facility Valjaonica III of Arcelor Mittal.
- Industrial wastewater and sewage from lateral sewer positioned along fence of Arcelor Mittal industry are discharged to Bosna River at the end and on the north side of Arcelor Mittal steel factory.



- Wastewater from the “right bank sewer” is discharged into river Bosna at the city entrance next to the settlement Blatuša
- Sewage from settlement Gračanica is discharged to Gračanički potok creek in the settlement Donja Gračanica. Gračanički potok is a tributary of Bosna River.

Individual households in settlements who are not served with municipal sewage system have their own septic tanks.

Based on the measurement of flow undertaken in 1985 on part of the sewer system positioned along fence of Arcelor Mitall industry, total quantity of wastewater discharged was 259.3 l/s.

Wastewater pumped from “Staram jama” and separation unit of coal mine Zenica that is discharged to sewer of Industrial zone Zenica I is on average 40.5 l/s.

Total quantity of wastewater discharged from Zenica Municipality is estimated based on the total quantity of water distributed and amounts to 8,248 368 m³ for the first 10 months in 2010.

3.2 Socio-economic profile

3.2.1 Demographic Profile

The population censuses in B&H have been carried out six times from 1948 to 1991. The table below shows population numbers for the municipalities recorded for the previous three censuses.

Table 25. Population Census Results 1971 to 1991

Census Year	Travnik	Novi Travnik	Vitez	Busovača	Zenica
1971	55,822	22,847	20,628	14,428	112,447
1981	64,100	26,154	24,166	16,289	132,733
1991	70,747	30,713	27,859	18,879	145,517

There was a steady increase in population in all the municipalities throughout the 1971-1991 period.

Population estimates from 2005 to 2009 for the individual municipalities, as reported by Federal Statistical Institute, totalled 248.205 inhabitants in the project area.

Table 26. Population Estimates by the Federal Statistical Institute

Municipality	Item	2005	2006	2007	2008	2009
Travnik	Population	55,590	55,195	55,217	55,093	55,000
	Growth %	-	-0.71	0.04	-0.22	-0.17
Novi Travnik	Population	24,753	24,826	24,840	24,834	24,859
	Growth %	-	0.29	0.06	-0.02	0.10



Municipality	Item	2005	2006	2007	2008	2009
Vitez	Population	24,906	24,982	25,010	25,070	25,052
	Growth %	-	0.31	0.11	0.24	-0.07
Busovača	Population	16,005	16,065	16,114	16,095	16,073
	Growth %	-	0.37	0.31	-0.12	-0.14
Zenica	Population	127,646	127,307	127,334	127,113	127,105
	Growth %	-	-0.27	0.02	-0.17	-0.01
Total for the region	Population	248,900	248,375	248,515	248,205	248,089
	Growth %	-	-0.21	0.06	-0.12	-0.05
FB&H	Population	2,328,000	2,325,000	2,328,359	2,327,195	2,327,318
	Growth %	-	-0.13%	0.14%	-0.05	0.01

As a consequence of disruption caused by the war the population levels have declined in all municipalities by 2005 and the population numbers have more or less stabilised.

3.2.2 Ethnic mix

The last reliable source of information on the ethnic mix in the project is based on the census of 1991. However, that cannot reflect the current situation accurately, which has changed significantly as a result of the upheaval created by the war in the 1990s. The following table gives estimates on current ethnic mix from Spatial Plan of Middle Bosnia Canton and Federal Institute for Statistics.

Table 27. Estimated Ethnic Mix by Municipality

Municipality	Total	Croats	Bosniaks	Srbs
	2003	2003	2003	2003
Travnik ¹¹	51,369	4,115	46,491	482
Novi Travnik ²⁰	25,198	12,584	11,426	1,153
Vitez ²⁰	21,354	11,700	8,427	734
Busovača ²⁰	11,451	10,421	760	260
Zenica ¹²	133,861	17,277	99,776	12,685

However for the purpose of updating the estimates the municipal departments were consulted in municipality to provide their estimates of ethnic mix in the existing settlements as well as those planned to be connected or switched to supplies from Plava Voda. These estimates are considered to be fairly accurate considering that all municipalities maintain household registers which include information on ethnic mix in each locality.

¹¹Spatial Plan of Middle Bosnia Canton 2005- 2025, Institut za arhitekturu, urbanizam i prostorno planiranje Sarajevo, Sveučilište u Zagrebu, Arhitektonski fakultet – Zavod za urbanizam i prostorno planiranje, Sarajevo/Zagreb 2005

¹²Federal Institute for Statistics, 31.12.2003.



Table 28. Estimated ethnic mix in local communities that are to be connected to Plava Voda in Travnik Municipality (including Nova Bila)

Local community	Ethnic mix (B-Bosniaks, C-Croats, S-Serbs, O-Others)	Current situation		Local system	Planned situation Connected to Plava voda			
		Bašbunar	Trebišnjica		B	C	S	O
Bojna	B 60% C 25% S 10% O 5%	1500			900	375	150	75
Dolac	B 36% C 54% S 2% O 8%	1794			647	976	31	140
Dolac n/L	B 30% C 70%	2000			600	1400		
Guča Gora	B 64% C 36%		1415		902	513		
Mosor	B 85% C 15%			625	537	88		
Nova Bila	B 5% C 95%		4500		225	4275		
Pokrajčiči	C 100%			325		325		
Slimena Polje	B 60% C 40%	3500			2100	1400		
TOTAL CONNECTED TO PLAVA VODA					5911	9352	181	215

Table 29. Estimated ethnic mix in settlements that are to be connected to Plava Voda in Novi Travnik Municipality

Settlement	Ethnic mix (B-Bosniaks, C-Croats)	Access to public system	Planned extension to Plava Voda	Population connected to Plava Voda	
				B	C
Bučiči	C 100 %	No	100%		874
Čehova	C 100 %	No	50%		280
Margetiči	C 100%	No	100%		355
Nević polje	C 100%	Yes			620
Novi Travnik	B 35% C 65 %	Yes	100%	4498	8352
Pribilovići	B 10% C 90%	Yes	100%	46	414
Rankovići	C 100%	Yes	100%		1305
Stojkovići	C 100%	Yes	100%		480
Trenica	B 80% H 20%	Yes	80%	275	69
TOTAL CONNECTED TO PLAVA VODA				4819	12749



Table 30. Estimated ethnic mix in settlements that are to be connected to Plava Voda in Vitez Municipality

Settlement	Ethnic mix (B-Bosniaks, C-Croats, S-Serbs, O- Others)				Access to public system	Planned extension to Plava Voda	Population connected to Plava Voda			
	B	C	S	O			B	C	S	O
Ahmići	87 (20%)	316 (75%)		23 (5%)	Yes, 40%	Yes 100%	87	316		23
Pirići	90 (45%)	100 (50%)		14 (5%)	No	Yes, 60%	54	60		8
Bukve	280 (100%)				No	Yes	280			
Putkovići	121 (100%)				No	Yes	121			
Tolovići	109 (85%)		1 (0.5%)	18 (14.5%)	No	Yes	109		1	18
Sivirino selo	278 (66%)	128 (30%)		11 (4%)	No	Yes	278	128		11
Šantići	181 (18%)	782 (78%)		29 (4%)	Yes, 80%	Yes, 20%	36	156		6
Ljubić	107 (98%)			2 (2%)	No	Yes	107			2
Kruščica	1389 (58%)	590 (25%)	S 12 (2%)	373 (15%)	Yes, 40%	Yes, 60%	833	354	7	224
Preočica	1148 (100%)				No	Yes	1148			
TOTAL CONNECTED TO PLAVA VODA							3053	1014	8	292

Table 31. Estimated ethnic mix in settlements that are to be connected to Plava Voda in Busovača Municipality

Settlement	Ethnic mix (B-Bosniaks, C-Croats, S- Serbs, O-Others)			Public system	Extension to Plava Voda	Population connected to Plava Voda		
	B	C	S			B	C	S
Busovača	1091	2732	60	Yes	√ (100%)	1091	2732	60
Carica	47	187		Yes (50%)	√ (20%)	10	38	
Kačuni	1404	351		No	√ (100%)	1404	351	
Kaonik	84	335		Yes	√ (100%)	84	335	
Katići	113	5	7	No	√ (50%)	56	3	4
Krčevine	8	380		Yes (50%)	√ (50%)	4	190	
Kula	95	221		Yes (50%)	√ (20%)	20	44	
Milavice	33	88		No	√ (50%)	17	44	
Podjele	18	60	15	Yes (50%)	√ (50%)	9	30	
Ravan	31	450		Yes (50%)	√ (50%)	15	225	
Skradno	300	20	150	Yes (50%)	√ (50%)	150	10	75
Solakovići	194		129	Yes (50%)	√ (50%)	97		65
Strane	30		270	Yes (50%)	√ (50%)	15		135



Settlement	Ethnic mix (B-Bosniaks, C-Croats, S-Serbs, O-Others)			Public system	Extension to Plava Voda	Population connected to Plava Voda		
	B	C	S			B	C	S
Merdani			300	No	√ (100%)			300
Grabje			200	No	√ (100%)			200
Gavrića	70		180	No	√ (100%)	70		180
Selište (Rasno)	200			No	Through Vitez Municipality √ (100%)	200		
Šefradini (Donje Ravno)	150			No	Through Vitez Municipality √ (100%)	150		
TOTAL CONNECTED TO PLAVA VODA						3392	4002	1019

Table 32. Estimated ethnic mix in settlements that are to be connected to Plava Voda in Zenica Municipality

Settlement	Ethnic mix (%)				Population estimate 2008	Currently connected to public system	Transferred to Plava voda	Newly connected to Plava voda	Population connected to Plava Voda			
	B	C	S	O*					B	C	S	O
Banlozi	90			10	1360	80%		20%	245			27
Bilmišće	100				720	100%	100%		720			
Crkvice	80	10	10		7500	100%	100%		6000	750	750	
Čajdraš	30	70			1000	50%	50%					
Dolača	100				2375			100%	2375			
Donja Vraca	100				974			100%	974			
Donje Babino	95		5		1188	20%	20%	80%	1129		59	
Drivuša	80	10	10		1120	100%	100%		896	112	112	
Gorica	100				750			100%	750			
Gornja Gračanica	97			3	1298			50%	630			19
Gornja Zenica	100				1180			50%	590			
Gornje Crkvice	50	50			792	60%	60%	40%	396	396		
Klopče	90	10			4398	80%	80%	20%	3958	440		
Lašva	100				984			100%	984			
Lokvine	100				3146			100%	3146			
Lukovo Polje	90		2	8	1317	100%	100%		1185		26	105
Novo Radakovo	80	10	10		4908	100%	100%		3928	490	490	



Settlement	Ethnic mix (%)				Population estimate 2008	Currently connected to public system	Transferred to Plava voda	Newly connected to Plava voda	Population connected to Plava Voda			
	B	C	S	O*					B	C	S	O
Pehare	100				4732	100%	100%		4732			
Perin Han	70	20	10		2900	80%	80%	20%	2030	580	290	
Podbrežje	15	80	5		970	70%		30%	724	232	14	
Raspotočje	60	40			2030	70%		30%	365	243		
Ričice	100				2100	80%	80%	20%	2100			
Staro Radakovo	80	10	10		6500	100%	100%		5200	650	650	
Trgovišće	100				2280	90%		10%	228			
Vražale	80	20			700			100%	560	140		
TOTAL									43845	4033	2391	151

* Roma people

The tables above and the overall assessment of national structure given in table below demonstrate that the social impact of the Plava Voda project will be very positive as the supplies will also be extended into the rural irrespective of ethnic mix. In fact, there was no indication of bias or discrimination in the process of selection of settlements to be connected to Plava Voda.

Table 33. Overall assessment of national structure

Municipality	Population	Ethnic mix				Total
		Bosniaks	Croats	Serbs	Others	
Travnik	Total population estimate (2003)	46491	4115	482	*	51369
	Population to be connected to Plava voda	5911	9352	181	215	15659
Novi Travnik	Total population estimate (2003)	11426	12584	1153	*	25198
	Population to be connected to Plava voda	4.819	12749			17568
Vitez	Total population estimate (2003)	11700	8427	734	*	21354
	Population to be connected to Plava voda	3053	1014	8	292	4367
Busovača	Total population estimate (2003)	760**	10421	260	*	11451
	Population to be connected to Plava voda	3392	4002	1019		8413
Zenica	Total population estimate (2003)	99776	17277	12685	*	133861
	Population to be connected to Plava voda	43845	4033	2391	151	50420
TOTAL population per ethnic groups to be connected to Plava voda		126582.8	83974	3599	658	



* Available population estimates did not include estimate of other ethnic groups such as Roma people.
** Number of Bosniaks in Busovača should be taken with reserve because total population estimate in 2006 is significantly higher and amounts to 17.545. However, no data on ethnic mix is available for 2006.

3.2.3 Population projections

Estimation of future population should be determined on the basis of existing growth rates of population. Population projections will be calculated for the series of years 2010, 2015, 2020, 2025, and 2030. Selected function of extrapolation will be applied in order to estimate the number of inhabitants. For further projections, population data from the period 2005-2009 is used, as well as logarithmic functions, which were best adapted to population growth curve in this period. Therefore, these functions are presented in the diagrams below.

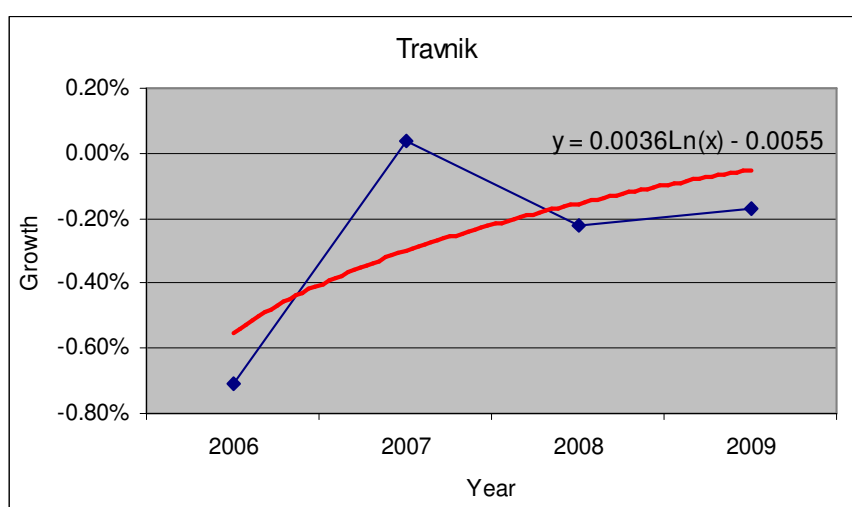


Figure 12. Growth logarithmic functions for Travnik Municipality

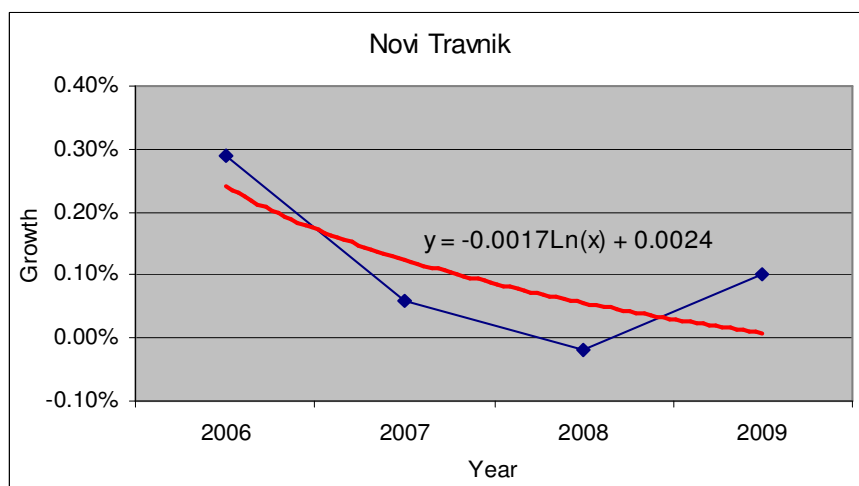




Figure 13. Growth logarithmic functions for Novi Travnik Municipality

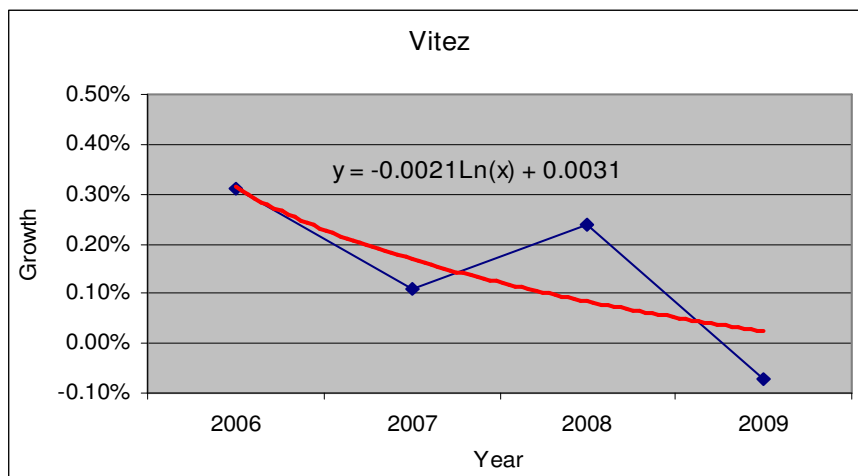


Figure 14. Growth logarithmic functions for Vitez Municipality

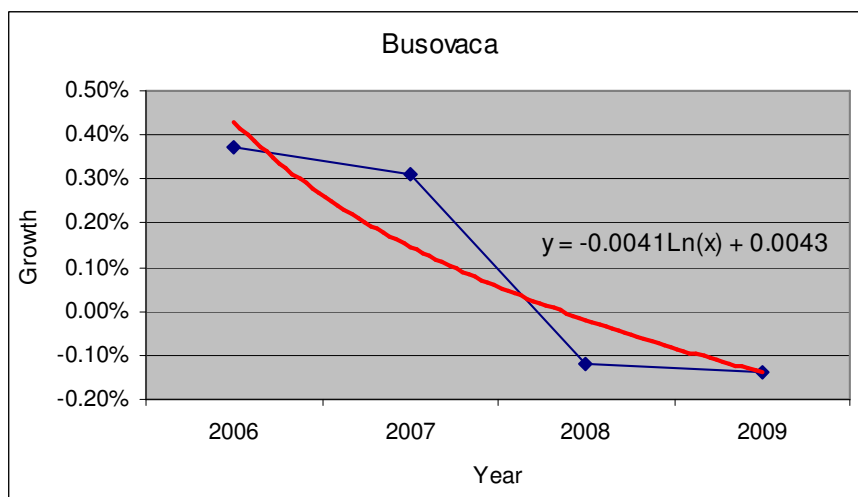


Figure 15. Growth logarithmic functions for Busovača Municipality

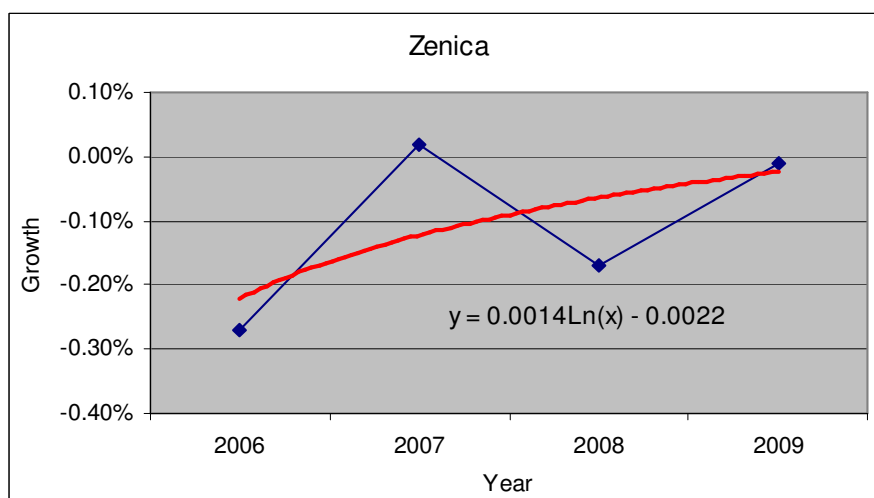


Figure 16. Growth logarithmic functions for Zenica Municipality



Based on the logarithmic functions shown in the previous diagrams, the annual population growth rate is calculated for the next 20 years.

Table 34. Projections of annual growth rates for related municipalities

Year	Annual growth rates %				
	Travnik	Novi Travnik	Vitez	Busovača	Zenica
2010	0.03	-0.03	-0.03	-0.23	0.01
2015	0.28	-0.15	-0.17	-0.51	0.10
2020	0.42	-0.22	-0.26	-0.68	0.16
2025	0.53	-0.27	-0.32	-0.80	0.20
2030	0.61	-0.31	-0.37	-0.89	0.23

Future population number for municipalities is calculated based on the annual growth rates, and it is shown in table below.

Table 35. Projections of population number for municipalities

Year	Population number				
	Travnik	Novi Travnik	Vitez	Busovača	Zenica
2010	55,016	24,851	25,045	16,036	127,112
2015	55,170	24,813	25,002	15,954	127,242
2020	55,404	24,758	24,937	15,845	127,444
2025	55,697	24,692	24,857	15,719	127,698
2030	56,036	24,616	24,766	15,579	127,993

3.2.4 Population projections available from Municipal Spatial Plans

Municipality of Travnik has 88 settlements. The only available data on population number in those settlements as well as the number of households, in the Spatial Plan of Travnik Municipality 2004-2020, are from the year 1991 (see Table below).

Table 36. Population and household number by settlements in Travnik municipality

No.	Settlement	Population number	No. of households	No.	Settlement	Population number	No. of households
1	Bačvice	748	187	45	Mudrike	741	150
2	Bandol	272	67	46	Nova Bila	737	204
3	Bijelo Bučje	924	205	47	Orahovo	399	82
4	Bilići	335	78	48	Orašac	170	32
5	Brajići	673	185	49	Orlice	41	11
6	Brajkovići	520	113	50	Ovčarevo	564	132
7	Brankovac	282	61	51	P.Slavka Gavrančića	417	312
8	Čifluk	147	32	52	Paklarevo	1255	103
9	Čosići	685	164	53	Podkraj	456	226



No.	Settlement	Population number	No. of households	No.	Settlement	Population number	No. of households
10	Čukle	1.37	281	54	Podovi	1039	161
11	Dolac	673	289	55	Podstinje	729	333
12	Dolac na Lašvi	492	153	56	Pokrajčiči	1382	62
13	Donja Trebeuša	261	154	57	Poljanice	296	114
14	Donje Krčevine	497	68	58	Priči	399	86
15	Donji Korićani	657	103	59	Pulac	499	111
16	Dub	964	137	60	Putičevo	1511	416
17	Đelilovac	1.232	199	61	Radića Brdo	310	87
18	Fazlići	197	41	62	Radojčiči	293	70
19	Gladnik	315	82	63	Radonjići	214	45
20	Gluha Bukovica	1.039	215	64	Ričice	635	146
21	Goleš	1.081	253	65	Runjići	309	74
22	Gornja Trebeuša	306	65	66	Sažiči	362	70
23	Gornje Krčevine	759	165	67	Sečevo	333	68
24	Gornji Korićani	752	149	68	Seferi	527	115
25	Gradina	569	130	69	Selići	448	101
26	Grahovčiči	1.284	263	70	Skomorje	225	53
27	Grahovik	334	95	71	Slimena	943	263
28	Guča Gora	815	224	72	Suhi dol	576	127
29	Hamandžiči	501	109	73	Šešiči	251	60
30	Han Bila	655	158	74	Šipovik	352	96
31	Jezerci	641	123	75	Šišava	611	127
32	Kljaci	741	187	76	Travnik	18849	5878
33	Kokošari	130	34	77	Turbe	4467	1193
34	Komar	312	79	78	Turići	793	188
35	Kraljevice	169	49	79	Varošluk	746	181
36	Krpeljići	716	154	80	Velika Bukovica	235	56
37	Kula	441	106	81	Vidoševići	224	59
38	Kundići	120	32	82	Vilenica	272	79
39	Lovrići	135	35	83	Višnjevo	969	197
40	Mala Bukovica	252	56	84	Vitovlje	702	177
41	Maline	1484	319	85	Vlahovići	340	75
42	Miletići	83	18	86	Vranići	61	12
43	Miškića Brdo	139	40	87	Zagrađe	639	118



No.	Settlement	Population number	No. of households	No.	Settlement	Population number	No. of households
44	Mosor	319	75	88	Zaselje	60	12
Total:						70,402	17,994

Municipality Novi Travnik has 52 settlements. Population number in Table below for 1991 (census) and for 2006 (estimate) was taken from the Spatial Plan of Novi Travnik Municipality. However, municipal representatives provided another estimate of the population number in 2008 (see Table below).

Table 37. Population number by settlements in Novi Travnik municipality

No	Settlement	Census 1991	2006	Municipal estimate 2008	No.	Settlement	Census 1991	2006	Municipal estimate 2008
1	Bučići	898	940	874	27	Novi Travnik	11522	12850	12850
2	Balići	590	610	590	28	Opara	301	250	220
3	Bistro	411	415	400	29	Orašac	580	590	580
4	Božići	183	150	140	30	Pečuj	608	615	600
5	Budušići	152	160	160	31	Petačići	304	225	214
6	Bugojčevići	228	220	200	32	Potočani	212	215	180
7	Bukvići	284	260	240	33	Pribilovići	542	460	500
8	Čakići	338	360	350	34	Pričani	320	260	270
9	Čehova	542	560	540	35	Rankovići	1058	1100	1040
10	Dahovo	100	80	25	36	Rastovci	627	620	560
11	Donje pećine	417	240	166	37	Rat	524	410	380
12	Duboko	202	165	140	38	Reput	200	190	223
13	Đakovići	283	121	121	39	Ruda	493	273	170
14	Gornje pećine	673	290	270	40	Sebešić	254	140	20
15	Hadžići	196	170	140	41	Seona	262	140	118
16	Has	374	380	340	42	Sinokos	439	430	510
17	Isakovići	156	154	140	43	Stojkovići	529	480	489
18	Kasapovići	792	745	600	44	Šenkovići	593	609	335
19	Kopila	272	260	270	45	Torine	261	221	220
20	Kovačići	289	103	40	46	Trenica	475	430	354
21	Krnjića potok	158	160	158	47	Trnovac	92	0	10
22	Lisac	349	320	307	48	Turalići	92	60	55
23	Margetići	392	355	330	49	Vejzovići	219	230	230
24	Monjići	294	300	294	50	Vodovod	134	110	105
25	Nević polje	643	620	630	51	Zenepići	256	130	153



No	Settlement	Census 1991	2006	Municipal estimate 2008	No.	Settlement	Census 1991	2006	Municipal estimate 2008
26	Nova Opara	350	200	230	52	Zubići	250	215	200
Total							30,713	29,591	28,281

Municipality Vitez has 34 settlements. According to the census of 1991 the municipality had total 27,728 inhabitants. Estimate of the population number in 2004, according to the Spatial Plan of Vitez municipality, is given in table below. Data in table below from the year 2005 and projection of population for years 2010, 2020 and 2030, are provided by the representatives of Municipality Vitez.

Table 38. Population number and projections by settlements in Vitez municipality

No.	Settlement	Projections of population number				
		Population 2004	Population 2005	2010	2020	2030
1	Ahmići	437	459	494	574	666
2	Kratine	41	38	41	48	55
3	Nadioci	408	457	492	571	663
4	Pirići	224	224	241	280	325
5	M. Mošunj	798	755	813	944	1095
6	V. Mošunj	274	263	283	329	382
7	Bila	2198	1515	1632	1894	2198
8	Bukve	303	280	302	350	408
9	Putkovići	128	140	151	175	203
10	Donja Večeriska	737	709	764	886	1029
11	Gornja Večeriska	461	437	471	548	634
12	Zaselje	162	163	178	204	237
13	Dubravica	1108	1094	1179	1368	1587
14	Tolovići	133	321	346	401	466
15	Sivrino selo	465	441	475	551	640
16	Krtine	84	79	85	99	115
17	Šantići	994	1003	1081	1254	1455
18	Gačice	957	632	681	790	917
19	Jardol	801	714	769	893	1036
20	Divjak	1323	1088	1172	1360	1579
21	Krčevine	730	701	755	876	1017
22	Ljubić	111	226	243	283	328



No.	Settlement	Population 2004	Population 2005	Projections of population number		
				2010	2020	2030
23	Kruščica	2414	2403	2589	3004	3487
24	Lupac	674	621	669	776	901
25	Počulica	417	747	805	934	1084
26	Prnjavor	298	284	306	355	412
27	Vrhovine	478	443	477	554	643
28	Preočica	1334	1240	1336	1550	1799
29	Rijeka	1367	1373	1479	1717	1992
30	Vraniska	432	404	435	505	586
31	Sadovače	477	455	490	569	680
32	Brdo	192	226	243	283	328
33	Zabilje	758	608	655	760	882
34	Vitez - Stari Vitez	7158	7185	7740	8983	10425
	Total	28,876	27,728	29,871	34,666	40,232

Municipality Busovača has 47 settlements. According to the 1991 census, the municipality had total 18,847 inhabitants. Population number per settlement, in the table below, is obtained from the municipal representatives (via questionnaires) and it presents a recent estimate. According to the same source, number of households in Busovača municipality is currently 4,529.

Table 39. Population number by settlements in Busovača municipality in 2008

No.	Settlement	Population number	No.	Settlement	Population number
1	Bare	213	25	Kupres	189
2	Bukovci	384	26	Lončari	301
3	Buselji	825	27	Mehurići	98
4	Busovača	3903	28	Merdani	416
5	Carica	234	29	Mihaljevići	380
6	Dobraljevo	450	30	Milavice	121
7	Dolac	150	31	Nezirovići	58
8	Donja Rovna	300	32	Očehnići	-
9	Gornja Rovna	307	33	Oselište	102
10	Grablje	147	34	Podbare	100
11	Granice	103	35	Podjele	93
12	Gusti Grab	160	36	Podstijena	250
13	Hozanovići	400	37	Polje	701



14	Hrasno	333	38	Prosje	11
15	Javor	12	39	Putiš	373
16	Jazvine	248	40	Ravan	481
17	Jelinak	300	41	Skradno	470
18	Kačuni	1755	42	Solakovići	323
19	Kaonik	419	43	Strane	300
20	Katići	125	44	Stubica	32
21	Kovačevac	108	45	Šudine	188
22	Krčevine	388	46	Turići	280
23	Krvavčići	48	47	Zarače	200
24	Kula	316	--	---	---
Total					17,099

According to the census of 1991, **Zenica municipality** had 81 settlements and there were 145,517 inhabitants (see Table below).

Table 40. Population number in Zenica municipality by settlements in 1991

No.	Settlement	Pop. no. 1991	No.	Settlement	Pop. no. 1991
1	Arnauti	1061	42	Ljubetovo	190
2	Banloz	470	43	Moščanica	826
3	Bijele Vode	85	44	Mutnica	382
4	Bistrica	526	45	Nemila	2505
5	Bistrica Gornja	98	46	Novo Selo	259
6	Briznik	1216	47	Obrenovci	659
7	Bukovica	188	48	Orahovica	2535
8	Dobriljevo	968	49	Osojnica	180
9	Donja Vraca	979	50	Osredak	133
10	Donji Čajdraš	313	51	Palinovići	303
11	Drugavci	312	52	Pepelari	391
12	Dusina	251	53	Peševici	284
13	Gladovići	558	54	Plahovići	344
14	Gorica	801	55	Plavčići	8
15	Gornja Gračanica	1027	56	Poca	431
16	Gornja Višnjica	233	57	Pojске	2664
17	Gornja Vraca	509	58	Ponihovo	71



No.	Settlement	Pop. no. 1991	No.	Settlement	Pop. no. 1991
18	Gornja Zenica	2516	59	Ponirak	507
19	Gornji Čajdraš	1368	60	Puhovac	399
20	Gradina	147	61	Putovičko Polje	893
21	Gradišće	2814	62	Putovići	799
22	Grm	1033	63	Radinovići	249
23	Gumanci	28	64	Sebuja	82
24	Janjac	550	65	Smajići	404
25	Janjići	102	66	Starina	734
26	Janjički Vrh	70	67	Stranjani	1984
27	Jasika	137	68	Sviće	692
28	Jastrebac	408	69	Šerići	1475
29	Jurjevići	147	70	Šiblići	430
30	Kasapovići	268	71	Tišina	339
31	Klopački Vrh	0	72	Topčić Polje	1257
32	Kolići	261	73	Trešnjeva Glava	292
33	Koprivna	319	74	Vranduk	625
34	Kovačići	362	75	Vranovići	147
35	Kovanići	549	76	Vražale	457
36	Kozarci	506	77	Vrhopolje	291
37	Kula	192	78	Vukotići	806
38	Lašva	693	79	Zahići	289
39	Lijeske	79	80	Zenica	96027
40	Lokvine	940	81	Živkovići	149
41	Loznik	23	--	---	---
Total					145,517

According to data obtained from the municipal representatives, today Zenica municipality has 71 local communities with 139,999 inhabitants living in 43,456 households.

Table 41. Population and household number in Zenica municipality by settlements in 2008

No.	Settlement	Pop. number 2008	Household number	No.	Settlement	Pop. number 2008	Household number
1	Arnauti	1100	280	37	Londža	3261	1122



No.	Settlement	Pop. number 2008	Household number	No.	Settlement	Pop. number 2008	Household number
2	Babino	1200	405	38	Lukovo Polje	1317	323
3	Banlozi	1360	440	39	Mokušnice	4550	2071
4	Bilmišće	720	169	40	Mošćanica	708	207
5	Bilino Polje	3121	1052	41	Nemila	2636	787
6	Bistrica	640	152	42	Nova Zenica	5495	1312
7	Bistričak	672	175	43	Novo Radakovo	4908	1636
8	Blatuša	6705	2065	44	Odmuť	4843	1745
9	Brist	4711	1067	45	Orahovica	2760	730
10	Briznik	1410	335	46	Pehare	4732	1183
11	Broda	2465	673	47	Pepelari	360	90
12	Carina	2300	788	48	Perin Han	2900	792
13	Centar	2946	979	49	Pišće	911	328
14	Crkvice	7500	2810	50	Pobrežje	970	333
15	Čajdraš- Vjetrenice	1675	411	51	Pojске	750	200
16	Dobriljevo	620	155	52	Puhovac	400	150
17	Dolača	2375	644	53	Radinovići	220	80
18	Donja Gračanica	2520	998	54	Raspotočje	2030	771
19	Donja Vraca	974	243	55	Ričice	2100	550
20	Donje Babino	1188	396	56	Sebuja	350	86
21	Drivuša	1120	411	57	Sejmen	2625	939
22	Gladovići	500	179	58	Seoci	1502	350
23	Gorica	750	230	59	Starina	787	170
24	Gornja Gračanica	1298	432	60	Staro Radakovo	6500	2020
25	Gornja Zenica	1180	320	61	Stranjani	1796	494
26	Gornje Crkvice	792	394	62	Šerići	1470	390
27	Gradišće	2156	650	63	Tetovo	802	353
28	Jalija	2987	983	64	Topčić Polje	1750	450
29	Janjac	400	123	65	Trgovišće	2280	600
30	Janjići	1090	300	66	Varda	700	248
31	Jastrebac	410	96	67	Vranduk	810	250
32	Klopče	4398	1466	68	Vražale	700	190
33	Koprivna	1537	485	69	Vrselje	800	180
34	Kovanići	320	92	70	Vukotići	806	196



No.	Settlement	Pop. number 2008	Household number	No.	Settlement	Pop. number 2008	Household number
35	Lašva	984	296	71	Zmajevac	1200	404
36	Lokvine	3146	1032	--	---	---	---
Total						139,999	43,456

3.2.5 Household size

The following estimates of average household sizes were obtained from the individual municipalities:

- According to the information obtained from the municipal representatives, which dates from 1991, the household size in Travnik municipality was 3.91. There are no newer estimates.
- An estimate of the municipal representatives is that an average household size in Novi Travnik municipality is 4.
- The average household size in 1991 in Vitez municipality was 3.6 members. There are no newer estimates.
- Based on data from 1991, the average household size in Busovača was 3.9 members. Estimation of the municipal representatives is that the household size is currently 3.7 members.
- The average household size in Zenica, according to the information obtained from municipal representatives, is 3.2.

3.2.6 Structure of Employment

Table 42. Structure of Employment in the Project Areas in 2009

Item	Middle-Bosnia Canton (Travnik, N.Travnik, Vitez, Busovača)	%	Zenica-Doboj Canton (Zenica)	%
Agriculture, hunting and forestry	1690	5%	1709	2%
Fishing	18	0%	7	0%
Mining	1183	3%	5006	7%
Manufacturing	9613	26%	21579	30%
Electricity, gas and water supply	946	3%	2267	3%
Construction	1355	4%	4459	6%
Wholesale, retail; certain repair	8183	22%	10377	15%
Catering trade	1868	5%	2722	4%
Transport, storage and communication	1493	4%	4362	6%
Financial intermediation	379	1%	972	1%



Real estate, renting and business activities	431	1%	1868	3%
Public administration & defence; comp.soc.sec.	2813	8%	4437	6%
Education	3387	9%	6011	8%
Health and social welfare	2782	7%	3853	5%
Other social and personal service	1120	3%	1278	2%
Private households with employed persons	-		-	
Unclassified according to activities CEA	37	0%	-	
TOTAL	37298	100%	70907	100%

The trends in the structure of employment by cantons show the dominance of manufacturing activities. As a result of karstic nature of soils, agriculture activities account for a very modest proportion of employment.

3.2.7 Employment and Wages

Data for “monthly average income” or “household income” are not collected or calculated by the Statistical Institutes in BiH. This would require regular household income and expenditure surveys, which would also show the impact of remittances from family members working elsewhere and other types of transfers such as pensions etc. The data which is collected and calculated is “monthly net average wages”, where “wage” is a more narrow term compared with “income” since it excludes the remittances and transfers. In most cases these elements can make significant contributions.

Data on monthly net average wages are available at municipality level from Institute for Statistics as “wages per employee”, meaning that this data is collected only for those inhabitants who are officially registered as employed.

Table 43. Employment and Wages by Municipalities in 2009

	Travnik	Novi Travnik	Vitez	Busovača	Zenica
Total population	55.000	24.859	25.052	16.073	127.105
Total employed	11.207	2.476	4.939	1.569	26.043
Labour participation ratio	20.4	10	19.7	9.8	20.5
Economically active population (15-64 years)	37.479	16.818	16.563	10.372	85.709
Employment rate	30%	15%	30%	15%	30%



Average monthly wages KM	644	677	570	696	737
--------------------------	-----	-----	-----	-----	-----

In an average middle-income economy, labour participation ratio is usually around 30 and employment rates amongst economically active population are between 50% and 60%. The statistics summarised above show the labour participation ratio and employment rate to be about half of an average middle income economy.

It is widely accepted that the actual size of the economy of any town or city in Bosnia is significantly greater than reflected by the “registered activities”. It is quite common for the registered resident population to include those working and living in other towns and cities and yet they would not be registered as employed in their town of registration. In practice, when assessing affordability of services, household income should also include non-monetary earnings, remittances from family members working and living outside the town, and earnings from the “shadow economy” where people are engaged in economic activities without being formally registered as employed.

The data necessary to determine the extent of this income in the project towns is not available. Unofficial estimates have indicated that estimates of household incomes should be at least increased by a half to take account of the non-monetary contributions, remittances, and earnings from the shadow economy. This would be confirmed by the quality of consumer products in the shops, standard of housing and those under construction and cars etc in the project towns. As there is considerable uncertainty regarding these factors, no additional allowance is made to increase the average household income, but it is assumed that there are 1.5 wage earners per household. In most assessments of household affordability, a ratio of average wage earners per household of 1.0 to 1.5 is quite common.

3.2.8 Consumer Affordability

Water supply services are considered affordable if households can pay the water bill without a significant reduction of expenses for other essential goods and services. As economic, social and political aspects tend to change over time which may have impact on rates and charges for water service, it is important to measure affordability of the customers to pay the bills.

The consumer affordability of existing water services can be estimated using the current tariff levels for domestic water and waste water services, estimated consumption and data concerning average household income.

Table 44. Estimated monthly cost for water and wastewater services

Municipality	Persons per household*	Average net water consumption per household** (l/d)	Domestic w&ww tariff (KM/m ³)	Monthly w&ww bill per household (KM)
Travnik	3.9	819	1.20	29
Novi Travnik	4	860	0.90	23
Vitez	3.6	774	0.93	22
Busovača	3.7	796	1.20	29



Municipality	Persons per household*	Average net water consumption per household** (l/d)	Domestic w&ww tariff (KM/m ³)	Monthly w&ww bill per household (KM)
Zenica	3.2	672	1.30	26
Average	3.6	784	0.97	26

* According to reports from the Municipalities.

**This is calculated based on water consumption per capita, which, for households only, is 210 l/c/d for Zenica and Travnik, and 215 l/c/d for Novi Travnik, Vitez and Busovača.

Based on the data, the estimated cost for water and wastewater services is approximately 26 KM/month per household. This reflects an average daily consumption per household of 784 litres per day (23.52 m³/month) multiplied by the corresponding water and wastewater tariffs.

In terms of consumer affordability, the monthly bill for water and wastewater services is to be compared with the average household income. Federal Institute for Statistics provides data on the average net personal income (wages) per employee in the five municipalities. However, as discussed above, taking into consideration the presence of grey economy, remittances and other transfer sources of income, a realistic estimate of the number of breadwinners per household is assumed to be 1.5.

Table 45. Household Affordability

Municipality	Average net wages per employee (2009)	Average net income per household* (2009)	Monthly w&ww bill per household (KM)	Monthly bill as % of household income
Travnik	644	966	29	3.0%
Novi Travnik	677	1015	23	2.2%
Vitez	570	855	22	2.6%
Busovača	696	1044	29	2.8%
Zenica	737	1105	26	2.4%

*Calculated as average net wages per employee multiplied by 1.5 (the number of breadwinners).

Percentage of monthly water and wastewater bill based on average net income of the households is different for each municipality and ranges from 2.2% for Novi Travnik to 3.0% for Travnik.

On the basis normally adopted international criteria for affordability, the households should not have to spend more than 4% to 5% of the monthly disposable income on water and wastewater services. This indicates that current services appear to be within the affordability boundaries. It should also be noted that current per capita consumption rates range from 210 to 215 litres per capita per day (l/c/d). These are very high consumption compared with average rates in Western Europe of around 130 to 150 l/c/d and reflect considerable wastage and indiscriminate use of water. It is expected that these average consumption rates would fall to around 120 to 130 l/c/d over the next few years as a result wide spread consumer metering, greater consumer awareness and implementation of more effective demand management measures by the water utilities Furthermore, the implementation of the Plava Voda project is expected to yield significant operating costs savings for individual



municipalities in not having to rely on inadequate and poor quality of existing water resources. Any long term real increases in future tariff levels are likely to be easily matched by favourable prospects for the national economy and significant real increases in household incomes.

3.2.9 Public health

Water pollution exposes the population to microbiological and chemical contamination. Unsafe drinking water can be a significant carrier of water-borne infectious diseases such as enterocolitis or hepatitis A, and can cause severe diarrhoeal infections and other health problems. Drinking water can also be tainted with chemical, physical and radiological contaminants with harmful effects on human health.

Public Health Institute of Central Bosnia Canton and Public Health Institute of Zenica-Doboj Canton control, monitor, and analyze epidemiologic situation in all municipalities in the Cantons, and make programs for disinfection and deratization, and supervise their implementation, monitor hygienic properties of drinking water, surface and waste waters, and sanitary regulations for foodstuffs.

Public Health Institutes implement the health regulatory requirements for water and foodstuffs issued by the Ministry of Health FBiH. They are also equipped with laboratories. There is microbiological and physical-chemical laboratory where regular tests for food and water quality are carried out. Epidemiology department keeps register of contagious, parasite and non-contagious diseases.

Table below shows data on waterborne diseases in the Municipalities of Travnik, Novi Travnik, Vitez, and Busovača for the period 2001-2009.

Table 46. Overview of waterborne diseases in Travnik, Novi Travnik, Vitez, and Busovača

Year	Travnik	Novi Travnik	Vitez	Busovača	Total
Enterocolitis					
2001	180	52	59	29	320
2002	214	61	77	26	378
2003	219	53	59	29	360
2004	155	47	36	36	274
2005	187	49	42	38	316
2006	242	88	39	38	407
2007	224	66	65	51	406
2008	161	58	31	26	276
2009	179	64	29	21	293
Total	1761	538	437	294	3030
Hepatitis A					
2001	32	2	17	1	52
2002	2	1			3
2003	2				2
2004	1		1		2
2005		2	1	1	4
2006	1		1		2
2007		1			1



Year	Travnik	Novi Travnik	Vitez	Busovača	Total
2008					
2009					
Total	38	6	20	2	66
Dysentery Bacilaris					
2001				1	1
2004	2	1			3
Total	2	1		1	4

Table below shows data on waterborne diseases in municipality Zenica for the period 2001-2009.

Table 47. Overview of waterborne diseases in Zenica

Year	Intestinal infectious diseases	Diarrhea and gastroenteritis	Typhoid and other rickettsioses	Hepatitis A	Total
2001	54	815	1	146	1016
2002	81	1110	-	27	1218
2003	53	1549	-	43	1645
2004	128	1393	1	23	1545
2005	90	1190	-	54	1334
2006	116	1804	62	64	2046
2007	108	2793	7	61	2969
2008	50	2846	-	55	2951
Total	680	13500	71	473	14724

3.2.10 Identification of directly affected and vulnerable groups

The regions of Middle Bosnia Canton and Zenica-Doboj Canton that are of concern for this project have no specific cultural characteristics that distinguish them from the rest of the region of the Federation of Bosnia and Herzegovina. No indigenous population live in this region.

Groups that may be directly affected by the project in the pre-construction phase are owners of the land who will be subject of complete or incomplete expropriation. Some of the landowners **will also be affected in the operational phase**, as the construction of buildings on their plots will be forbidden in the pipeline right-of-way.

In order to assess the impact on landowners the Census was carried out in June 2011 in line with the requirements set up in EBRD Environmental and Social Policy (PR 5).

The Census results show that a total of 230 private land plots will be affected by the Project, of which there are:

- 10 affected businesses,
- 66 households (with 158 household members in total),
- 126 private land plots with no structures.

The size of affected plots ranges from 74 m² to 40.000 m².



The Socio-economic Survey covered 10 businesses and 48 households.

In the category of **households**, 41 resident owners and 7 resident non-owners were identified. With regards to the legality of the structures, 6 informal structures and 34 formal structures were identified, while the remaining of the respondents did not wish to respond to the question.

The affected population consists mostly of Croats (75%), followed by Bosniaks (23%) and Serbs.

The majority of the local population has been living in the affected plots since birth. The period of construction of structures in the Project area ranges from 1947 to 2004.

The Census and Survey results show that the Project affected areas consist of rural areas, and the population consists of households with livelihoods based on agriculture. 88% of the affected population grow fruit or vegetables on the affected plots for their own needs.

The **affected businesses** employ a total of 153 employees. All businesses are legally registered. Out of a total of 10 business structures, 9 are fully legal while 1 structure is of temporary character. All businesses actively use the affected land plots.

Vulnerable groups that may be affected by the project in the operational phase are those below the poverty line who may not be able to afford to pay for any potential increases in tariffs. However, it is not necessary that tariffs would be necessarily increased as a consequence of operating cost savings that are likely to be made by the operating utilities.

The Household Budget Survey undertaken in 2007 for Bosnia and Herzegovina gives preliminary poverty profile at the country level and at each Entity²³. As it turns out, the costs of a minimum-calories food bundle calculated in this Survey is equal to KM 1,005.68¹³. This is used as average poverty line for BiH. Only 0.52% of the population has a total consumption expenditure (including both food and non-food) that is less than the food poverty line, while 21.37% of the population spends in "food and beverages" only less than the food poverty line. The Survey concludes that about one fifth of the overall country population can be considered poor and that:

- Poverty is more widespread in the RS than in FBiH. Depth and severity are also higher in the RS than in FBiH.
- Poverty is higher in rural than urban areas. Urban poverty in the RS is more widespread than rural poverty in FBiH, and it is deeper and more severe.
- The poverty head-count is significantly lower for female-headed households than for male-headed households.
- Poverty is widespread among the larger households. Poverty is more concentrated in households with children, and it is more widespread, deep and severe. Poverty rates for households with no children are generally lower than the average. Also, as expected, as the number of children increases, poverty incidence worsens.

¹³ 2007 Household Budget Survey for Bosnia and Herzegovina, Agency for Statistics B&H, Federal Office for Statistics, and Institute for Statistics RS, 2007, available at www.fzs.ba/Anketa/HBS07_Poverty_eng.pdf



- Poverty rates are higher than the average for the unemployed and the disabled to work, while among those who are active, poverty rates are higher among the self-employed and the non-permanently employed.
- In terms of sectors of occupation, poverty is concentrated in agriculture, industry and construction, which absorb about half of the poor household heads that are employed.

Although data are available at the entity level only, it very likely that the households living below the poverty line exist in the project area.

The identified vulnerable groups that live below the poverty line are: recipients of the social welfare benefits (disabled persons, war veterans, displaced persons, children receiving child allowance), recipients of pensions, and Roma people. The table below gives estimate of identified potential vulnerable groups per municipality. It should be noted that none of the municipalities subsidise water bill issued to social categories. Instead, the assistance is received indirectly from central and local government institutions.

Table 48. Identified vulnerable groups

Municipality	Recipients of social welfare benefits						Displaced persons	Retired	Roma ppl
	Disabled persons	Civil war victims	Disabled war veterans	Families of killed soldiers	Families with child allowance	Fam. with permanent social benefits			
Travnik	77	95	1181	1117	254	95	1472	7799	475
Novi Travnik	641	57	929	550	196	51	1436	3500	26
Vitez	653	108	1083	841	264	52	84	3250	428
Busovača	310	38	416	340	90	80	0	2207	0
Zenica	74	104	1471	697	2,500	684	760	15000	900
TOTAL	1755	402	5080	3545	3304	962	3752	31756	1829

The analysis has also shown that the project in its operational phase might also directly affect the following people:

- citizens of Travnik and tourists coming to the area due to the amenity value of "Plava Voda" as explained in the next chapter,
- owners of restaurants on Plava Voda in Travnik who benefit from visitors to "Plava voda", as well as,
- fisherman associations that catch fish on the Lašva river and can be affected by decrease of fish population, if any.

The analysis of impact of the project on affected people and vulnerable groups is presented in the next section.



3.2.11 Public amenities

In the context of this project, the public amenities are understood to include (a) feature that affects attractiveness or value of a certain location as well as (b) a useful or pleasant facility or service for public.

According to the information collected during the interviews with the municipal representatives and during the public hearing session carried out as a part of national environmental permitting procedure, the only recognised amenity that could be negatively affected by the project is the “Plava Voda” broader region. “Plava Voda” is well known municipal attraction due to the attractiveness of its white water flows downstream from the intake, which are especially enjoyed by people visiting the surrounding restaurants. Moreover the site is well known as one of the top-attraction for tourists. The citizens of Travnik and surrounding settlements also visit “Plava Voda” for walks and recreational purposes and consider Plava Voda as a symbol of Travnik.

All other public amenities (e.g. schools, sport centres, hospitals...) in the project areas will be connected to the system and can only benefit from this project. More information about the possible impacts of the project on the public amenities in the region is in the next section.



4 DESCRIPTION OF THE ENVIRONMENT

4.1 Climate

Project area of Regional system Plava Voda is under the influence of moderate continental climate with strong influence of mountain climate in the high sea areas. Summers are relatively warm. The warmest month is July, with the mean temperature around 18,3°C in the valleys.

Mean January temperatures are negative and ranges between -2 to -3°C. Annual temperature fluctuations are quite large and they vary around 20°C, but significantly larger fluctuations exist in mountainous areas, which is characteristic of continental climate.

Mean annual air temperatures in the valleys are around 8.8°C with much expressed seasons, temperature fluctuations in spring and autumn and late spring and early autumn frosts. According to low maximum temperature values in July and August (between 25 and 30°C) it can be concluded that the summer in this area is relatively warm.

Significant differences occur in geographic distribution of temperature, as well as its parameters which are conditioned by local influences. On the basis of displayed temperature regimes it can be concluded that summers are warm and winters are cold in this area, which makes the major annual changes as influence of continental climate.

Average annual precipitation is relatively low and ranges between 814 and 1.000 mm. However, although small amounts of precipitation, it can be said that they are sufficient, considering their equal distribution throughout whole year. Maximum rainfall is in the autumn. In addition to the main maximum in autumn, there is a secondary maximum in spring.

Number of days with snow cover increase from north to south, and it is in conjunction with altitude, which highly influences length of snow cover existence. Snow cover lasts 40-60 days in lower parts, while in mountain belt lasts to 90 days. Its average height is 30-40 cm.

Annual distribution of cloudiness shows that winter represent more cloudy part of the year, while in summer period it is small and below 50%. Period of sunshine duration is relatively long and it is between 170 and 180 hours as annual average.

In general, the climate of this area is favourable, with medium humidity, moderate temperatures, and significant sunshine without strong stormy winds and basically it is favourable for various human activities, urbanization, agriculture, tourism, sport and recreation, etc.



4.2 Geology

4.2.1 Introduction

In chronostratigraphic terms, the researched area of the “Plava Voda” regional water supply system, is a very complex area, both structurally and tectonically. Accordingly, the entire area is characterised by different types of deposits, mostly Palaeozoic but also Mesozoic metamorphites and magmatites, as well as Mesozoic or Cenozoic sediment deposits (Annex 2).

4.2.2 Lithostratigraphic characteristics

The oldest formations (Sillurian-Devonian), that build the researched area, have been identified on the right side of the Lašva River valley, southeast from Novi Travnik. In spatial terms, their presence is large, while in lithostratigraphic terms, they belong to the complex of metamorphites, built of chlorite-muscovite, quartz-sericite and sericite schist, meta-sandstones and greywacke. Only in some places the dolomites, quartz-graphite and tremolitic schist may also be found.

Within this complex, in several distinctive locations, with overall presence on several tens of km², there are effusive bodies from Carboniferous-Permian period, which are in lithological terms represented by rhyolite and in some places metamorphic rhyolites, and quartz-sericite schist. The northern edge of the concerned area is covered by lake and marsh sediments, as well as alluvial, delluvial, proluvial and fluvio-glacial sediments. These sediments cover the area along the Lašva and Kozica watercourses, on the reach Vitez – Busovača and further to southeast, and in relation to the surface presence, their coverage is very small. Over the analysed complex on the western side, there is a discordant contact with Permian and Permian-Triassic rock deposits.

Permian metamorphites, that also build the terrain on the right valley of the Lašva River, have full surface presence. The carbonate schist and slate sandstones also belong to this stratigraphic element, and in some places the marble and limestone breccia.

Sediments from Permian-Triassic period are mainly represented by alverolites, while in the final part of stratigraphic column, in some places, the porous thinly layered limestones are present, which build the significant parts of researched terrain on the right valley side of the Lašva River, south from Travnik. The concerned sediments to a smaller extent participate on the left valley side of the Lašva River, toward Turbe, i.e. in the area northwest from Turbe.

The lower parts of the column of this stratigraphic element are built of quartz-mica carbonate schist and carbonate schist, as well as alverolites, sandstones, marble, limestones and limestone breccia.

Taking into account the above, it is possible to draw out the conclusion that there was a horizontal movement of rock mass in the concerned area, along the contact zone between the plastic series of Permian-Triassic age (alverolites and schist) and complex of rough rock mass, and carbonates of Permian and Triassic, i.e. mainly Mesozoic age.

The complex of Lower Triassic K (T₁) clastites and metamorphites build smaller parts of surface of the researched terrain (southwestern area), and in lithological terms, they are mainly present in form of greenish sandy alverolites, reddish-violet sandstones, Eolithic sandstones and thinly layered marly limestones and limestone breccia. Verfen sediments lie concordantly at Permian-Triassic sediments, and it can therefore be said with certainty that their presence is much larger in the terrain structure than on the surface.



The reduction of Verfen sediments happened in the process of formation of Mesozoic carbonates over the Palaeozoic clastites and metamorphites, i.e. Permian-Triassic clastites and metamorphites.

Middle Triassic sediments (T_2) have somewhat larger surface presence than the Lower Triassic (T_1) sediments, and they build the edge area of the northwestern part and central part, but they also have significant presence in the southwest, outside of the researched area.

Generally, the largest part of this complex, in lithological terms, is built of dolomites and dolomitic limestones, that are mainly massive, and only in some places banked.

Volcanogenic sediment formations in form of tuffs, tuff sandstones and silicified claystones dominate in the southwest. Also, there are plutonites and metamorphic forms of certain deposited components, such as: quartz-diorites, gabbro, olivine and amphibolic gabbro, gabbro-diorites, quartz keratophyres and metamorphosized quartz keratophyres. There is a significant presence of rhyolites, and to some extent of actinolitic and amphibolic schist, as well as quartz-seritic schist with epidote, while there are also different forms of thermometamorphic rocks. Zoogenic sand bar limestones and Upper Jurassic dolomites (J_3^3) build the furthest northwest surface parts of the researched area, while in the wider surroundings it is possible to observe the basal breccia and conglomerates.

These sediments lie transgressively and discordantly, mainly over the older Middle Triassic sediments. The Jurassic-Cretaceous and Upper Cretaceous sediments may be found in almost entire northeastern reach of the researched area, and they are present in form of Nemila flysch series of silicified claystones and calcarenite, and limestones, which in their Vranduk series turn into marly limestones, but still with the presence of marlstones and sandy claystones.

The Upper Cretaceous (K_2^3) massive limestones, and to some extent banked limestones, mainly build the northern and northeastern parts of the researched area, but they may also be found in form of significant enclave immediately by the "Plava Voda" source.

This chronostratigraphic element is present in flysch facies, and it also builds the northern and northeastern parts of the terrain in the researched area, as well as the immediate surroundings of the source, however, in case of enclave, its existence may be identified in several locations along the Lašva River.

In lithological terms, the dominant presence of this stratigraphic element is manifested by sediments such as marlstones, large-grained limestones, or massive and layered limestones, and in some cases limestone breccia.

Oligo-Miocene sediments (Ol, M) generally build the northern parts of the researched terrain and they represent the base for the younger Miocene deposits. Sedimentation within the Sarajevo-Zenica Neogene basin in the concerned area begins with clastic series of sediments made of conglomerates, sandstones, clay with coal in some places, and it continues in the carbonate facies with calcareous layered limestones.

The Miocene sediments may be found as an extremely large geological body, whose approximative borders are the Bila and Lašva Rivers, and the coal layer of the Zenica basin, as the northern edge outcrop area, and the immediate closeness of the right bank of the Kozica River along the entire course. In lithological terms, they are present in form of clay, sandstones and marlstones in the area of base coal layers ($M_{1,2}$), up to limestone in the roof with roof coal layers (M_2). As we move away from this edge area, the thinly layered marlstones and sandstones begin (M_2), as well as clastites and limestones ($M_{2,3}$), clastites and limestones with coal in some places (M_3), and small-grained conglomerates and



sandstones (2M_3). Generally, these sediments (2M_3), have small surface expansion, and they are present in form of sandy marlstones, clays, sandstones and conglomerates.

Pleistocene and Holocene sediments, as mentioned above, are present mainly in the area of Lašva and Kozica river valleys, as well as the Bosna River valley. They are mainly in form of sandy clay, gravel and clayey sand, fluvio-glacial and lake sediments or terrace, delluvial, proluvial and alluvial sediments.

4.2.3 Tectonic characteristics

Structural-tectonic system of the described area clearly indicates that the terrain went through significant changes caused by the pressures from the direction of northeast, which resulted in formation of flexures in the zone of plastic deformations of sediments and significant horizontal movement of rigid rock mass.

The intensive horizontal movement of the limestone "Vlašić" area conditioned the tectonic contact with the rock mass in the west, northwest and southeast, which seems to indicate that Vlašić has a position of horst.

The researched area belongs to the Internal Dinarides, and according to the tectonic scheme of Petković K. (1958), it fully belongs to the structural-tectonic unit of "Palaeozoic schist and Mesozoic limestone". The tectonic structure of this unit is unusually complex, considering that in addition to the tectonic elements of Alpine folding in Dinaric direction, there are also elements of Variscan folding – "Bosnian criss-cross folding" (Katzner F, 1925), which makes the full interpretation of this area a large and difficult task.

The zone of Palaeozoic schist and Mesozoic limestone may be divided into three structurally facial units:

- Folded structures of Nemila-Travnik area;
- Area of diverged folding;
- Tectonic depressions.

Folded structures of Nemila-Travnik area is made of three tectonic units:

1. *Vranduk-Mehurići zone of several parallel reverse faults and laid down isoclinic folds*, represents the area located to the northeast (NE), of the Sarajevo-Zenica Basin. That is a specific folded area of Jurassic-Cretaceous flysch sediments, strongly pushed toward southwest (SW), i.e. very often compressed and in form of parallel reverse faults and folds, in some rare cases hundred meters large. Due to the strong pressure, the folds are sometimes transferred over the top of the folds dipped toward northeast (NE), while locally there is torsion of the entire fold packages.
2. *The Vlašić structure*, is made of relatively rigid, arched limestone-dolomite, Triassic-Jurassic-Cretaceous plate, whose movement is most probably conditioned by pushing from the side of Vranduk-Mehurići zone of several parallel reverse faults and laid down isoclinic folds toward southwest (SW). During movement of this structure, the formations of higher levels of Lower Triassic (T_1) were worn out and its small appearance near Škulje (below Inić), is what remained wedged in the sliding zone. Due to that, it is sometimes possible to notice how Middle Triassic (T_2) limestone-marly deposits, and even dolomites, whose position in the column is higher, are lying directly over the lower parts of Permian-Triassic series (Travnik series of alverolites and sandstones). Also, the Upper Jurassic deposits may sometimes be found.



3. *The area of isoclinal folds of Turbe*, covers the space between Travnik, Karaula and Goleš, and it is represented by folded isoclinal Permian-Triassic (P,T) deposits of Travnik series of alverolites and sandstones. The folds are mainly laid down toward southwest (SW), while axial areas are inclined toward northeast (NE).

The area of diverged folding implies area in which the axis of the folds are laying in the direction of southwest – northeast (normal and diagonally to the common direction of the fold axis in Dinarides). This area is not unified as the two tectonically specific areas may clearly be identified:

- area of folded structures of Variscan tectonics
- area of structures formed through adjusting of wedged in mass caused during differential movement of surrounding blocks

Elements of Variscan tectonics in the geological structure may be found in the area of Zahor anticline (4), where the axis of the fold are laying in the direction southwest – northeast (SW – NE), while the layering is almost always transposed into the foliation. Strong metamorphosis destroyed the primary structures and layering in general, while the pressing of rhyolites has also significantly deformed the geometry of structural forms. The Variscan tectonics has to a large extent formed the Sillurian-Devonian formations, as well as the Lower-Carboniferous formations, and finally the mass of rhyolites that was involved in the same movements. Permian-Triassic and younger Mesozoic deposits, lie disconcordantly to the folded Carboniferous and older sediments.

In this concrete case, the area of divergent folding includes four units, but for our research three of them are interesting:

- Zahor anticline, presented on a basic geological map in scale 1:100000, extends along the south-eastern part of the Zenica sheet. It covers the area between Rostovo in the west, and Busovača in the east, and Bakovići in the south. Its top is broken down and it covers lower basin area of Kozica stream. The eastern part of the anticline is lowered and also broken in the area of Busovača fault.
- Divergent structure created by adjustment, was created in inter-spaces by relative movement of blocks between dominant movement directions between the Zahor anticline, Goletica structure and area of Turbe isocline folds. The position of fold axis of these structures is also oriented in the direction southwest – northeast (SW – NE). In chronostratigraphic terms, the Permian-Triassic, as well as younger Mesozoic deposits may be found here. Between the Zahor structure and Bijela Gomila laccolith, the compressed and folded Upper Permian and Triassic deposits (Oparska syncline), have the axis laying in the direction northwest – southeast (NW – SE).
- Busovača fault area is characterised by the complex system of faults along which the movement is especially pronounced in older Quaternary.

Tectonic depression, within the research area, is present in Sarajevo-Zenica basin, which is a consequence of radial tectonics present in the wider area.

Sarajevo-Zenica basin is the area of deposited Tertiary sediments, in which, at the very end of deposition of the basin series, some most significant tectonic movements took place. It is presumed that this process took place at the time when Miocene was transferring into Pliocene, which stopped the sedimentation process in the concerned area. Still, certain folding structures have been formed in the area of the entire basin, where, from the furthest



northwest to Sarajevo in the southeast, the existence of several syncline and anticline structures was identified, with relatively gentle slope of the flanks, whose axis are mainly sinking toward west. It is necessary to mention that the directions of these axis, almost in all cases, significantly deviate from the main direction of the basin, which, as one unit, has specific Dinaric direction of its expansion, while its axial areas of internal basin structures are to the largest extent located in the direction east-west.

Many of anticline forms within this basin were deeply destroyed by erosion and, from geological aspect, the basin, in these parts, is almost entirely crushed. In this sense, the Lašva River penetrated its course practically along the top of one gentle anticline fold, known as the "Lašva Fold".

In addition to the abovementioned folding structural forms within the concerned area, other, rather numerous radial disturbances have been identified, which imply faults, very much present in the closer and wider surroundings of the trunk pipeline (of the Plava Voda regional water supply system).

Generally, the identified direction of the fault is oriented in northwest-southeast direction (NW – SE).

It is emphasized that in the area of basic geological map of B&H in scale 1:100000, Zenica sheet, this division is more complex, but considering that other tectonic structures have not been covered by this research, it is in that sense implied that they do not have to be mentioned in this study.

4.3 Hydrological data and quality of surface waters

4.3.1 Introduction

In the area of interest for this project three major water courses can be found: the Lašva River, Plava Voda spring and the Bosna River. There is also a number of small streams and sporadic nameless streams along the route which will be crossed over or under the river bed. These include: Gučanski, Preoški, Jordalski, Tolovički, Dubravički, Banovac, Lučica, Mali Do, Veliki Do, Vran Do, Marčetina, Gradina, Suha, Blatišta, Trebišnjica, Gorski, and Hadžija streams, and rivers Bila and Kozica. The information on hydrological characteristics and the quality of these streams were not available to the consultant as the quality in the subsidiary watercourses in FB&H is not a subject to regular monitoring by Water Agency or any other relevant body. However, considering the fact that abovementioned watercourses will be under no impact related to hydrology or change in water quality during project utilisation it is estimated that this information is of no relevance for the discussion. Impacts in the construction phase will be of importance for these watercourses and mitigation measures will be discussed in the section 6.1.

On the other hand, it is estimated that three main watercourses - the Lašva River, Plava Voda spring and Bosna River will be under greatest impact by construction and use of Plava Voda regional supply system project. Thus the hydrological data and quality of surface water that are of relevance for these watercourses will be presented in the following chapters.

In addition to the hydrological and quality data, relevant calculation of environmental flow (i.e. ecologically acceptable flow) will be given for the Plava Voda and Lašva River that are



of significance for impact analysis. Based on Federal Law on Water (70/06) **environmental flow is defined as the minimum flow needed in a watercourse to maintain natural balance and ecosystems in waters.** Based on article 62 of the Law, in the transition period without relevant calculation method officially announced through Official Gazette, environmental flow can be calculated using minimum average monthly flow of 95% probability.

4.3.2 “Plava voda” spring

“Plava Voda” spring is hypsometrically located in the lowest place of contact between the Triassic-Jurassic limestones, which contain the aquifer, and the Paleozoic clastites as the medium with low permeability. The point where the water from the karst aquifer spurts out of the ground indicates the most dominant direction of groundwater drainage from the Vlašić massif. There are no registered surface streams in the Plava Voda catchment area as this area is formed of highly water permeable carbonate limestone with cavernous and fissure porosity.

Historical hydrological data shows significant oscillations in the capacity which indicates that this is a specific karst spring, with typical karst basin of large area (the estimated hydrogeological basin is from 80 to 100 km²) and that this is most probably the overflow type of water source. The ratio between the minimum and maximum water at the “Plava Voda” spring ranges from 1:5 to 1:7, which is a relatively small ratio for the karst spring.

In the period 1972-1975, extensive geological, hydrogeological and geophysical research was conducted in the area of “Plava Voda” spring, as well as in its basin, in order to determine typical flows. The results show that 20-year return period minimum discharge is 0.950 m³/s, average discharge 1.9 m³/s, and maximum discharge 3.5 m³/s. The abovementioned values are related to the overall capacity of the source at the registered measurement site of the “Plava Voda” spring, immediately before the confluence with the Lašva River. According to the assessments, the year 1974 was a wet year and it was therefore concluded that the registered minimum flow rate might be smaller.

At the end of 1984, during 1985 and by the middle of 1986, the Hydro-Engineering Institute Sarajevo conducted a rather detailed research of the “Plava Voda” spring. It was concluded that the minimum flow of 20-year return period is approximately 700 l/s but that results should be taken with reserve as the analysis did not encounter wider regional analysis of minimum water flows and was done based on two calculation methods with limited number of relevant data available.

The most recent research of quantitative characteristics of the “Plava Voda” spring was conducted in the framework of the latest EC project “Plava Voda Regional Water Supply System. The research was carried out in the period from July 2009 to October 2010¹⁴.

Within this report, the capacity measurements were carried out in different hydrological periods from July 2009 to October 2010 at the established measurement site called “Elektrodistribucija”. The record of measurements of the Lašva River at the gauging station Merdani were also used as benchmark values, as the historical series of 30-year monitoring data was available and could be used to define all necessary hydrological parameters. The same methodology for calculation of typical minimum discharge for the Plava Voda spring, applied during 1984-1986 research was used. Based on obtained data, the estimated minimum capacity of the “Plava Voda” of 20-year return period was 700 l/s, while average and minimum flow were determined as 1.4-1.6 m³/s and 3.7-4 m³/s, respectively. It was also determined that Water Utility Company “Bašbunar”, based on the obtained concession for

¹⁴Determination of Yield and Spring Water Quality of Plava Voda Source, Hydro-Engineering Institute Sarajevo, 2010



the Plava Voda spring, abstracts the 194 l/s on the average, i.e. 136 l/s when one pump is in operation and 251 l/s when two pumps are in operation.

It may be concluded that the “Plava Voda” spring’s overall minimum capacity of 20-year return period amounts to 700 l/s. It could be noted that this quantity also includes the quantity of water abstracted for Travnik which, in the average, amounts to 194 l/s. It is to be emphasized that according to the historical data and measurements conducted, minimum capacities are observed in the winter period.

According to the physico-chemical and bacteriological characteristics of water, these sources belong to the category of quality water. Occasional appearance of turbidity and faecal origin bacteria was recorded, as well as the presence of nitrates, which is a consequence of human activities within the basin, namely extensive pastoral farming. The detailed information on quality of water at Plava Voda spring is presented in chapter 3.1.1.

The environmental flow of Plava Voda, defined as minimum average monthly flow with a 95% probability, is calculated by establishing correlation between hydrological situation at Lašva River, measured at gauging station Merdani, and Plava Voda. The hydrological study undertaken for the project has revealed that correlation between the two exists, especially in the dry season when discharge from the Plava Voda and Lašva River catchments occur based on similar hydrological conditions. On this basis, the statistically defined environmental flow of Lašva River is used for calculating the environmental flow of Plava Voda.

If it is assumed that there is the same relationship between minimum flows of 20 years return period for Plava Voda and Lašva River, which is reasonable to expect, then based on the established correlation between the two in the recession period and the fact that the two waters streams are in the same catchment area, the following equation can be used:

$$\frac{Q_{env.flow}^{Lašva}}{Q_{20yearmin}^{Lašva}} = \frac{Q_{env.flow}^{P.V.}}{Q_{20yearmin}^{P.V.}}$$

$$Q_{20year.min}^{P.V.} * Q_{env.flow}^{Lašva_g.s_Merdani} = Q_{env.flow}^{P.V.} * Q_{20year}^{Lašva}$$

$$Q_{env.flow}^{P.V.} = \frac{Q_{20year.min}^{P.V.} * Q_{year.min}^{lašva}}{Q_{20year.min}^{Lašva}} = \frac{0.7 * 3.84}{2.9} = 0.926 m^3 / s$$

It is calculated that the environmental flow to be maintained in the Plava Voda watercourse is equal to 926 l/s.

4.3.3 Lašva River

The area of the Lašva River basin covers approx. 989 km² and it is mainly located on the territory of Central-Bosnia Canton. It is located on the territory of four municipalities: Travnik, Novi Travnik, Vitez and Busovača.

This is a morphologically typical highland region where the lowest point in the basin is located at the elevation of 370 m.a.s.l., which is the altitude at the point where the Lašva River is exiting from the basin area. The altitude is indirectly influencing the pollution



intensity, in a way that at larger altitudes the percentage of snowfall is larger, which causes larger retention of water in form of snow and frozen water on the land, and ice on rivers, during winter. Such phenomena reduce runoff, infiltration and seepage due to freezing of water in upper layers of soil, and water evaporation.

If we analyse this for each sub-basin, the average watercourse gradient ranges from 2.1 – 129.0 m/km. The value of the average watercourse gradient in the entire basin indicates to a rather complex morphology and very abrupt watercourse transition from highland to lowland areas. These very pronounced gradients result in appearance of torrents in the periods of intensive rainfall and melting of snow. Such regime of the main Lašva watercourse, and especially of its tributaries, has characteristics of erosion, and in the abovementioned periods, causes significant water turbidity. As a consequence of the torrential flow, in addition to the appearance of suspended solids, significant increase of nutrient concentration may also be observed.

Hydrographic network within the river basin is very much disintegrated. The watercourse of the highest category – main watercourse is the Lašva River, which flows in the direction northwest – southeast along 48.1 km of its length. The most important left tributaries of the Lašva River are the Bila River, which flows from the hillsides of Vlašić and joins the Lašva River in Nova Bila, and Plava Voda. Plava Voda has a very small length, of only 250-300 m, but this is a hydrologically very important watercourse, with large minimum yield. Of the watercourses of lower category on the left bank of the Lašva River, the Jasenica River may be mentioned. The Jasenica River flows into the Bila River in Mehurići settlement. The most important right tributaries of the Lašva River are Kozica, Kruščica, Grlovnica and Komarnica Rivers.

In the framework of the LIFE project “Strengthening of Diffuse Source Pollution Control” implemented in the Lašva River basin¹⁵, simultaneous hydrological and qualitative measurements were conducted, including a measurement site downstream from the Plava Voda spring at the Merdani gauging station. Using the hydrological analysis of the Merdani gauging station, prepared by the Republic Hydrometeorological Institute Sarajevo (RHMI, 1991) for the period of thirty years (1959-1988), mean perennial discharge was defined, which amounts to : $Q_{Laš,mean} = 16.5 \text{ m}^3/\text{s}$. Basic hydrological data for Lašva River are given in the table below.

Table 49. Hydrological data for Lašva River

River	Gauging station	Qavg.y. (m ³ /s)	avgQmin (m ³ /s)	Max Q I/T (m ³ /s)		
				20 g.	50 g.	100 g.
Lašva	Merdani	16.5	4,94	336	390	466

The control of Lašva river water quality was systematically conducted before the war at the site located at the confluence with the Bosna River in order to determine the river class and monitor preservation of its quality. Based on results of 1985, 1986, 1987, 1988 and 1989 analysis, Lašva River used to be classified as river of mainly II and III category¹⁶ (Table 50).

It is to be noted that waters of II class are those that can be used in their natural condition for swimming and recreation, water sports, fish breeding (cyprinid fish) or that can be used for

¹⁵ EC Life Third Countries project “Strengthening of Diffuse Source Pollution Control”, Hydro-Engineering Institute Sarajevo, 2003-2006

¹⁶ Classification is done in accordance with the “Regulation on the classification of waters and coastal sea of Yugoslavia within the boundaries of SR B&H” (“Official Gazette SR B&H”, No. 19/80), and the Regulation on Classification of Watercourses (“Official Gazette SR B&H”, No. 42/67)



drinking water and in the food and beverage industry after adequate treatment (coagulation, filtration, disinfection and alike). Waters of III class are those that can be used for irrigation and for use in industry (except for food and beverage industry) but only after adequate treatment. Water of IV class can be used for other purposes only after adequate treatment.

Basic indicators of quality, based on which the classification was done, were: dissolved oxygen, suspended solids, KMnO_4 consumption, biological oxygen demand (BOD), iron content, bacteriological contamination and the presence of micronutrients. For a general assessment of quality, the saprobiological analysis was used.

Table 50. Review of prescribed and currently existing class of Lašva River at the confluence with Bosna River during testing period 1985-1989

River	Profile	Prescribed class	Identified class of watercourse					Meets the class? YES/NO
			1985	1986	1987	1988	1989	
Lašva	Confluence with Bosna river	II	II-III	II	II	III-II	III	NO

It can be concluded that the Lašva River quality did not meet the requirements of the II class watercourse which can be explained by the presence of large industrial polluters in the catchment area at that time.

The baseline quality of the Lašva surface watercourse is assessed on the basis of existing data collected from the relevant institutions in the water sector, the data from abovementioned LIFE project as well as on the basis of the results of one sampling series at 8 measurement sites along the Lašva River conducted in September 2009 for purposes of development of Environmental Impact Assessment Study for M-5 Lašva – Donji Vakuf high-speed road (LOT 2).

Data obtained within the LIFE project showed quite different overall quality at eight measurement sites along the Lašva River. It was concluded that watercourses in the upper part of the Lašva River basin are rather clean, except for the occasionally increased presence of nutrients in some locations, and occasionally increased turbidity, which is most often caused by heavy rainfall. At those sites located near large settlements, significant quality degradation was observed, which is especially reflected in increased presence of nutrients in water, as well as suspended solids, turbidity and increased consumption of KMnO_4 . For some parameters, the Lašva River does not fulfil conditions of II category.

For all analysed series of samples, significant reduction in concentration values at distance of 20 km from the spring was observed. Namely, immediately downstream from the measurement site 7, the Plava Voda spring flows into the main watercourse. As this is the spring with significant yield, from which the drinking water is flowing, it was concluded that such drop in concentration values of all parameters in the Lašva River is a consequence of dilution made by the Plava Voda spring. The dilution effect is clearly noticeable in the summer period, considering that the discharge of the spring and discharge of the Lašva River are almost identical at the confluence site. The results of the physico – chemical, microbiological and biological indicators show that the Lašva River at the confluence with the Bosna River belongs to II - III category.



Table 51. Lašva River water quality based on biological parameters (2005)

Profile	Phytobentos		Zoobentos		Ichthyofauna	
	Bonitet class	Saprobic index	Bonitet class	Saprobic index	Bonitet class	Saprobic index
Confluence with Bosna River	II-III	2.4	II	2.03	II-III	β - α

The analysis done in September 2009 in the framework of EIA Study for M-5 Lašva – Donji Vakuf high-speed road, was made using samples taken at eight selected measurement sites:

- MS1- Lašva at the site of gauging station Merdani
- MS 2-Lašva downstream from Vitez
- MS 3- Lašva upstream from Vitez
- MS 4-Lašva upstream from the confluence with Grlovnica
- MS 5-Lašva downstream from Plava Voda
- MS 6-Lašva upstream from Plava Voda
- MS 7-Lašva upstream from Travnik
- MS 8-Lašva upstream from Turbe

Samples were analysed for the following parameters: temperature, turbidity, pH, conductivity, suspended solids, dissolved oxygen, oxygen saturation, ammonia nitrogen, N-Kjeldahl, Nitrate N, Nitrite N, total N, ortho-phosphates, total P, total oil and grease, and consumption of potassium permanganate (KMnO₄) (non-filtered and filtered). Analyses were done in accordance with standard methods prescribed in "Standard Methods for Testing of Water and Wastewater". APHA. AWWA. WEF, 19th Edition 1995." The results of specific physico-chemical quality parameters of the Lašva River at eight selected measurement sites in September 2009 are given in Table 52.

The results confirm findings of the LIFE project showing slight increase in the concentration of nutrients, nitrates and nitrites, as well as oxygen saturation and consumption of KMnO₄. It is also observed that quality parameters are lower downstream from Lašva's confluence with the Plava Voda, which confirms that Plava Voda with its significant flow dilutes pollutants in the Lašva River.



Table 52. Water quality parameters of Lašva River (2009)

Parameters	MAC ¹⁷	Lašva on profile G.S. Merdani (MP1)	Lašva downstream from Vitez (MP2)	Lašva upstream from Vitez (MP3)	Lašva upstream from the confluence with Grlovnica (MP4)	Lašva downstream from Plava voda (MP5)	Lašva upstream from Plava voda (MP6)	Lašva upstream from Travnik (MP7)	Lašva upstream from Turbe (MP8)
Sampling date		9.9.2009.	9.9.2009.	9.9.2009.	9.9.2009.	9.9.2009.	9.9.2009.	9.9.2009.	9.9.2009
Temperature (°C)		13	12.5	12	11	10.5	12.5	13	13.5
Turbidity (NTU)	-	2.7	3.1	2.6	2.4	3.9	4.9	4.0	4.4
pH value	5.8-8.5	7.83	7.89	7.87	7.83	7.71	7.53	7.54	7.75
Conductivity at 20 °C (µS/cm)	-	388	406	398	379	384	448	457	441
Suspended Solids (mg/l)	30	3	3	14	10	10	17	3	12
Dissolved Oxygen (mg/l)	> 6	8.40	7.88	8.61	8.45	7.45	5.40	4.88	8.02
Oxygen Saturation (%)	75-90	106.2	105.6	108.5	106.8	93.4	67.9	64.7	101.8
Ammonia Nitrogen (mg N/l)	0.1-0.25	0.10	0.19	0.16	0.18	0.49	1.23	0.09	0.15
N Kjeldahl (mg N/l)		1.68	1.68	1.68	1.96	2.24	3.08	1.68	1.68
Nitrate Nitrogen (mg N/l)	0.5-1.5	2.06	2.06	1.81	2.04	1.72	2.02	1.59	1.73
Nitrite Nitrogen (mg N/l)	0.01-0.03	0.072	0.059	0.039	0.050	0.039	0.065	0.045	0.028
Total Nitrogen (mg N/l)		3.812	3.799	3.529	4.050	3.999	5.165	3.315	3.438
Ortho-phosphate (mg/l P)		0.094	0.101	0.106	0.100	0.126	0.204	0.127	0.119
Total phosphorus (mg/l P)	0.1-0.25	0.144	0.167	0.165	0.173	0.311	0.298	0.179	0.156
Total oil and grease (mg/l)		24	11	22	23	19	35	41	32
Consumption KMnO ₄ (mg O ₂ /l) non-filtrated	12	9.48	12.33	9.80	8.53	14.54	24.65	18.33	14.22

¹⁷ MAC- Maximum Allowable Concentration according to Regulation on Hazardous and Harmful Substances in Water (Official Gazette of FBiH ", no. 43/07) and Regulation on classification of waters and coastal sea waters of Yugoslavia within the boundaries of SR BiH (" Official Gazette of SR BiH ", no. 19/80)



Using the data obtained through measurements carried out within the above mentioned LIFE project, the relationship between the discharges at these two sites was established.

Table 53 gives overview of simultaneous measurements conducted in the Lašva River at the site of Merdani gauging station downstream from the confluence of the Plava Voda and Lašva River.

Table 53. Overview of simultaneous measurements downstream from the confluence of the Plava Voda and the Lašva River

Date	Discharge Q (m ³ /s)	
	Measurement site downstream from Plava Voda	Measurement site of the Merdani g.s.
10 July 2003	2.74	6.37
7 November 2003	3.65	12.1
7 April 2004	6.6	22.6
7 July 2004	3.81	9.4
20 August 2004	0.47	7.3

Relationship between discharge of the Lašva River at the site immediately downstream from Plava Voda and at the Merdani gauging station is given at Figure 17.

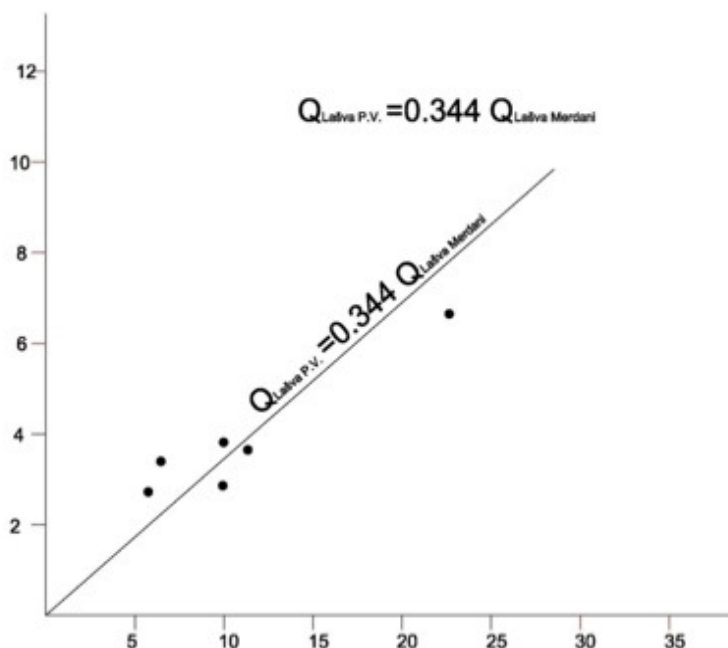


Figure 17. Relationship between discharge of the Lašva River and Plava Voda



The environmental flow of the Lašva River at Merdani gauging station is obtained statistically as minimum monthly discharge of 95% probability, according to the valid analysis of the Merdani gauging station, and it amounts to:

$$Q_{95\%}^{Lašva - R - Merdani - g.s.} = 3.84 \text{ m}^3 / \text{s}$$

By use of the above defined relationship and statistically defined environmental flow of the Lašva River for Merdani g.s., the environmental flow of the Lašva River at the site downstream from the confluence of the Plava Voda and Lašva River was generally defined and amounts to:

$$Q_{95\%}^{LašvaR - downs - from - PV} = 1.321 \text{ m}^3 / \text{s}$$

4.3.4 Bosna River

The Bosna River is the right tributary of the Sava River on the territory of Bosnia and Herzegovina and belongs to the Sava River catchment area. The source of the Bosna River is a strong karst spring located at the bottom of the Igman Mountain near the City of Sarajevo. The Bosna River catchment has an area of about 10.460 km² (7,692.68 km² in Federation of B&H), and encompasses the central part of Bosnia and represents one fifth of the total area of B&H.

It neighbours with the river basins of the Vrbas River in the west, Drina River in the east, Neretva River in the south and Sava River in the north. The natural length of the Bosna River flow amounts to 275.5 km. The mean altitude of the flow amounts to 640 meters above sea level, the sources of Bosna River are at 491.67 meters above sea level, and the delta is at 77.73 meters above sea level. The total difference in height of the flow amounts to 413.94 m, while the mean longitudinal head amounts to 0.0015. The water regime of the Bosna River is pluvial-snow with high water in the spring due to the snow melting, and with some lower autumn discharges due to the intensive rainfall.

The natural length of the Bosna River on the concerned section, from the confluence with the Lašva River to the river crossing toward Putovići water tank, amounts to about 3,709.17m.

The main hydrologic parameters, which quantify hydrologic characteristics of the Bosna River at the concerned section are presented in Table 54.

Table 54. The main hydrological characteristics of Bosna River along concerned section

River	Gauging station	Qavg.y. (m ³ /s)	avgQmin. (m ³ /s)	Max Q I/T (m ³ /s)		
				20 g.	50 g.	100 g.
Bosna	Zenica	79.8	20.6	1.078	1.277	1.427

Quality control of surface water was conducted systematically in the Bosna River until 1992. The quality of water was analysed, among others, on the following measurement sites of concern for this study: measurement site B7 – upstream from Zenica (Raspotočje) and



measurement site B8 – downstream from Zenica. According to the legal categorization¹⁸, the Bosna River, along the concerned section, should satisfy the quality prescribed for III category of water.

Republic Hydroeteorological Institute from Sarajevo carried out the monitoring of the prescribed category of watercourse in B&H.

Table 55 presents overview of determined and prescribed category of watercourse at relevant measurement sites upstream and downstream from Zenica. Evaluation of the prescribed and determined class of watercourse status was done based on results obtained during 1985, 1986, 1987, 1988 and 1989. Basic indicators of quality were: dissolved oxygen, total suspended solids, consumption of KMnO_4 , biological oxygen demand (BOD_5), concentration of iron, bacteriological pollution and presence of micronutrients. For the purpose of general evaluation of water quality the saprobiological analysis was carried out.

Table 55. Overview of prescribed and determined class of watercourse in the period of research from 1985 to 1989

Profile	Proscribed class	Determined class of watercourse					Satisfying the class YES/NO
		1985	1986	1987	1988	1989	
Bosna river upstream from Zenica	III	4- Outside the limit	3-4	3-4	3	3-4	NO
Bosna river downstream from Zenica	III	3	Outside the limit	Outside the limit	Outside the limit	Outside the limit	NO

From the table above, it is clear what the state of water quality was in the period until 1990, when there was a large number of industrial plants in the Bosna River basin. Quality of the watercourse was significantly worse from the conditions prescribed. However, in some sections, total destruction of water quality was recorded.

The latest data on surface water quality of the Bosna River was found among the results of the project "Analysis of Surface Water Quality in the area of the Sava River Basin in FB&H". The relevant measurement sites for analysis of the quality of the Bosna River are measurement site B7 – upstream from Zenica (Raspotočje) and measurement site B8 – downstream from Zenica. The results are presented in the following table.

Table 56. Bosna river classification as of October 2005

Profile name	Class
Upstream from Zenica (Raspotočje)	II and III
Downstream from Zenica (Jelina)	II and III

¹⁸Classification is done in accordance with the "Regulation on the classification of waters and coastal sea of Yugoslavia within the boundaries of SR B&H" ("Official Gazette SR B&H", No. 19/80), and the Regulation on Classification of Watercourses ("Official Gazette SR B&H", No. 42/67)



4.4 Flora

The route of the regional water supply system Plava Voda is located in the area of so-called hilly landscape. Natural conditions, relief and climate have directly affected the appearance and condition of vegetation cover of the project area. The original appearance of the vegetation has been significantly changed by anthropogenic factors, but despite that, area is characterized by diversity of ecosystems and habitats.

According to genesis, ecosystems are classified into primary and secondary. In the observed area, the primary ecosystems may be found in form of forest, while the secondary ecosystems (anthropogenic) are present in form of agricultural areas (lawns, arable land), urban areas (settlements, cities), etc.

Thus, the project area is characterized by the following ecosystems: forests, lawns and arable land.

Broadleaf-deciduous forests and meadows are present in this region. A typical picture of hilly landscapes is provided by climatozonal forest communities *Querco-Carpinetum Illyricum* (Sessile Oak and Hornbeam forest) with a large number of floristic and geologic-pedological variations. Azonal types of forest vegetation consisting of Manna Ash and Oriental Hornbeam appear in habitats with a pronounced slope, shallow humus-accumulative soils on the geologic permeable layer.

The tree floor includes: Sessile Oak (*Quercus petraea*), Common Hornbeam (*Carpinus betulus*), cherry (*Prunus avium*), Field Maple (*Acer campestre*), Sycamore Maple (*A. pseudoplatanus*), Elm Tree (*Ulmus campestris*), Mountain Elm (*U. Montana*), Large-leaved lime (*Tilia platyphyllos*), Wild Service Tree (*Sorbus tarminalis*) etc; the shrub floor includes: hazel (*Corylus avellana*), Spindle Tree (*Evonymus europaeus*), Wild Rose (*Rosa arvenisis*), mezereon (*Daphne mezereum*), Honeysuckle (*Lonicera caprifolium*) and other species; a number of central European species are represented in a layer of ground flora as well as numerous Illyrian elements: Giant Dead Nettle (*Lamium orvala*), Alpine Barrenwort (*Epimedium alpinum*), Dogtooth violet (*Erythronium dens canis*), Wood Anemone (*Anemone nemorosa*) and others.

As this area is crossed by the Lašva River and numerous streams, ecosystems of higrofile forest communities are developed here such as: willow, walnut and scrubs of purple willow but they are here present on a relatively small area, mainly creating a narrow, often discontinuous belt along the bank of the Lašva and Bosna Rivers due to anthropogenic effect. These communities occur on flat terrain on alluvial deposits of different ages.

The most frequent species within higrofile communities with willows are: White Willow (*Salix alba*), Crack Willow (*Salix fragilis*), Black Alder (*Alnus glutinosa*), bittersweet (*Solanum dulcamara*), Black Poplar (*Populus nigra*), Elm (*Ulmus laevis*), Blackberry (*Rubus fruticosus* and *Rubus caesius*), Creeping Jenny (*Lysimachia nummularia*), Wild Mint (*Mentha longifolia* and *Mentha rotundifolia*), Common Butterbur (*Petasites hybridus*), False Brome (*Brachypodium silvaticum*), Self Heal, (*Prunella vulgaris*), and others.

However, previous forest stands of *Querco-Carpinetum Illyricum* community are now cleared in a large area of the future regional water supply system and their habitats are converted into a variety of agricultural areas, thanks to the favourable climate, edafic and relief conditions. These are mostly arable lands, followed by meadows and pastures which mostly belong to order *Arrhenatheretalia* and somewhat lesser to order *Brometalia erecti*.

Depending on the nature of anthropogenic factor and hydrothermal conditions of the habitat, anthropogenic tertiary vegetation present in this area is differentiated into several types:

- ruderal communities of tall biennial and perennial species (class *Artemisietea*),



- communities of annual plants of initial stages of progressive successions and field-weed communities in row crops (class *Chenopodietea*),
- communities of overgrazed pastures and trampled habitats (*Plantaginetea majoris*).

This vegetation has been developed in the settlements.

4.5 Fauna

The main characteristics of the composition of fauna within researched area of the regional water supply system route are primarily caused by degree in development and degradation of plant cover. Generally, the whole area is characterized by pronounced anthropogenic influence which is primarily reflected in construction of settlements, which had a direct impact on retreat of fauna into wild parts of the ecosystem.

The water supply system route will also cross several watercourses (one is given in the table below). Plava Voda source, Lašva and Bosna Rivers are the largest aquatic ecosystems which may be affected during construction and operational phase of the project. Construction works will not cause significant impacts on other intermittent streams beside those generally caused by presence of machinery and workers on site that can be mitigated by good construction practice.

Plava Voda represents fish spawning site from its source to the confluence with the Lašva river. Salmonid species migrate into Plava Voda where they spawn in certain periods of the year. Generally speaking, for salmonid fish the spawning period is between 1 October and 1 March.

According to data from fishing clubs from the relevant municipalities, the Lašva River is mainly inhabited by salmonid fish species: rainbow trout, grayling, bullhead, lamprey, huchen, and several types of small fish that are of paramount importance (gudgeon, minnow). It is important to mention cyprinid species such as chub and barbell, and presence of crabs as well. Having in mind that the Lašva River is habitat of mostly salmonid fish, fishing in the Lašva River is prohibited during the spawning period (01 October – 01 March).

The Bosna River is inhabited by 28 species of fish, mainly cyprinid. Some of the species are: chub, barbell, Mediterranean Barbel, pearl roach, tench, catfish, Aral Asp, Common Nase, vimba, carp bream, the Common carp, Pike-perch, Gibel carp, crucian carp, burbot, Danube roach, brown trout, rainbow trout, huchen, and grayling. Fishing is prohibited in the spawning period of certain fish species. For example, the spawning period for common carp is between 1 April to 31 May, catfish during the period from 1 April -15 June, rainbow trout from 1 October to 1 March etc.

The other aquatic fauna here is represented with two-winged insects, well-segmented worms, leeches as typical inhabitants of polluted streams.

The Kozica River and the Bila River are also located within the route of the water supply system. They are inhabited by grayling, trout, huchen, European chub, Danubian Barbel and lamprey. The impacts on Bila rivers will be reduced to a minimum and mainly related to presence of machinery and workers, as the river crossing is planned by suspension on the bridge, while crossing of Kozica river will be performed by digging of the trench below the stream. The impacts will be minimised by good working practices.



4.6 Air quality

For the area of Central Bosnia and Zenica-Doboj Canton there is no cadastre or monitoring of changes in the natural environment, which would provide timely information about potential air, land and water pollution and which would also track changes in the environment.

Measurement of air quality was never performed in municipalities Busovača, Vitez, Novi Travnik, and Travnik, so there is no existing data about emissions or air quality. The "Vatrostalna" Company is currently the largest stationary pollution source in the area of Busovača. On the other hand, air pollution in this municipality is also caused by fuel combustion in furnaces of private buildings and harmful emission of gases that are the product of combustion in motor vehicles.

Due to general economic recession, as well as the consequences of war, industrial buildings in Vitez Municipality operate with reduced capacity. Reduction of harmful emissions into the air from stationary sources, i.e. air quality improvement, is certainly result of that situation. However, the traffic, especially in the inner city core of Vitez, represents one of the most significant sources of air pollution.

In the area of Novi Travnik, air pollution is mainly caused by fuel combustion in the heating systems of private and industrial buildings in furnaces of private and industrial buildings and harmful emission of gases that are the product of combustion in motor vehicles.

Area of Travnik Municipality is not excessively overloaded by pollutants into air. Air pollution is mainly caused by fuel combustion for heating of private and industrial buildings and harmful gases emission as a product of combustion in motor vehicles.

Middle Bosnia Canton still has no action plan for air quality protection.

On the basis of available data from the spatial plans of municipalities, significant air pollutants have not been identified in the concerned area.

Based on information on air quality taken from Local Environmental Action Plan¹⁹, air quality in Zenica Municipality has significantly deteriorated. The monitoring of air quality was performed at several measurement points in order to gain insight into the status of air quality in this municipality. Overview of the results of measurements clearly shows that the concentrations of SO₂ and dust PM₁₀ are elevated. In Zenica Municipality, poor control of waste flue gases from the boiler-rooms directly affects the human health. Transportation is also a significant source of emissions of pollution which was not controlled at all. The largest industrial polluter is Mittal Steel factory.

4.7 Soil and agricultural land

The relevant maps of land use in areas relevant to the project are given in Annex 3 and 4.

Total agricultural area in the area of Travnik Municipality amounts 22.774 ha or 43,1% of the total surface area of the municipality. Within agricultural areas, there is no I category in the area of Travnik while all other categories of II-VII are represented in the areas shown in the following table.

¹⁹Local Environmental Action Plan for Zenica Municipality, Dvokut pro d.o.o., 2009



Table 57. Status of agricultural land in Travnik Municipality

Land capability class	(ha)	(%)
II	222	0.4
III	408	0.8
IVa	153	0.3
IVb	4455	8.4
V	8023	15.2
VI	6298	11.9
VII	2814	5.3
VII	401	0.7
TOTAL	22.774	43.1

In the area of Travnik Municipality mostly are represented II, III, IV, V, VI and VII categories of agricultural land. The most represented are V and VI, then IVb and VII, while spatially the least represented are IVa, II and III categories. The third category of agricultural land is located in the area of settlements Han Bila, Dolac na Lašvi, Grahovik and Slimena. This landsa are suitable for agricultural production, particularly due to suitable flat reliefs. The fourth category of land engages approx. 8.4% of the total surface area of the municipality. The area around Komarščica next to settlements Turbe, Gudale and Savanovići belongs to this category of land. Areas that belong to this category of land are meadows with bad grass composition which serve as bad hay-making meadows. Areas of IV category, whether they are under meadows or plough lands, could be significantly intensified by agrotechnical measures. The biggest part of this area is located on part of the municipality, which belongs to Malo Vihovlje, settlements Ponir, Marnice, Ober; parts of the Brajkovići Municipality, Kula, Brenkovac. Since the soil of this category represent the basic stock of agricultural land of Municipality, it should be obligatory protected from stealing.

Land of V and VI categories are in the greatest % represented in the area of the Municipality. Lands of this category can be excellent meadows and pastures. They are located in entire territory of the municipality.

Production capacity and method of land use are illustrated by agro-zones.

- **First agro-zone** covers 9,7% of the total surface area of the Municipality. These are the most valuable land. Areas of this agro-zone are used mainly as plough lands, and less frequently as natural and artificial meadows.
- **Second agro-zone** engages 25,7% of the Municipality. They are used as pastures and meadows in livestock production, and less frequently as plough lands.
- **Third agro-zone** engages approx. 7,1% of the Municipality. They are used as pastures in livestock production.

Total agricultural surface area in Novi Travnik Municipality covers 6.33,0 ha. Agricultural surface areas of the municipality are represented in bonitet categories II-VII, as follows:

Land of II category is located in the northern part of the municipality and covers cca. 0.6% of its area. They mainly represent plough lands suitable for agriculture, primarily the production of cereals and fodder crops. Land of III category is located in its north-eastern part and occupies 1,8% of the municipality. There is more this category than the II category and because of that it represents a major area for agriculture. It is widespread in lowland areas and on the terrace and such forms of low-mountainous relief. Although a lot of land of this category have non-regulated water regime, they have good production capacity, with a good drainage system and irrigation system.



Table 58. Shares of agricultural land classes in Novi Travnik Municipality

Land capability class	Area (ha)		%
II	139.14		0.6
III	441.86		1.8
IVa	237.80	793.36	3.3
IVb	555.56		
V	2.641.90		10.9
VI	2.361.17		9.7
VII	213.68		0.9

Lands of IV categories include 3,3% of municipality area and they are sorted into two subcategories IVa and IVB. IVa category represents the land of plain parts along watercourses and with non-arranged water regime, from which arises the need for hydromelioration. These lands are mainly used as natural meadows with hydrophyll vegetation and as plough lands. IVB category is represented on hilly terrains with slope of ground 10° - 12° . They are used as plough lands, orchards, natural and artificial meadows. V land category is present in the mountain areas with slope of ground up to 20° , on shallow lands and occupies 10,9% of the municipality. VI categories of land is represented in the north-western part of the Municipality and occupies 9,7% of its total territory. These soils are subjected to soil erosion and subsidence, low production capacity and they are used only as meadows and pastures. VII land category of municipal mountainous land area is represented within the forest area on the very steep and rocky terrain occupying 0,9% of the municipal territory in its southern part. These are the lowest land quality and with maximum limits and under natural meadow vegetation.

Area of Novi Travnik Municipality is divided into five production capacity zones as follows:

- I agro-zone – includes the most valuable land of the municipality. This includes II, III and IV (IVa and IVB) capability classes of agricultural land. I agro-zone covers the area of 1374.42 ha.
- II agro-zone – covers 20.6% of the total municipal area. These are lands of V and VI class of agricultural land with restrictions in use. These classes of land are good for fruit production. They cover the area of 5003.06 ha.
- III agro-zone – covers 0.5% of the municipal area. It includes lowest quality class of agricultural land. These are the areas under pastures, mainly in the social sector. It covers the area of 13.68 ha.
- IV forest zone (covering an area of 16928.37 ha) and V zone - urban and areas excluded from the plant production (covering an area of 756.92 ha).

In the area of Vitez, in its northern part, total agricultural area is 4.642,0 ha, or 29.5% of the total surface area of the municipality. Within agricultural areas, in the area of Vitez there is no category I, while all other categories are represented (Table 59). Category IVb is the most represented, followed by category V, while categories II, VII and IVa are the least represented. Domination of IVb and V class indicates that there is no real agricultural production in the area of Vitez Municipality.



Table 59. Shares of agricultural land classes in Vitez Municipality

AGRICULTURAL LAND	
Land capability class	Area (ha)
I	-
II	201.5
III	538.6
IVa	428.9
IVb	1401.7
V	1386.5
VI	489.2
VII	195.6
TOTAL	4642.0

Based on the analysis of land production capacity, seven bonitet categories of the land are determined in the area of Vitez Municipality. Aparted bonitet categories are classified into five land use zones on the basis of production capacity (Table 60), of which agricultural lands are classified into three agro-zones. I agro-zone (zone intended for intensive agricultural production) occupies 16,3% of the total surface area of the municipality.

Second agro-zone, which is intended for semi-intensive agricultural production - dry farming, extensive orchards and meadows, covers cca. 12% of the municipality. III agro-zone is least represented (zone of meadows and pastures intended for livestock farming).

Table 60. Production capacity zones in Vitez Municipality

Zone	Surface area (ha)
agro-zone I	2570.8
agro-zone II	1875.6
agro-zone III	195.6
forest zone IV	10126.6
V urbanised land and land unsuitable for plant production	977.3
TOTAL	15745.9

Of the total area of Busovača Municipality, which, according to information from Spatial Plan²⁰ amounts to 15760 ha, agricultural land covers 5246 ha or 33.28% of the territory. Land use distribution is given in the following table. It is to be noted that the largest part of the territory is covered by forest while arable land for food production is represented by only 18 %.

Table 61. Land use in Busovača municipality

	AGRICULTURAL LAND												
	Arable land	%	Orchards	%	Meadow	%	Pasture land	%	Total	%	Forest area	%	Unfertile land
Busovača	2,926	18.8	582	3.7	924	5.9	814	5.2	5,246	33.3	9,801	62.2	713

Balance of agricultural land in Busovača Municipality, based on the situation assessment in 2005 and estimated population number of 16.073, is given in the following table.

²⁰Spatial plan of Busovača Municipality 2026, Institute for Urban Planning Sarajevo, 2008



Table 62. Balance of agricultural land in Busovača municipality

	ha	ha / capita	Recommended value
Municipality territory	15,760		
Agricultural land	5,246	0.32	0.40
Arable land	4,432	0.27	0.17

The area occupied by land capability classes is given in the table below.

Table 63. Shares of agricultural land classes in Busovača Municipality

AGRICULTURAL LAND		
Land capability class	Area (ha)	%
Class III	273.68	1.7
Class IVa	321.87	2.1
Class IVb	1107.86	7
Class V	2496.62	15.9
Class VI	411.52	2.6

It can be concluded that the largest proportion of agricultural land in Busovača Municipality belongs to land class V that is found on the steep terrains up to 20° which may be under the influence of erosion processes.

The good quality agricultural land covers only 273.68 ha, meaning that it must be preserved for production of food.

In the area of Zenica Municipality there are no significant areas of highly valuable and protected agricultural land from the viewpoint of agricultural production.

Based on the information from the Spatial Plan of Zenica-Doboj Canton 2009-2029, unfertile land covers largest percentage of the area of Zenica Municipality – 3,240 ha. On the other hand, in relation to the other municipalities in the Canton, Zenica Municipality has largest areas covered with orchards (1.834 ha) and meadows (7.263 ha). Soils favourable for agricultural production in this Canton are located in the lowland areas, dominantly in the river valleys where land capability classes I, II and III may be found, and they present potentially best soils for mechanized, intensive and highly intensive agricultural production.

The area of concern for this project, in Spatial Plan for Zenica-Doboj Canton, is identified as urban area with a small industrial zone along the Bosna River.

4.8 Protected natural areas

In the Travnik Municipality, according to the Spatial Plan of B&H and central register of Institute for Protection of Cultural, Historical and Natural Heritage B&H, two areas of spatial value are registered for protection as protected landscape, namely Protected Landscape "Vlašić" and Protected Landscape "Ranča" (with part of its territory in Travnik Municipality). These areas are not located on the route of Plava Voda regional water supply system.

In the Vitez Municipality, Mountain Kruščica is characterized as an area of exceptional natural value. The mountain area of Kruščica is proclaimed as protected area by Spatial



Plan of Vitez Municipality, and has the status of protected landscape. However, this natural area is not on the route of regional water supply system.

High mountainous forest areas of the Busovača Municipality and the area of Zavora are characterized by exceptional beauty. Therefore they are protected by the Spatial Plan of Busovača Municipality (2026) as V category of protection under the IUCN categories, i.e. this area was established as protected landscape. This area is not on the route of the pipeline as well.

Yew (*Taxus baccata* L.) which has dendrological value and in accordance with the spatial plans of considered municipalities is protected as a dendrological monument, can be found on a private property in Travnik Municipality, Vraniska settlement (Vitez Municipality), area of "city rocks" in Tisovac (Busovača Municipality), and in Pepelari village (Zenica Municipality). These locations are not in the vicinity of the construction works.

4.9 Cultural-historical heritage

According to the spatial plans of municipalities through which the regional water supply system is passing, and according to the list of national monuments obtained from Cantonal Institute for Spatial Planning, Environment and Heritage of Central Bosnia Canton, the following cultural and historical monuments were identified in the narrow surroundings of the planned projects:

- Busovača Municipality: In the Katići village there are two cultural and historical monuments from the Prehistoric period and Middle Ages
- Vitez Municipality: Monuments from the Prehistoric period and Roman period in places Mali Mošunj, Krčevine, Grbavica.
- Travnik Municipality: Muslim tombstone of Travnik mufti and old Muslim cemetery with tombstones from 15-19th century (found on the temporary list of national monuments), "Lutvina kahva" or "Rudolfova kafana" restaurant (mentioned in the 2nd Travnicka hronika" book of Nobel prize winner Ivo Andrić) Elči Ibrahim Pasha Madrasah, from 18th century, remaining of Feudal Palace - Hasan Pasha tower, Jusuf Pasha Mosque from 17th century, dam wall of reservoir Plava Voda and Hydro power building built in 1906, Historical monument Clock-Tower on Musala, Jeni Mosque, medieval fortress Old Town of Travnik from 15th century, Mosque "Šarena džamija", domed burial site "pod lipom" (under the lime-tree) and Mosque of Mehmed-Pasha Kukavica, all from the Turkish period.
- Novi Travnik Municipality: One historical monument from the prehistoric period in the village Stojkovići
- There were no cultural and historical monuments identified in the narrow area of the planned project in Zenica Municipality.

It is to be mentioned that "Plava Voda" site represent unique and inseparable part of cultural-historical and natural values included in the Regulation Plan of Cultural-Historical Zone, and unique and attractive combination of natural ambient and cultural heritage.

It was assessed that none of the monuments identified above will be endangered by the construction of regional system. On contrary, a separate Project entitled "Restoration and urban planning of Plava Voda greater area" is initiated in June 2011 that will contribute to preservation and improvement of cultural-historical nucleus of Travnik town.



4.10 Infrastructure

As it can be seen on the map of infrastructure facilities relevant to the project (Annex 5) four main infrastructure objects that are planned in the same area as the regional water supply system are gas pipeline Zenica-Travnik, high-speed road Lašva-Donji Vakuf, Bosanski Šamac-Sarajevo railway and highway on corridor Vc. Beside them regional water supply system will cross existing and planned water supply and sewage collection pipes in several places. The main crossings are given below:

- In Travnik Municipality, transport pipeline route including the branch to Dolac n/l crosses telecommunication duct in several places.
- Branch to Novi Travnik crosses planned sewage collector, planned high speed road and planned main gas pipeline Zenica-Travnik as well as gas pipeline branch to Novi Travnik.
- In Vitez Municipality transport pipeline route in several places crosses telecommunication ducts.
- In Mali Mošunj settlement, transport pipeline route crosses planned and existing water supply pipelines while in Divjak settlement it crosses existing water supply pipeline in two places.
- Branch to Vitez cuts planned high speed road and the existing water supply pipeline in two places.
- In Busovača Municipality, transport pipeline route crosses telecommunication ducts in two places. From Sajtovići to Merdani settlement it crosses planned secondary sewage collector at 5 places.
- In Sajtovići settlement, on chainage 21+674, transport pipeline crosses the gas pipeline, the planned water pipeline, and the planned high speed road at 7 places.
- Branch to Busovača crosses planned sewage collector and railway.
- In Zenica Municipality, transport pipeline route cuts highway on corridor Vc on chainage 31+766.

4.11 Noise

According to the *Law on Protection from Noise (Official Gazette of Central Bosnia Canton no. 11/00 and Official Gazette of Zenica-Doboj Canton no. 2/08)* the maximum noise level in urban zones during the day and night is 60 db(A) and 50 dB(A), respectively, with peak level being 75 dB(A). The proposed regional water supply system route passes mostly through the urban area near trunk and local roads, along the old railroad and between the houses, with a small section between Vitez and Busovača passing through arable lands along the Lašva River and forest area on the way to Kula water tank in Busovača. Thus, the noise level is mainly determined by traffic frequency and car speeds, as well as noise associated with urban activities especially in industrial zone of Vitez Municipality.

4.12 Mines

The planned route of Plava Voda regional water supply system mostly follows the old railroad and goes through urban areas, and therefore, no land mines are found in the project area.



5 ANALYSIS OF ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS OF THE PROJECT

Following the presentation of environmental and social aspects it is concluded that implementation of Plava Voda Regional Water Supply System project could have impacts on physical environment in phase of construction and operation on the following components: stability of the terrain, water quality, flora and fauna, soil quality, infrastructure and level of noise. Apart from the impact on the physical environment the project may have significant impacts related to the socio-economic aspects, which include the effects on the population, socio-cultural aspects that brings in an element of acceptability from the inhabitants around, employment, traffic, housing and community structure. The possible impacts are analysed in more details in the following chapters and adequate conclusions are drawn.

5.1 Environmental impact assessment

5.1.1 Stability of the terrain

In the light of analysis of geological structure found along the route, the stability of terrain was assessed in order to determine section of the main transport pipeline and branches that may be constructed with care in order to avoid soil disturbance and surface runoff. The analysis also covers the area in which the water tanks of local water supply systems have been built, or are planned to be built.

Transport pipeline

I – The route of the transport pipeline from the source to the connection for Nova Bila, is to a largest extent located in the alluvial sediments of the Lašva River in which, in the base part, the solid, massive dolomites and dolomitic limestones may be found to some extent (T2), while the larger area is covered by basal zone of conglomerates, sandstones and clays. Considering that these sediments are fully located in the area of the flat part of the route, and in the place of old narrow gauge railway, or old road along the Lašva River, it may be concluded that the concerned terrain belongs to the stable area for construction of the concerned part of the trunk pipeline of the “Plava Voda” regional water supply system.

II – From the area of the Grovnica River to Vitez, the route of the trunk pipeline will be placed in the valley of the Lašva River, within the river alluvion (al), and to a smaller extent in the edge area of sediments of the first river terrace (t1). Due to monotonous morphology, and lithological structure of the terrain, the concerned area belongs to the category of stable terrains.

III – From Vitez to Kaonik, 50% of the route is located in the alluvial sediments, as well as the sediments of the first river terrace. Due to identical lithological, as well as morphological characteristics, the concerned terrain may be placed in the category of stable terrains.

IV – The second part of this terrace, within this reach, is represented by flysch sediments of the Upper Cretaceous (1K23), in the area with pronounced morphology (grey-green sandy



marlstones, rough sandstones and limestone breccia). Having in mind these morphological characteristics, and lithology quality, as well as the closeness of the river course, this area belongs to the category of conditionally stable to unstable terrains.

V – The area from Kaonik to the confluence of the Lašva and Bosna Rivers, within a short reach, also implies flysch sediments of the Upper Cretaceous (Mehurići Facies), as well as Sillurian-Devonian metamorphites after crossing of the Kozica River, and sediments of the Middle to Upper Miocene (M2,3), made of Lašva alternating series of clastites and limestones. This sedimentation material is characterised by relatively good quality in terms of stability, however, due to pronounced morphology this terrain is assessed as conditionally stable.

VI – The route of the trunk pipeline cuts the Lašva River and continues along the left bank of the Bosna River (almost entirely passing through the Miocene Lašva alternating series of clastites and limestones. In this area, the route along the old railroad is passing through the stable (in some parts) and conditionally stable terrain.

VII – Crossing the Bosna River toward reservoir in Putovići, the route of the regional water supply system is passing through the stable alluvial area, and then, along the hill slope, it is climbing toward the final point (Putovići water tank). In this part the route is fully passing through Middle Miocene sediments (2M2), made of the transition zone of thinly layered marl and sandstones. The concerned area is characterised by pronounced morphology, with potential landslides along the terrain slopes, because of which this area is largely characterised as “unstable terrain”.

Branches

Dolac n/I disconnects from the transport pipeline in the area where it crosses the surface watercourse (the Lašva River), and it continues horizontally along the right bank of the Lašva River, in the segment of alluvial sediments. In the area of Upper Cretaceous flysch sedimentation area, it has an upward line (conditionally stable terrain), and it continues along the top of the ridge after which there is wide levelled area with gentle slope, which means much safer building conditions. In this area, the construction of one water tank has been foreseen, and the terrain may be characterised as conditionally stable to stable.

Nova Bila represents an area of a shorter pipeline branch, where the existing Kula water tank is used. The concerned area is built of conglomerates, sandstones, clay, with coal in some places. This is the terrain on which the water tank has already been built, but from the aspect of stability it represents a conditionally unstable terrain. The facilitating circumstance in this case is the fact that the connection and the water tank in this area already exist.

Novi Travnik represents a disproportionately long route of the connection pipeline, which is passing through the alluvial sediments of the Grovnica River. The route is also located along the asphalt road that leads to Novi Travnik, as well as the old route of the narrow gauge railroad.

Along its entire length, the route is passing through the stable terrain, except in its final part, where, from the cemetery (Novo Naselje), over the Permian-Triassic (P,T) mainly alverolite and sandstone sediments, and even limestone breccia, the connection pipeline with the water tank, at the highest altitude, is passing through the conditionally stable terrain.

Vitez implies a route reach from the Lašva River over the soccer stadium to the main asphalt road. Along the entire described area (especially in the zone of asphalt road), the route of



the connection pipeline is passing through the alluvial sediments of the Lašva River, and lake sediments in the second, final part, which implies stable area. The final part of the route at the end of which there is a water tank, is also made of lake sediments, but due to the large slope on which it was constructed, this terrain is treated as conditionally stable.

Busovača is a connection pipeline extending from the area of Kaonik to the branching off point toward “Kula” or “Hrastova Glavica” along the right bank of the Kozica watercourse, which is mostly composed of Sillurian-Devonian (S,D), chlorite-muscovite, quartz-sericite schist, metasandstones and greywacke. These materials mean that this area is firm and solid, therefore, the terrain through which the concerned connection pipeline is passing belongs to the category of stable terrain.

To some extent, the exception is only the reach from the branching off point toward “Kula”, considering the pronounced ascent toward the final point in which the water tank is located and in that sense the terrain may be characterised as conditionally stable to stable.

The second branch of the connection pipeline leads to “Hrastova Glavica”, and its largest part connects to the alluvial sediments of the Kozica River and its tributary Ivanovica, to finally end at a hypsometrically highest altitude of the connection (the water tank altitude), where it is passing through the fluvioglacial materials also deposited along a rather firm and solid hillsides of the Busovača valley. The appearances of landslides have not been recorded, however, due to lithological composition, as well as pronounced morphology, this area is categorised as conditionally stable terrain.

Zenica (Putovići), is a water tank at the very end of the trunk route of the Regional Water Supply System “Plava Voda”. As already emphasized, this water tank is positioned in a natural valley in Putovići settlement near Zenica, in the part of the route located in the Middle-Miocene sediments (2M_2), made of the transitional zone of thinly layered marl and sandstones. The concerned area is characterised by pronounced morphology, with potential landslides along the natural slopes, which is why this area is recognised as the area of unstable terrain. In this sense, the fact that the Putovići water tank has actually already been built is very important.

Conclusion

The analysis of terrain stability indicates that unstable terrains can be found in the alluvium of the Bosna River as well as on the slopes toward the Putovići water tank in Zenica Municipality. In such terrains, construction works should be carried out with care, in order to avoid soil disturbances and surface runoff which can also have wider negative impacts on water quality and workers' safety. The ESAP will recommend performing construction works in shorter intervals.

5.1.2 Water quality

In the phase of construction

Having in mind that the regional water supply system route in several sections is passing along the Lašva and Bosna rivers, as well as that the route is crossing over a number of smaller rivers, it is assessed that the construction works might have negative impacts on the quality of surface and ground waters in the project area including watercourse downstream from the works on construction of “Plava Voda” water intake structure.

The identified impacts are mainly related to the following:



- Increased sedimentation and erosion initiated by excavation works that will result in alteration of channel stability or water quality;
- Pollution of surface and underground waters by spilling or discharge of oil and oil derivatives, motor oil, and similar wastes originating from machinery and vehicles on site;
- Change in surface water quality due to uncontrolled deposition of excavated material in the river/stream bed;
- Change in surface water quality due to uncontrolled deposition of solid waste in the river/stream bed;
- Change in surface and ground water quality due to uncontrolled discharge from the onsite toilets for workers.

The construction of the pipeline crossing over the Bosna River is planned to be carried out by building of inverted siphons using method of horizontal directional drilling. The pipeline will be laid down 1.5 m below the river bed and placed in protective tube. This method causes negligible disturbance to the water body, however construction works on both sides of the river can cause above mentioned impacts.

Smaller, low flow watercourses will be crossed using open-cut trenching method. This method can increase erosion and sedimentation in the water body if the water body is not restored before the wet season.

The above mentioned impacts are all of temporary nature and reversible after the construction works are finalised. Mitigation measures will be proposed by ESAP that will reduce negative impacts in the phase of construction and ensure restoring of the previous conditions.

Pollution of the watercourses can also be caused by improper disposal of solid waste and waste fluids as well as excavation material. The ESAP will propose adequate measures for on-site storage and off-site disposal of waste, so that significant impacts on environment are not expected.

The project will not deplete groundwater supplies or significantly disturb groundwater recharge. The soils in the area of Travnik, Novi Travnik and Vitez are impermeable, thus no contamination of the ground water is expected. The route will pass nearby Kremenik spring but the works will not be performed in the recharge zone as the water inflow area is on the right bank of the Lašva River.

In the phase of operation

The historical analyses of the Lašva River quality parameters indicate the presence of natural dilution effect occurring downstream of “Plava Voda”’s confluence point. The dilution effect is clearly noticeable in the summer period, considering the fact that the “Plava Voda” spring’s capacity and Lašva River’s capacity are almost identical at the confluence site.

Scarce hydrological data indicates that the summer decrease in the discharge at “Plava Voda” spring starts in the period of June-July, while minimums can be expected in October. It seems that the Plava Voda capacity, regardless of abstracted quantity, will remain sufficient to preserve dilution effect to some extent in the summer period.



It is expected that the same effect will be preserved throughout the year, as the probability of occurrence of low waters at both streams at the same time is very low.

Table 64. Reduction in the dilution effect in the Lašva River downstream from the confluence point

No.	Parameters	Average	Spring	Summer	Autumn	Winter
1	Observed flow in Lašva River upstream from the confluence point (m ³ /s) ²¹	2.70	4.24	1.44	2.48	2.36
2	Observed flow in Lašva River downstream from the confluence point (m ³ /s)	4.96	6.81	3.32	4.76	4.61
3	Observed flow in Plava Voda downstream from the intake (m ³ /s)	2.33	3.01	2.22	2.03	1.90
4	Calculated Lašva River flow downstream from the confluence point m ³ /s (1)+(3)	5.04	7.26	3.66	4.50	4.26
5	Difference between observed and calculated flow in Lašva river downstream from the confluence point m ³ /s (average 5)-(4)	+/-0.3				
6	Plava Voda after abstraction for regional water supply (m ³ /s) (3)-(550 l/s)	1.78	2.46	1.67	1.48	1.35
7	Calculated flow in Lašva downstream for the confluence point expected after extraction from Plava Voda (m ³ /s) (1)+(6)	4.48	6.7	3.11	3.96	3.71
8	Approximate reduction of the dilution of the river Lasva caused by Plava voda spring abstraction for regional water supply, calculated as the reduction of Plava voda water contribution to the river Lašva (550 l/s)*100/(7) (%)	12%	8%	18%	14%	15%

If it is assumed that on average 550 l/s will be extracted for regional water supply project in a year, it is calculated that reduction in dilution effect in the river Lašva will range from 8% during the spring period with high water flows and up to 18% during the dry summer period. Therefore, it is also expected that the concentration of pollutants presented in *Table 52*, will increase from 8 – 18% downstream from Lašva's confluence with Plava Voda.

Comparing the pollutants concentrations upstream and downstream from the confluence point presented in *Table 52*, it can be concluded that even in cases of dilution effect complete absence, the quality of Lašva River downstream from the confluence point would not significantly worsen compared to the upstream quality.

²¹Data under items (1), (2) and (3) are taken from EC Life Third Countries project „Strengthening of Diffuse Source Pollution Control“, Hydro-Engineering Institute Sarajevo, 2003-2006



Negative impact on water quality in Lašva and Bosna River can also be expected from number of new connections to Plava Voda regional water supply system that will create additional quantities of sewage to be discharged to these rivers. The responsible governmental bodies should, in any case, work on enhancement of the Lašva and Bosna River water quality by building municipal and industrial wastewater treatment plants and discharging treated wastewater instead of polluted one. However, proposing such mitigation measures would be beyond the scope of this project.

5.1.3 Impacts on flora and fauna

In the phase of construction

Recognizing that water supply system route mainly passes through urban zones and inhabited areas, along roads, and along railways, where tertiary types of ecosystems are already dominant, it is unlikely to expect significant negative impacts on flora and fauna. A temporary loss of habitat along the working corridor could reduce the carrying capacity of the home ranges of the fauna, especially until vegetation cover is re-established. However, the majority of species are common and widely distributed throughout the area and the loss of a few individuals will have a negligible impact on the overall population both at local and regional level. Generally speaking, all impacts caused by construction work are of temporary and reversible nature and can be mitigated by appropriate good working practices that will be prescribed by the ESAP.

The branches leading to Kula, Hrastova glavica, and Gradina water tanks will pass through the forest area, the length of which is 499.45 m, 255 m and 1,302.4 m respectively. The construction works involving clearance of construction areas 5 m on each side of the pipeline, removal of humus and top soil, as well as excavation of trenches can have negative impacts on forest ecosystems. Having in mind the length of the pipeline passing through the forest area, this impact was not considered to be significant and will not cause habitat loss or fragment forest ecosystems. The good working practices will be prescribed by the ESAP in order to avoid damage to the forest by machines, possible forest fires and alike, as well as the measures of site restoration following termination of construction.

Crossing of the Bosna River, according to the Preliminary Design, will be performed using horizontal directional drilling under the river bed. This method will have minimum negative impacts on the river ecosystems that are likely to occur due to the presence of machines and workers on the site. These impacts can be mitigated by appropriate good working practices. High quality fisheries or rare aquatic species are not found in the Bosna River, in the section of concern for this project. Other river crossings will be excavated by open-cut trenching method preferably during dry period.

Mitigation measures prescribed in ESAP will minimise these temporary impacts on forest and river ecosystems in the phase of construction as much as possible. Thus, the impacts on flora and fauna in the phase of construction are assessed as insignificant.

In the phase of operation

Impact on Plava Voda, downstream from the intake.

In the operation phase, if maximum water demand is to be satisfied in all hydrological conditions, the project might have negative impact on aquatic ecosystems of "Plava Voda"



downstream from the intake, and the Lašva River downstream from the confluence point, especially on the fish population.

Namely, in the spawning season (1 October – 1 March), salmonid species migrate to Plava Voda to take advantage of lower water temperature and spawn there. In case that the environmental conditions in “Plava Voda” change, salmonids will be stressed which can reduce spawn rate and quantity of fish. A prolonged exposure to elevated temperatures during migration period is significantly related to pre-spawning mortality as salmonids use up their energy stores and are unable to reach their spawning grounds. Warmer waters also increase the risk of bacterial and fungal infections in salmonids. Warmer water in spawning streams could affect the hatching of fish-eggs because there is less oxygen in warm water.

If maximum of 550 l/s for regional water supply is abstracted in the spawning period, which coincides with the Plava Voda’s minimum winter capacities, it is possible that the environmental flow will be reduced and water temperature increased.

The table below gives observed and calculated flows at “Plava Voda” and Lašva River in the spawning period (Autumn – Spring) as well as calculation of remaining flows after the extraction of maximum demands ²².

Table 65. Observed and calculated flows at “Plava Voda” and Lašva River

No.	Parameters	Average	Autumn	Winter	Spring
1	Observed flow in Lašva River upstream from the confluence point (m ³ /s) ²³	2.70	2.48	2.36	4.24
2	Observed flow in Lašva River downstream from the confluence point (m ³ /s)	4.96	4.76	4.61	6.81
3	Observed flow in Plava Voda downstream from the intake (m ³ /s)	2.33	2.03	1.90	3.01
4	Calculated Lašva River flow downstream from the confluence point m ³ /s (1)+(3)	5.04	4.50	4.26	7.26
5	Plava Voda flows after abstraction for regional water supply (m ³ /s) (3)-(550 l/s)	1.78	1.48	1.35	2.46
6	Calculated flow in Lašva downstream for the confluence point expected after extraction from Plava Voda (m ³ /s) (1)+(5)	4.48	3.96	3.71	6.7
7	Approximate % reduction of flow in Lašva River caused by Plava voda spring intake at maximum demand for regional water supply system (2)-(6)/(2)*100 (%)	10%	17%	20%	2%

²²550 l/s required by the project and 200 l/s currently used by Water Utility Company “Bašbunar”

²³Data under items (1), (2) and (3) are taken from EC Life Third Countries project “Strengthening of Diffuse Source Pollution Control”, Hydro-Engineering Institute Sarajevo, 2003-2006



Bearing in mind that calculated environmental flow for “Plava Voda” downstream from the intake is 0.926 m³/s, and looking at the calculated flow of “Plava Voda” after maximum demand is withdrawn (row 5 in the table above), it may be assumed that most of the time the environmental flow will not be endangered and will be sufficient to maintain natural balance and ecosystems in “Plava Voda” waters.

Moreover, maximum demand is expected in the summer period, when needs for water are higher, which does not coincide with the spawning period. It is expected that the abstracted water quantity in the winter period when salmonids spawn will be lower, proportional to the demand. According to hydrological data presented in hydrological study²⁴, it seems that most of the years the winter capacities of “Plava Voda” will be enough to satisfy winter demands and preserve calculated environmental flow. If environmental flow is satisfied, and also taking into account the lower outside temperatures in the spawning period, it may be assumed that the water temperature will not change. Having all this in mind, it may be assessed that the impact on ecosystem and especially fish population in “Plava Voda” stream will not be significant.

However, once in every 20 years when minimum capacities of 20-year return period might occur at “Plava Voda”, the impact may be significant on ecosystem and specifically fish population causing reduction of offsprings. Such impact will be of temporary nature and with implementation of mitigation measures can be mitigated and reversed.

The proposed mitigation measures to be included in ESAP, and that will have positive impact on environmental conditions in “Plava Voda” are:

- compensation for fish loss in form of fish juveniles for fish planting,
- Inclusion of special condition in **Water Buying Contract between Public Regional Company Plava Voda and individual water utilities** according to which users should modify (i.e. lower) the abstracted quantities of water in accordance with hydrological situation in order to satisfy environmental flow that is to be calculated/determined based on the monitoring programme prescribed by ESAP,
- reduction of losses in the network, also prescribed by the Feasibility Study, that will increase efficiency of water supply system and presumably require abstraction of a smaller quantity of water to satisfy demands throughout the year, modification of abstracted water quantities to satisfy environmental flow.

Impact on Lašva River, downstream from the confluence point.

Lašva River is home to salmonids and cyprinids that spawn in the same period as noted above.

Bearing in mind that calculated environmental flow for Lašva River at the site downstream from the confluence point is 1.321 m³/s, and looking at the calculated flow in Lašva River downstream for the confluence point after extraction from Plava Voda in the table above (row 6), it may be assumed that most of the time the environmental flow will not be endangered and will be enough to maintain natural balance and ecosystems in waters.

Moreover, hydrological study indicates that in the period of winter minimum flows at “Plava Voda” spring, high winter capacities are registered at Lašva River, and vice versa. This

²⁴Determination of Yield and Spring Water Quality of Plava Voda Source, Hydro-Engineering Institute Sarajevo, 2010



indicates that the probability of occurrence of minimum flows at both streams at the same time is very low.

Once in every 20 years when minimum capacities of 20-year return period might occur at Lašva River, determined to be $2.9 \text{ m}^3/\text{s}$, following extraction of 550 l/s for regional water supply the remaining flow of $2.35 \text{ m}^3/\text{s}$ will still be sufficient to support natural balance and ecosystem in Lašva river whose environmental flow is calculated to be $1.321 \text{ m}^3/\text{s}$.

The analysis of decrease in dilution effect done in Chapter 5.1.2 shows that possible change in pollutants concentration caused by the partial or complete absence of dilution effect will not be significant and should not have negative impact on fish population.

Non-existent data on biological monitoring (type and number of fish per season/year in the watercourse that could be correlated to water quality parameters) makes difficult to estimate the possible percentage reduction in fish population on both watercourses with any confidence. Again, if assumed that above assumptions are correct and that environmental flow will be satisfied in all situations, it is expected that environmental conditions in both watercourses will be adequate to support same conditions for spawning. Nevertheless, mitigation measures propose fish planting in case of any possible reduction of fish population.

The impact on ichthyofauna in other municipalities during operational phase is assessed to be insignificant.

5.1.4 Impact on air quality

The impact on air quality is expected as a result of construction works. The processes which will generate pollutants emission are: construction of temporary access roads, transport of uncovered material, movement of machinery and vehicles on site and excavation works.

The impact on air quality is expected within the area of several hundred meters of the working corridor. It is not expected that significant impact will occur on local residents or that emissions will exceed regulatory permissible ground-level concentrations. All impacts are of temporary nature, location specific and reversible.

The impact on air quality is considered to be insignificant if appropriate mitigation measures are implemented such as dust suppression techniques, regular maintenance of vehicles, use of high quality fuel, etc.

The difficulties in isolating air pollution originating from construction works and air pollution from the surrounding sources are expected, which will have impact on monitoring programme.

5.1.5 Impact on soil quality

Based on the maps on land use obtained from municipalities or their Spatial Plans, the analysis of the length of the main transport pipeline and branches passing through different categories of land is given in the following tables.

As it can be seen from the tables above, regional water supply system will occupy high quality agricultural land as well as forest land that are considered to be under the greatest impact of the construction.



The works on construction including removal of topsoil (humus) and digging, as well as presence of machinery and workers at site will have negative impact on soil quality and consequently on flora and fauna. The identified impacts are the following:

- Mechanical impact on soil during trench excavation;
- Stimulation of water and wind erosion;
- Soil pollution by spilling or discharge of oil and oil derivatives, motor oil, and similar wastes originating from machinery and vehicles on site;
- Soil pollution due to uncontrolled deposition of solid waste on the land;
- Soil pollution due to uncontrolled discharge from on-site toilets for workers on the land;
- Delays in soil reinstatement.

Impacts originating from the presence of machinery, vehicles and workers on site can be mitigated by good working practices. Temporary road networks will be reinstated to the pre-existing conditions upon termination of the construction works, where appropriate. With implementation of these measures, the residual impacts are not considered significant.

In the areas where steep slopes are to be crossed, construction can have potential to cause soil erosion and sediment run-off. Soils with a high clay and silt content are particularly prone to erosion. Implementation of proposed mitigation measures will minimize these effects and include use of temporary banks, fences and ditches to restrict and limit pollution.

Reinstating the land has become standard practice and will be carried out above a pipeline once it is welded and buried in the ground. The objectives of restoration are twofold:

- In the shorter term, to reinstate the land contours, drainage patterns, stabilise the soils by installing permanent erosion control and redistribute the topsoil to allow vegetation to grow; and
- In the longer term, to establish sufficient vegetation cover to reinstate the local plant species and ecology.

The delay in reinstatement can cause deterioration in topsoil quality, dissatisfaction by land owners and can increase the cost of later reinstatement.

Where required, the seed of species remaining in the preserved topsoil will be supplemented with equivalent materials (seeds, bulbs, and plants) and/or by the re-planting of species removed from project area before construction. In agricultural areas, the land is to be restored to the state fit for the landowners to re-plant their own seed crops.

During construction, the correct preservation of topsoil to maintain fertility will be carried out. The topsoil will be carefully stripped and stockpiled (into piles no more than 2 meters high) at all sites. Reinstating activities will take place immediately after pipe is buried in order to preserve quality of topsoil removed. With implementation of these measures, the residual impacts are not considered significant.



Table 66. Land occupation by the main transportation pipeline

Municipality	MAIN TRANSPORTATION PIPELINE					
	Old railway		Local road (M5)		Agricultural land	
	L (m)	From - To	L (m)	From - To	L (m)	From - To
Travnik	6267.84	2km - 8.26km	2000	0km - 2km		
Novi Travnik	339.4	8.26km - 8.60km	587.2	8.60km - 9.00km	372	9.00km - 9.56km
	1126	10.5km - 11.6km	927.51	9.56km - 10.5km	1358.7	31.58km - 32.947
	3037.56	11.6km - 15.2km	596	11.6km - 12.2km		
Vitez			483.12	15.2km - 15.7km		
			864.85	15.7km - 16.55km	2213.01	16.55km-18.77km
Busovača			9018.04	18.77km - 28.87km		
Zenica			2716.29	28.87km - 31.58km		

Table 67. Land occupation by the branches

Municipality		BRANCHES									
		Agricultural land – agro-zone 1		Agricultural land – agro-zone 2		Along local roads		Forest land		Agricultural nursery	
		L (m)	From - To	L (m)	From - To	L (m)	From - To	L (m)	From - To	L (m)	From - To
Travnik	Nova Bila	570.46	0km - 0.57km	570.46	0km - 0.57km						
	Novi Travnik	845.22	0km - 0.84km	845.22	0km - 0.84km	61.62	0.84km - 0.90km				
Novi Travnik						4511.93	0.84km - 5.41km				
Vitez		2070.89	0km - 2.07km	2070.89	0km - 2.07km			1302.4	5.41km - 6.72km		
Busovača Hrastova Glavica		2455.16	0km - 2.45km	2455.16	0km - 2.45km	690	2.83km - 3.52km	255	3.52km - 3.78km	376.72	2.45km - 2.83km
Busovača Kula		420.07	0km - 0.42km	474.3	0km - 0.89km			499.45	0.89km - 1.39km		



5.1.6 Impact on infrastructure

In the phase of operation

Based on information given in Chapter 4.10 Infrastructure, the regional water supply system will cross roads, telecommunication cables, and existing water distribution pipelines at several places along its route.

The mitigation measure for this impact would be timely contacting of relevant institutions and obtaining of appropriate approval for works in the vicinity of underground structures / roads. Namely, the good practice would be to contact relevant institutions, including relevant Water and Sewerage Utility Companies, BH Telecom and relevant Cantonal or Federal Road Directorate, following the completion of Preliminary Design and prior to development of Detailed Design in order to obtain the relevant approvals. The responsible institution is to overlap regional water supply route with the maps of their installations and prescribe conditions under which the works can be carried out in the concerned sections. These may include complete relocation of underground pipelines, measures for traffic management, etc. The developer is to include these conditions in the Contract with the contractor for construction works.

In the phase of operation

Generally speaking the present status of sanitary infrastructure in the project area is poor. Water supply distribution networks are old and insufficient maintained, while the sewage system is either non-existent or inadequately developed. Sewage collection is limited to urban centres.

According to the present plans of municipalities and their water utility companies, 550 l/s of water from “Plava Voda” will primarily serve to replace water from currently used sources (limited to the supply of the city centres) which is either of insufficient quantity to meet the needs over a year (especially in the dry seasons or of poor quality and requires treatment. With the replacement of the existing sources, a significant improvement in both water quality and quantity will be realised. With increased supplies some additional pressure on sewer system is to be expected in the urban centres.

In addition, water from “Plava Voda” spring will be used to supply better quality water as well adequate quantities to the residents in the suburbs and neighbouring settlements. These areas predominately rely on traditional sources such as nearby springs which usually dry up in the summer months and water shortages are usually met by municipalities providing them with water tankers at significant costs. While reliable and adequate water supplies will generate significant welfare benefits there will also be a negative in terms of increased wastewater flows to local water courses.

According to the information obtained from water utility companies, the following settlements would be additionally connected to water supply system using “Plava Voda” water:

- In Travnik: settlement Varošluk
- In Novi Travnik: Bučići, Balići, Rankovići, Rastovci, Krnjića potok, Stojkovići



- In Vitez: Ahmići, Pirići, Bukve, Putkovići, Tolovići, Sivrino selo, Šantići, Ljubić, Kruščica, Preočica
- In Busovača: Carica (20%), Kaćuni, Katići (50%), Krčevine (50%), Kula (20%), Milavice (50%), Podjele (50%), Ravan (50%), Skradno (50%), Solakovići (50%), Strane (50%)
- In Zenica: Banlozi (20%), Vjetrenice, Dolača, Donje Babino (80%), Gorica, Gornja Gračanica, Gornja Zenica, Gornje Crkvice (40%), Klopče (20%), Lašva, Lokvine, Prein Han (20%), Podbrježe (30%), Raspotočje (30%), Ričice (20%), Tetovo (5%), Trgovišće (10%), Vražale, Zmajevac (20%).

It should be noted that a leakage study is scheduled to commence in the near future which will develop leakage reduction plans and identify priority distribution replacements to maximise the benefits of the Plava Voda supplies. It is anticipated that an EU contribution would be available to address the urgent needs. With regard to improved wastewater collection and treatment, a project is currently under implementation supported by an IFI and EU to develop wastewater collection and treatment infrastructure in the smaller municipalities in the Federation and Republika Srpska. It is expected that this will gain greater momentum in the future.

5.1.7 Level of noise

During the construction phase of the project it is expected that elevated levels of noise will be produced in the construction area. Noise will originate from the construction works themselves, including presence of machines, vehicles and workers on site.

It is to be noted that large proportion of works will be carried out in urban areas, including settlement and industrial zones that are noisy by nature. The settlements that are most likely to be affected by elevated levels of noise are listed in the table below:

Table 68. Settlements most likely to be affected by increased noise levels

Affected settlement	Location
Nova Bila	Between 5 and 6 km of the transport pipeline route
Nova Bila	On the 8th km of the transport pipeline route
Stara Bila	On the 9.5 km of the transport pipeline route
Kremenik and Krčevine	Between 11 and 14 km of the transport pipeline route
Katići	On the 24.5 km of the transport pipeline route
Janjići	On the 31 km of the transport pipeline route
Putovići	On the 33 km of the transport pipeline route
Pribilovići	Around the location of the water tank
Hrastova Glavica	Around the location of the water tank

Pipeline construction would progress along the route and, as a result, all noise impacts would be temporary. The construction progress cannot be estimated at this stage as it depends on many factors such as number of workers, type of mechanisation, type of soil, presence of other infrastructure (existing underground pipes), etc.

The works will mainly be carried out during the daylight working hours, however, depending on the nature of the work, it may be necessary to perform some construction activities around the clock. Mitigation measures will prescribe daylight working hours in the most affected zones.



Nevertheless, the mitigation measure should be prescribed in order to keep noise at the acceptable level as prescribed by *Law on Protection from Noise (Official Gazette of Central Bosnia Canton no. 11/00)* and *Law on Protection from Noise (Official Gazette of Zenica-Doboj Canton no. 2/08)* enforced in Middle Bosnia Canton and Zenica-Doboj Canton, respectively.

The difficulties in isolating noise originating from construction works and noise from the surrounding source are expected, which will have impact on monitoring programme.

5.2 Social impacts assessment

5.2.1 Impact on affected people and vulnerable groups

As identified in chapter 3.2.10, 230 private plot owners (business, households and individual plots with no owner or structure identified during the Census) will be directly affected by the project in the pre-construction and operational phase.

The Project foresees only land acquisition, without resettlement of the households or businesses. Land acquisition will mostly be temporary ("incomplete expropriation") for the purpose of placement of the main transport pipeline and its branches, even though several cases of permanent land acquisition ("complete expropriation") are foreseen for the purpose of building permanent structures such as pumping stations and water tanks.

The two reservoirs to be built in the Municipality of Busovaca will require permanent acquisition of two private land plots, identified as unused plots during the Census. The reservoir to be built in the Municipality of Novi Travnik will be located on a private land plot, identified as an unused plot. In Nova Bila, the planned reservoir will be located on a land plot in the ownership of the company "Šipad Sarajevo", identified as forest land. The reservoirs to be built in the Municipality of Vitez and the Municipality of Zenica will be located on state owned land.

Landowners whose land will be expropriated for the purpose of pipeline placement will be permanently impacted as the construction of buildings on their plots will be forbidden in the pipeline right-of-way. Nevertheless they will be no restriction to use the land for agriculture purposes.

The interview carried out with the identified members of households that will be impacted by the project revealed that, for the majority of the respondents, the crucial issue is the loss of right to construct additional structures and disturbances caused by pipeline construction works. 50% of the respondents stated they had plans to build additional structures on the affected plots in the future. The respondents were asked to rank each potential type of loss caused by the Project on a scale of 1-3 according to its importance, with 1 being most important, 2 less important and 3 least important. The perceived losses and frequencies of responses are presented in table below.

In terms of compensation, most respondents stated they would require cash compensation while 10% stated they would wish to be connected to the water supply system. The most frequent comment regarding the Project referred to the possibility of route realignment in order to avoid land acquisition of plots in private ownership.



Table 69. Perceived Losses and Frequencies

	Most important	Less important	Least important
Loss of livelihood	2	2	5
Property disturbances	26	9	0
Loss of right to build	9	12	6

The crucial issues for the businesses include loss of customers, disturbance due to construction works, loss of right to build additional structures and loss of income in the course of construction works due to access restrictions.

The mitigation measure proposed for the affected landowners is to carry out the land acquisition and compensate (appropriate and fairly) for loss of assets in accordance with national laws and EBRD procedure. For those landowners who will be forbidden to construct buildings on pipeline right-of-way, adequate compensation for loss of the possibility to use their land as intended should be provided.

Vulnerable groups that may be affected by the project are identified in chapter 3.2.10. Identified social categories that live below the poverty line are: recipients of the social welfare benefits (disabled persons, war veterans, displaced persons, children receiving child allowance), recipients of pension, and Roma people. They are considered vulnerable since they may not afford to pay for any potential increases in tariffs as a result of connection to Plava Voda regional water supply system. As already stated none of the municipalities subsidise water bill issued to social categories. Instead, monthly assistance is received indirectly from central and local government institutions.

The mitigation measure for these social categories would be to consider introducing subsidies for water at municipal or cantonal level.

The economic evaluation analysis demonstrated that in the absence of the project, the conditions in the project areas would be characterised by continuous water shortages, further deterioration in drinking water quality and prevalence of increasing incidence of waterborne diseases. This project is intended to provide good water supply for all regardless of gender, ethnicity or other disadvantages at affordable prices.

As highlighted earlier, the Plava Voda project will have positive impacts on all inhabitants of municipalities that will be supplied water from Plava Voda system. The system will provide increased quantities of high quality water and more reliable services to the populations of the towns: Novi Travnik, Busovača and Zenica Municipalities and inhabitants of sub-urban and rural area in all five municipalities. Consequently, all vulnerable groups in the region will equally benefit from these improvements.

The representatives of people that might be affected by the project in the operational phase including the owners of restaurants adjacent to Plava Voda spring in Travnik and fisherman associations that use Lašva River were interviewed. The minutes of these meetings are given in Appendix 2.



Generally speaking, owners of the restaurants did not have any objection to the project. They were aware that flows would be reduced but they would not disappear altogether. They were concerned about reduction of natural ambience of the Plava Voda spring downstream from the water intake. The same concern was shared by wider public participating in the Public Hearing held as a part of national environmental permitting procedure.

Representatives of fisherman associations were mainly concerned with possible decrease of fish population that will be caused by changes in the water flow in "Plava Voda" downstream from the intake and Lašva River. It must be stressed that the fishing activities at the Lašva River are not of commercial nature, but recreational and therefore there should be no economic consequences for the livelihood of the local community. Generally speaking, they did not have objections to the project but they requested for project to provide annual compensation for possible fish population decrease in form of additional fish planting. The mitigation measure related to the objections will be recommended in ESAP.

5.2.2 Impacts on public health

No specific serious adverse impacts on health of workers or population are expected as a result of construction and operation of regional water supply system.

There is potential hazard risk from open trenches in the vicinity of populated areas during the construction phase that should be mitigated by appropriate warnings and fencing.

During operations of the project the only potential risk identified is for workers that manage the chlorination station at the Plava Voda intake. This risk will be mitigated by ensuring that workers wear protective clothing when entering chlorination unit. There are hundred of such facilities in the country and risks are well known and understood.

On the other hand, based on the information on current status of water supply services in participating municipalities, it can be concluded that the project will have significantly positive health impacts on health of population served by the water from "Plava Voda" system. They will receive continuous supply of good quality water. Water quality is a particular concern for Novi Travnik, Busovača and Zenica Municipalities and consequently a significant number of households buy bottled water for drinking. The poorer households which can not afford to purchase bottle water use other coping mechanisms including boiling and filtering water for drinking needs, which also increases the expenditure on water. The incidence of water borne diseases is a clear indicator of population's sufferings as a consequence of poor water quality. While the Plava Voda project will not cover the water supply needs of entire population in each municipality, it will however make a significant difference to well being of a large proportion of the population connected in the short term and medium term.

The project will also have positive impact on health care services number of health care institutions, geriatric centres and and nursing homes will be connected to "Plava voda" system. This will be of outmost importance for the Main hospital in Zenica presently supplied from the local resource Babina Rijeka (source with very poor water quality). Significant number of schools and child day-care centre are also expected be connected to "Plava Voda". The list of institution that will benefit from "Plava Voda" is given in the table below.



Table 70. Public institutions to be connected to “Plava Voda” regional supply system

	Hospital		Health center “Dom zdravlja”/ “Ambulanta”		Care center for children with special needs		Nursing home		Primary school		Secondary school		Child daycare centers	
	# of hospitals	# of users*	# of centers	# of users*	# of centers	# of users	# of homes	# of users	# of schools	# of users	# of schools	# of users	# of centers	# of users
Travnik	-	-	-	-	-	-	-	-	3	1197	1	443	1	48
Novi Travnik	-	-	1	-	1	45	1	47	3	1661	2	1078	3	108
Vitez	-	-	1	n/a	-	-	1	70	4	1970	2	823	2	82
Busovača	-	-	1	-	-	-	-	-	3	2100	2	800	1	50
Zenica	1	2308	1	149	-	-	1	87	11	6641	7	3804	6	340
TOTAL	1	2308	4	149	1	45	3	204	21	13596	14	6948	13	580

* number of beds plus number of employees

5.2.3 Impact on public amenities

As already defined in Chapter 4.2, the public amenities are understood to include (a) feature that increases attractiveness or value of a certain location as well as (b) a useful or pleasant facility or service for public.

Considering the attraction value of “Plava Voda” it can be concluded that abstraction of Plava Voda for drinking purposes will have negative impact on category (a): a natural amenity of “Plava Voda” which is an attractive tourist destination. The flows make “Plava Voda” a public attraction in Travnik. It is recognised that decrease in “Plava Voda” flows downstream from the abstraction point will decrease this amenity value.

Considering the following requirements:

- Using scarce hydrological data, “Plava Voda” spring’s overall minimum capacity of 20-year return period is determined to be probably 700 l/s.
- Water Utility Company “Bašbunar” from Travnik has concession to 200 l/s of which they currently use 194 l/s on the average.
- The planned water abstraction for regional water supply system is 550 l/s which, together with 200 l/s currently used, indicate that 750 l/s should be available in the period of maximum demand if concerned municipalities are to be continuously supplied with requested quantities of water.
- Environmental flow, calculated in chapter 4.3.2 as 926 l/s, should be ensured.

It seems that current requirement for 550 l/s for regional water supply might not be satisfied in all hydrological conditions although the probability of having minimum capacities in the period of maximum demand is very low.



Here is to be noted that article 47 of the Water Law (Official Gazette of Federation B&H, 70/06) states that water used for drinking purposes has priority over the other types of water use. However, the fact that the overuse of water from Plava Voda spring can dry up “Plava Voda” downstream from the intake structure in the period of minimum water should not be neglected.

Two facts should be taken into consideration:

- The environmental flow is calculated based the federal Water Law - using minimum average monthly flow of 95% probability as the valid method before officially prescribing the new calculation method. The new Rulebook on Environmental Flow calculation is in preparation and will foresee calculation of environmental flow based on the minimum mean discharge (MNQ) method.
- Water Framework Directive (2000/60/EC) and Federal Water Law (art 31-36) prescribe categorisation of surface water body types. For each surface body type, hydromorphological and physicochemical conditions shall be determined to define its ecological status. Relevant bodies are to collect and maintain information on the type and magnitude of the significant anthropogenic pressures to which the surface water bodies in each river basin district are liable to be subject, in particular the estimation and identification of significant water abstraction for urban, industrial, agricultural and other uses, including seasonal variations and total annual demand, and of loss of water in distribution systems. Relevant governmental bodies shall use the information collected above, and any other relevant information including existing environmental monitoring data, to carry out an assessment of the likelihood those surface waters bodies within the river basin district will fail to meet the environmental quality objectives.

Thus, it is expected that currently calculated minimum capacity and environmental flow will be subject to revision according to the new calculation methods defined by the Rulebook currently in preparation, monitoring program that will certainly be prescribed by the ESAP, and future requirements related to water categorisation.

Additionally, it is to be noted that all concerned municipalities are working on the leak detection projects and that there is a plan to work on reconstruction of water supply network prior to connection to Plava Voda regional water supply system. This is also recommended by the Feasibility study from 2007 as an action that should precede works on connection to regional water supply system. It is expected that, following the implementation of these projects, the actual maximum water demand will be lower and environmental and social impacts significantly reduced.

Nevertheless, the mitigation measures must be proposed. The ESAP will include the following measures in order to keep the amenity value:

- mitigation measures related to changes in the stream bed including decrease of bed slope, construction of cascades that will decrease the flow velocity and produce desirable visual effect of flow richness.
- to include special condition in **Water Buying Contract between Public Regional Company Plava Voda and individual water utilities** according to which concession users should modify (i.e. lower) the abstracted quantities of water in accordance with hydrological situation in order to satisfy environmental flow that is to be calculated/determined based on the monitoring programme prescribed by ESAP.



On the other hand, the project will also have positive impact on category (b) public amenities reflected through increased reliability and quantity of water supply for hospitals, dormitories, nursing homes, and swimming pools and for future extensions of the water supply system to suburbs and surrounding villages currently without reliable water supplies.

5.2.4 Economic Impact

The proposed project will address the following shortcomings of the present situation:

- Supply of high quality water, which complies with EU Drinking Water Directive to areas which currently suffer from water shortages and poor water quality of existing supplies.
- Extension of supplies to areas which are not connected to the public water supply systems as a consequence of lack of inadequate water resources.

After implementation of the project the following benefits will be realised:

1. Benefits of cost effective development of a new water source for all areas covered by the regional system
2. Benefits of consumer convenience of adequate supplies of good quality water
3. Benefits of improvement in public health from safe drinking water supplies.

Benefits of Cost Effective Development of New Source

All municipalities to be connected on the regional system (except Travnik) suffer from inadequate water supply sources and lack of scope for development of viable alternatives. This is equally true for the settlements Town of Nova Bila and Dolac n/L, which are part of the Travnik Municipality. The present public water supply systems in all five municipalities are limited to the urban areas, while sub-urban and rural areas are usually supply by small local systems. In addition, all the existing water supply sources suffer from poor water quality and water supply shortages to a varying degree. In order for these municipalities to increase the volume of water supplied and extend the coverage of public water supplies to other settlements, which currently rely unsafe and inadequate community based systems, they would have to incur quite substantial costs in alternative water source developments and/or water treatment facilities.

The benefits of the project are calculated by comparing the long term economic average incremental costs of supplies from Plava Voda for each municipality with the benchmark figure of KM 0.40 / m³ used for costs of alternative source developments and operations in the "without project" situation in the absence of Plava Voda project. The annual resource cost savings benefits in constant economic prices are determined for each municipality and for the project as whole. It is estimated that the overall resource cost savings from the project will be KM 4.046 m per annum in present value terms over the life of the project.

Consumer Benefits of Improved Water Quality

In the absence of the Plava Voda project, the consumers in the municipalities would continue to suffer from poor water quality and in some cases inadequate supplies. The household consumers presently pay tariffs in the range of between 0.4 KM / m³ in Zenica to 0.8 / m³ in Busovaca for relatively poor quality drinking water supplies. The situation would



radically change with regard to improved water quality when they are supplied from Plava Voda. A measure of consumer's willingness to pay more for an improved water supply can be used for estimating the potential benefits of the project. This technique uses consumer surplus analysis as a measure of project benefits. It is considered to more realistically reflect the full value of benefits achieved by the consumers from improved water supplies. The measure of consumer surplus comprises two components: resource cost savings from not having to buy bottled water for drinking and the convenience of adequate supplies of good quality water. For the purpose of the analysis it is assumed that the consumer surplus benefits will be reflected by their willingness to pay KM 0.20 /m³ more for the improved water quality supplies from Plava Voda. The annual consumer benefits of improved water quality in constant economic prices are estimated at KM 3.593m in present value terms over the economic life of the project.

Benefits of Improvements in Public Health

Unsafe drinking water is a significant cause of waterborne infectious diseases such as enterocolitis or hepatitis A, and can cause severe diarrhoeal / gastroenteritis infections and other health problems. Drinking water can also be tainted with chemical, physical and radiological contaminants with harmful effects on human health. The health statistics for all municipalities show high incidence of all these waterborne diseases and especially the prevalence of enterocolitis. The real economic costs of medical treatment, loss of productive days and human suffering and distress are considerable. All these factors are difficult to quantify in monetary terms. Nevertheless, a proxy value of two days saved per person per annum for the population in each municipality supplied from Plava Voda, valued at daily average wage rate, is taken to represent the benefits of improvements in public health. This is a very conservative figure but it helps to highlight the order of magnitude of health benefits. The annual benefits of improvements in public health in constant economic prices in present value are estimated at KM 5.280 million per over the life of the project.

Capital Investment Costs

The cost of the proposed project including all the associated works are estimated at KM 40.359 million at 2010 constant prices including physical contingencies but excluding VAT and price escalation. The overall investment will be phased with construction from 2012 to 2014. It is assumed that the completion of the construction will allow the municipalities to start utilising their allocation of the agreed volumes of water requirements within two years of completion of construction and start of operations.

Results of Economic Evaluation

The results of the economic evaluation are shown in terms of economic internal rate of return (EIRR) and benefit cost ratio at the discount rate of 8% for each municipality in Table below.

Table 71. Results of Economic Evaluation

	Travnik	Novi Travnik	Vitez	Busovaca	Zenica	Overall
EIRR	29%	22%	31%	20%	31%	28%
Benefit Cost Ratio	3.8	2.8	4.2	2.5	4.1	3.1



Economic benefits from implementing the Plava Voda project significantly exceed economic costs and therefore provide strong economic justification for its implementation from the point of view of each municipality. The implementation of Plava Voda project will ensure improvements of water supply services and drinking water quality as well as an improvement in public health. The project will also provide related benefits including increased development potential in the project areas. In the absence of the project, the water supply services would further deteriorate and lead to increased public health problems or the municipalities would incur substantial costs in alternative developments, which may not be affordable and economically sustainable.

The overall project is shown to realise a robust economic internal rate of return (EIRR) of 28% and a benefit cost ratio of 3.1, which makes it economically viable by a wide margin. The EIRR remains above 20% if there is a 30% reduction in benefits or a 30% increase in capital investment costs.

5.3 Project risks

The following potential project risks have been identified:

1. Objection by landowners of different ethnic groups to expropriation;
2. Objection by different ethnic groups to unfair water distribution;
3. Risk that some municipalities will step out of the project;
4. Objection to project in general by Travnik citizens due to the loss of amenity value at "Plava Voda" downstream from the intake.

Ad 1) the preliminary estimates suggest that approximately 79% of the pipeline by length will be constructed on public property while the remaining 21% will be laid down on private land. Out of this 21% the majority (ca 95%) will be subject of incomplete expropriation. More information about the general rules for the expropriation and compensation issues is to be found in section on land acquisition issues.

Preliminary information from the Census reveals that no problems should be expected with landowners if appropriate and fair compensation will be provided. In some cases, landowner asks only to be connected to "Plava Voda" system. This issue will be further investigated and confirmed during the preparation of the Expropriation Study. For the purposes of this exercise it can be considered as a potential risk of the project.

Ad 2) the analysis of ethnic mix in local communities that will be connected to "Plava Voda" water supply system was estimated by the municipalities and that water will be delivered to all citizens regardless of their ethnic background. Distribution of ethnic groups that will receive water is more or less proportional to the estimated ethnic mix at the municipal level. It can be concluded that no **social risks** for the project are expected.

Ad 3) Municipal council of Vitez Municipality has not fully committed to become part of this project and connect to Plava Voda system. According to the decision of the Municipal Council, Municipality Vitez will allow the construction of the main pipeline on its territory. It reserves the right to join the project in the future and will cooperate on expropriation process. For time being it will postpone the construction of the branch line and connection to the system for the future.

Ad 4) The public hearing, as part of national environmental permitting procedure, carried out on 14 March 2011 in Travnik revealed the concern of Travnik citizens about loss of amenity



values. This impact will be mitigated by different measures proposed which were taken into consideration at the hearing for the planned project for the “Restoration and urban planning of Plava Voda greater area” including the objections and suggestions of local population, representatives from municipalities and other institutions responsible for the preservation of historical and cultural heritage.

5.4 Consultation requirements

As already explained in Chapter 1.5, this project is required to pass EIA procedure and obtain environmental permit according to the national regulations. This means that public consultation procedure should be carried out as a part of EIA Study evaluation process. Article 61 of the Law on Environmental Protection prescribes organisation of public hearing where stakeholders are to be invited by printed media 15 days prior to public hearing. Comments can be submitted in written form within 30 days after the public announcement. Ministry is preparing minutes from the public hearing. The public hearing is carried out on 14 March 2011 in Travnik and the minutes are available from the Federal Ministry of Environment and Tourism. The main concern of all Public Hearing participants was related to loss of “Plava Voda” amenity value and impact of construction work on cultural-historical heritage of Travnik.

Public consultation is also to be carried out in the framework of preliminary water permit issuing procedure. According to the Article 124 of the Water Law, the public is to be informed by posting information on the announcement board of the body responsible for issuing of water permit and in the local media. The period of 30 days is to be left for written comments. In case of a need, responsible body can organise public hearing. According to the article 25 of the *Rulebook on Content, Scope, Conditions, Ways of Issuing and Archiving of Water Documents (Official Gazette of FB&H, no. 6/08)* issued agreement/permit is to be posted on the Water Agency’s public board and web site. Interested stakeholders can file complaint to the issued permit according to the Law on Administrative Procedure. The preliminary water permit is issued on 21.09.2010 and no objections were received.

In the scope of preparation of this Study individual consultations were carried out with representatives of two affected groups as discussed above.

Based on the PR 10 of the EBRD’s Environmental and Social Policy stakeholders are to be engaged and meaningful consultation process proposed. If an ESAP is prepared, the full document or its non-technical summary, depending on the assigned project category by EBRD, is to be disclosed in local language in a manner that is accessible and culturally appropriate. It is proposed that the document is disclosed in the public areas in concerned municipalities as well as on their web pages for one month. The public notice on the possibility to comment on the project should be also placed in daily newspaper. All concerned parties are to be provided with opportunity to give their comments and suggestions in a written form related to the Study and the project itself and leave it to existing municipal mechanism for complaints.

Based on the category assigned by EBRD, public consultation process might be carried out in concerned municipalities. Public consultations should be carried out in the premises of municipal building in all five concerned municipalities. Information about the place and time of the consultations should be announced well beforehand through local media and posting of notices at visible public places and especially in local communities (“mjesna zajednica”) where expropriation is to be carried out. Representatives of fisherman associations,



restaurant owners on “Plava Voda” as well as all other identified stakeholders (tourist association, NGOs, etc.) should be invited by direct invitation. The minutes are to be kept and all suggestions and comments by public should be taken into account. The participants are to be informed in a timely manner of the final decision on the project, associated environmental and social mitigation measures and benefits of the project for the local communities. The information can be placed on the web site of the municipalities as well as in form of the announcement on the announcement board of the municipalities.

The detailed Stakeholder Engagement Plan for the needs of EBRD is prepared in June 2011.



6 ENVIRONMENTAL AND SOCIAL ACTION PLAN (ESAP)

The ESAP has been prepared based on the result of the environmental and social impacts assessment done in the Chapter 5.

The ESAP includes measures to minimize potential negative impacts which will be applied during the project implementation, including responsibilities for their implementation, a timeframe with associated milestones and cost estimates, and monitoring plan.

6.1 Environmental mitigation measures

The mitigation measures are categorised as:

- Mitigation measures prior to construction,
- Mitigation measures in the phase of construction,
- Mitigation measures in the phase of operation.

Mitigation measures prior to construction are related to obtaining other relevant permits, namely environmental and preliminary water permits that regulate environment and water protection, as well as conditions for work in the vicinity of underground infrastructure and roads from relevant governmental authorities and companies (water and sewerage utility companies, BH Telecom, cable TV companies and road directorates). The Client (Public Regional Utility Plava Voda) is to include these conditions in the Contract for construction works.

Mitigation measures in the phase of construction are mainly related to implementation of good working practices in order to avoid negative impacts on soil stability, water and soil quality and noise level. Their implementation is responsibility of the Contractor and should be included in Contract for Execution of Works together with monitoring plan given in Chapter 6.3. The cost of implementation of these measures should be included in construction costs, although they mainly include good housekeeping measures and usually do not require significant financial means. The Client and appointed Supervising Engineer for environmental, health and social issues shall monitor the implementation of mitigation measures and monitoring programme.

Mitigation measures in the phase of operation include measures that will mitigate environmental impacts and ensure that environmental flow and fish species are preserved.

All mitigation measures are given in

Table 72. The list of good working practices and Waste Management Plan that are to be included in the Contract for Execution of Works is given after the table.



Table 72. Environmental mitigation measures

Phase	Issue	Action to be taken/ Mitigation measure	Comments	Responsibility	Timeframe	Cost
Following Preliminary Design Development	Permits and agreements	Obtain urban permit and environmental permit as well as agreements for construction in the vicinity of ground installations and roads.	Federal Ministry of Physical Planning issues urban permit, Federal Ministry of Environment and Tourism issues preliminary water permit. Other authorizations are to be obtained by relevant governmental authorities and companies (water and sewerage utility companies, BH Telecom, cable TV companies and road directorates).	Public Regional Company Plava Voda	Request are to be submitted following completion of Preliminary Design	2500 €
Pre-construction	Organization of construction works with least impact on environment	Implement general requirements, measures related to supply and transport of materials, and measures related to organization of construction site, all listed after this table.	Public Regional Company Plava Voda should include these mitigation measures in the Contract for Execution of Works	Contractor	Prior to construction works	Usually, these measures are not implemented at extra cost and are included in construction cost
Construction	Prevention of water, soil and air pollution, impact on flora and fauna, and increased noise level	Implement mitigation measures related to execution of construction works listed after this table.	Public Regional Company Plava Voda should include these mitigation measures in the Contract for Execution of Works	Contractor	During the construction	Usually, these measures are not implemented at extra cost and are included in construction cost



Phase	Issue	Action to be taken/ Mitigation measure	Comments	Responsibility	Timeframe	Cost
ROW Reinstatement	Prevention of negative impact on habitat deterioration and soil erosion	Implement mitigation measures related to organization of construction site after completion of works, listed after this table.	Public Regional Company Plava Voda should include these mitigation in the Contract for Execution of Works	Contractor	Immediately after competition of works on concerned sections	Should be included in decommissioning costs
Operation	Reduction of losses in water supply network in all concerned municipalities	Develop a Leak Detection Study and reconstruct the network according to recommendations from the study	The project of detection of losses in concerned municipalities has already started. Grant for networks reconstruction is pending development of Studies	Public Regional Company Plava Voda	Prior to putting Regional Water Supply System in use	To be determined by a Leak Detection Study
Operation	Preservation of environmental flow	Include special condition in the Water Buying Contract according to which water buyers (municipal water utilities) should modify (i.e.) lower the abstracted quantity of water in accordance with hydrological situation to satisfy environmental flow		Public Regional Company Plava Voda	Following full establishment of Public Regional Company Plava Voda	Free of charge
Operation	Preservation of fish species in Lašva River	Fish planting	In case fish loss is observed compensation in form of fish juveniles should be ensured	Public Regional Company Plava Voda in cooperation with fisherman associations	In the years when fish decreased is observed	20,000 €



The requirements in terms of good working practices to be included in the Contract for Works are as follows:

General requirements

- Contractors shall be obliged to follow practice of good ecologic construction during all construction activities, and to reduce to the minimum the damage caused to vegetation, soil, groundwater, surface water, landscape, as well as disturbance of settlements and local communications.
- Application of environmental protection and mitigation measures as well as monitoring will be implemented in parallel with construction activities. They will start at the time when workers, equipment and/or material are moved to the construction site, and they will end with the termination of construction works, when all workers, equipment and/or material leave the construction site, and when environment is restored to previous condition.
- The contractor has obligation to appoint a Health, Safety and Environment Coordinator who will be responsible to ensure compliance with the laws and objectives of the environmental protection, occupational safety and fire protection.
- Contractor is to ensure order, discipline and professional responsibility of all employees on the construction sites. Work and residence must be restricted exclusively to the zone of construction works and damage to private property, land and crops must be avoided. He is to ensure regular contact with the representatives of local inhabitants (local community council) with purpose of information exchange or in order to find solutions to possible disputes (originating from violation of ownership rights, damage caused during construction works, etc.).

Supply and transport of materials

- While buying construction and rehabilitation material for water tanks, the contractor will choose supplier that operates in accordance with valid environmental permit or other environmental standard recognized in B&H and/or EU.
- Aiming at prevention of dust emissions, the contractor shall transport asphalt, gravel, stone, earth and other material in trucks covered with tarpaulin. Transport of stone and gravel shall be carried out in moist condition. The speed of transport vehicles shall not exceed 30 km/h. The contractor shall avoid unnecessary driving of vehicles.

Organisation of construction site

- Construction should start (if possible) at the time of the year when the advantages of dry soil conditions can be utilized, i.e. when compacting and degradation through use is at minimum level.
- Adequate machines shall be used and/or protection plates that would prevent compaction during soil removal, for example with rails or low pressure pneumatics in locations that indicate possibility of compaction. Adequate procedures for separate removal, handling, storage and replacement of humus and subsoil shall be used.



- The contractor shall establish temporary disposal sites for construction materials, area for rinsing of concrete pumps and mixers, and area for washing of vehicle tyres with adequate cleaning agent. Temporary disposal sites for excavation material (topsoil) shall be reduced to maximum 2 m of height, in order to prevent compaction caused by weight of the soil, and storage time is to be reduced to minimum.
- Contractor shall ensure that all construction equipment has been licensed and approved in accordance with local regulations, and if possible, certified in compliance with the EU standards.
- The contractor shall use modern machines and vehicles that fulfil environmental standards in terms of emission of harmful gases (complete combustion). He also shall use filters for reduction of emissions of soot particles, and fuel with favourable chemical structure (low sulphur content) and efficient/safe decantation.
- The contractor shall use modern machines and vehicles that have enclosed sources of noise (engines, exhaust system). This mainly implies supply of new machines or measures for installation of additional sound insulation, as well as its constant maintenance. In addition, it is recommended that machines should only operate in the period from 07-20 h in all sections of the route whose distance from nearest residential houses is less than 60 m).
- The contractor shall use biodegradable lubricants and gear oils. Maintenance, filling and cleaning of machines must be carried out off the site and outside of the area with surface water.
- Contractor shall specify and follow the control measures for dust generated through handling of equipment and/or during rehabilitation works. Contractor must submit the plan in which the above proposed paths for transport of material have been listed, and he also needs to give statements about proposed method of dust control in places where transport through settlements may not be avoided.
- Develop a project of construction site organization with the appropriate solutions of drainage and treatment of sanitary wastewater as well as storm water from the construction site zone. Receive used water from the construction site by appropriate systems sewage, collect in waterproof tanks and treat in the prescribed manner (whether on-site, or at the remote location), and prior to discharge into the recipient or the city sewage system.
- Contractor shall ensure that machines and vehicles parking places and worker's residence containers are not located inside the forest areas, that they do not impact watercourses and do not affect endangered flora and fauna.
- Contractor shall ensure protection of areas sensitive to erosion with stabilization agents (temporary banks, fences, ditches) and replanting after termination of construction works.

Execution of construction works

- In order not to endanger land stability, in the unstable or conditionally stable terrains, construction works shall be carried out in shorter intervals.
- During earthworks, humus layer shall be deposited in piles no more than 2 m high and be protected from pollution to maintain its fertility.
- In order to reduce negative impacts on the river and river banks to the minimum, activities on construction located in or near the surface water bodies, should be carried out during the low water season, which is most often in the period from



July to September. It is recommended to take this into account during preparation of timetable of activities.

- All manipulations with oil and its derivatives in the process of construction and supply of machinery, shall be performed with maximum protection measures to avoid spills. All packaging for oil and other oil derivatives must be collected and carried away on controlled landfill of contractor from where it will be carried away by the authorized municipal enterprise. In the case of accidents, spills of fuel or lubricants in the environment, urgent intervention in accordance with the Procedures for the discharge of fuel and lubricants is required.
- Machines and vehicles shall not be washed in the area of work.
- Wastewater from worker's toilets shall not be discharged on land or in the water streams.
- Waste shall be managed in accordance with Waste Management Plan (details given below).
- Deposition of excavated material and any other solid waste in water bodies shall be forbidden.
- Driving of machines inside the rivers, streams, or on their banks should not be allowed except in situations when that cannot be avoided due to construction of some special structure.
- Bottoms of the river beds shall be protected and shall not be completely blocked during trenching in order to protect the existing water-corridors for unobstructed communication between the original species living at the bottom and those freely swimming. Further natural restoration of existing banks should be ensured through planting of damaged areas with adequate vegetation.
- Contractor shall implement adequate traffic control measures, in accordance with the law, during contract period, and such measures must first be approved by the Supervision Engineer. Traffic safety management measures shall include temporary illumination and adequate signalization during trenching and rehabilitation works.
- Contractor needs to appoint permanent staff that would be engaged on traffic safety issues, and would be responsible for implementation of traffic safety measures and implementation of traffic measures as prescribed by the national laws, which would include: (i) inspection of the condition and position of the equipment for traffic control in use; (ii) design review – part related to traffic control equipment necessary to provide safe and efficient traffic flow; (iii) correction of all traffic deficiencies where that is applicable; (iv) inspection of work areas, handling of equipment and storage, handling of material and storage related to traffic safety.
- The contractor shall not leave trenches unattended and shall fence and signalize all open trenches to prevent accidents.

Organization of construction site after completion of works

- The contractor shall also remove all special objects and sites that are used to support construction including temporary buildings and their foundations, temporary installations (electric power, water, sewage) and equipment (sedimentation tank,) reinstating of temporary roads (especially in the forest area and on private properties) and the working plateaus, removal of fences, signs and notices.
- Contractor shall remove all construction waste.



- All construction areas and other influential areas during construction shall be reinstated depending on future use of land.
- Reinstating activities shall start immediately after the pipe is buried.
- Construction area shall be seeded with species preserved in topsoil and supplemented by adequate material if needed.
- Agricultural areas shall be returned to a state fit for landowners to re-plant their own seed crops.
- Chlorine solution used to disinfect pipeline system shall not be discharged to surface waters. It shall be stored in a tank until dissolution of chlorine is obtained and residual chlorine measures maximum 0.5 mg/l.

Waste Management Plan to be made as an inseparable part of the contract should contain the following:

Clarification of terms

- "waste" shall mean any substance or object which the holder discards or intends or is required to discard; according to the one of the categories mentioned in the list of waste established in *Rulebook on Waste Categories with Lists (Official Gazette of FBiH, no. 09/05)*
- "municipal waste" – is the waste from households and other waste, which by its nature or composition is similar to waste from households
- "hazardous waste" – is any waste that is determined by a special regulation and which has one or more features that caused danger to human health and the environment by its origin, composition or concentration, as well as the waste mentioned in the list as hazardous waste and regulated by an implementing regulation;
- "non-hazardous waste" – is the waste that is not defined as "hazardous waste";
- "inert waste" – is the waste that does not undergo any significant physical, chemical or biological transformations. It does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. Its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater;
- "holder" shall mean the producer of the waste or the natural or legal person who is in possession of it;
- "producer" shall mean anyone whose activities produce waste ("original producer") and/or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of this waste;
- "disposer" – is any person that delivers the waste or dispose such waste
- "operator" means the natural or legal persons empowered to carry out waste management;
- "Waste management" - means a system of activities and actions related to waste, including the prevention of waste generation, reducing waste quantity and its hazardous characteristics, waste treatment, planning and control activities and processes of waste management, waste transport, establishment, operation, closure and maintenance devices for the treatment of waste after the closure, monitoring, consulting and training related to business practices and waste management activities.

Waste categories



No.	Group	Code of waste
NON-HAZARDOUS WASTE		
1	MIXED MUNICIPAL WASTE	
1.1	Mixed municipal waste	20 03 01
1.2	Paper and cardboard	20 01 01
1.3	Plastic	20 01 39
1.4	Wood waste	20 01 38
2.	TIRES	
2.1.	Worn tires	16 01 03
3.	IRON	
3.1.	Scrapings and chippings that contain iron	12 01 01
3.2.	Scrapings and chippings of ferrous metal	12 01 03
3.3.	Iron and steel	17 04 05
4.	MIXED CONSTRUCTION WASTE (RUINS)	
4.1.	Concrete	17 01 01
4.2.	Bricks	17 02 02
4.3.	Tiles, Tiling / ceramics	17 01 03
	Mixtures of concrete, bricks and ceramic tiles that do not contain hazardous materials	17 01 07
4.4.	Wood, glass and plastic	17 02 01, 02 i 03
	Earth and stones, and excavated earth by excavator	17 05 04 and 06
4.5.	Insulating materials (Styrofoam)	17 06 04
HAZARDOUS WASTE *		
1.0	WASTE OILS, BITUMINOUS, SUBSTANCES CONTAINING OILS	
1.1	Bituminous mixtures containing tar	17 03 01*
1.2	Biodegradable hydraulic oil	13 01 12*
1.3	Machine oils	13 02 06* and 07*
1.4	Packaging which contains residues of hazardous substances or which are contaminated with harmful substances	15 01 10*
1.5	Lead battery	16 06 01*
1.6	Exploited absorbent (absorbent materials in case of oil and grease spillage, rags, protective clothing)	15 02 02*
1.7	Inorganic media for the protection of wood	03 02 04*
1.8	Waste from the application and removal of paints and varnishes	08 01 11*, 13*, 15*, 17*, 19* and 21*
1.9	Mixture of oil and grease from the oil / water separators	19 08 10*
1.10	Synthetic oil for the transfer of heat	13 03 09*

Methods of collection, storage and handling of waste

The goal of selective waste collection, storage and handling is to prevent the threat to human health and the environment, especially the discharge of harmful substances into the water and soil.



Collection and storage of waste will be organized within the technical base and in the area of mixing plant, and it is based on the basic principles of waste management:

- Principle of separate collection
- Prevention
- Recycling

Waste generated on construction site and in areas where administration is situated, will be collected selectively, or in separate containers in accordance with the classification of waste.

The basic principle to be followed is separation of hazardous from non-hazardous waste, then separation the construction waste from the other categories, as well as separation of waste which can be recycled.

Hazardous waste and its packaging shall be marked in accordance with the regulations which define labelling of dangerous goods. Hazardous waste should be collected and sorted by category as defined in the table above.

Waste oil shall be collected and stored separately. It is forbidden to discharge waste oil in surface and underground rivers, drains or soil, which also applies for substances which contain the mineral or synthetic oil.

Separately collected waste shall be stored on specially designated locations in adequate waster bins as follows:

1. Container for hazardous waste - mixed hazardous waste (15 01 10*, 16 06 01*, 15 02 02*, 08 01 11*, 13*, 15*, 17*, 19* and 21*, 03 02 04*)
2. Container for non-hazardous waste – mixed municipal waste (20 03 01)
3. Container for non-hazardous waste - mixed packaging waste which can be recycled (20 01 01 , 38 and 39)
4. Container for non-hazardous waste – mixed metal waste which can be recycled (12 01i 03 and 17 04 05)

Containers shall be manufactured for mentioned purposes so not to allow leakage of material. Each container must be appropriately marked.

Collected waste oils (13 02 06 * and 07 *) shall be stored in barrels or other suitable container that will prevent leakage. Servicing of vehicles shall take place exclusively in the service plateau away from watercourses and sensitive areas, where barrels for waste oil will be positioned.

For disposal of construction waste, the Contractor shall provide temporary and permanent location for the deposition along the route, in the area of construction and at special location.

Temporary landfill sites are required for deposition of humus, excavated materials, as well as for smaller amounts of buffer material and stone fractions. Contractor shall identify locations for permanent and temporary disposal, if necessary make landfill project, and obtain necessary permits.

All permanent landfills shall be reinstated to previous conditions with surplus of excavated humus.



Disposal of waste

Producer of waste shall selectively collect all waste and deliver to the operator i.e. to authorized companies for collection, transport and processing of waste in accordance with the *Law on Waste (Official Gazette of FB&H 33/03)*.

In the process of seeking the best offer, the producer will require proof from the bidder that he is registered for waste management in accordance with the relevant regulations.

The Contractor shall make Contract with selected company.

Record keeping

Producer of waste shall maintain records of type and quantities of waste he produces. The record includes the following information:

- data on produced waste and causes of its occurrence,
- waste storage,
- waste removal.

Producer shall prepare the record sheet for each waste shipment, in two copies, one copy for the operator and one for his own archives.

Record sheets of delivered waste should be kept in Constructors permanent office and copy at temporary locations for inspection.

Responsibility

The Contractor shall appoint Supervising Engineer for environmental, health and social issues who will be responsible for supervising waste management operations at construction site.

Procedure in case of fuel and lubricants leakage

Contractor shall ensure that no oil products, colours or other harmful substances get into water. Storage places for fuel, lubricating oils, chemicals and places for their handling will be located in safe areas, and they can, under no circumstances, be stored on unprotected soil. All waste oils and waste substances must be disposed of off the site, in cooperation with the institution authorised for waste management. Workers handling these substances must be specially trained. During rehabilitation, the contractor has full administrative and legal responsibility for pollution of all water bodies, according to existing regulations.

Contractor shall prepare the *Emergency Response Plan* in case of leaking of fuels and lubricants, which implies preparation of emergency cleaning programme, in case that leaking of fuel, oil, chemicals or other toxic substances occurs. Plan implies at least the following:

- Defining of emergency response teams in case of leaks, with clearly defined duties and responsibilities;
- Training of the emergency response team members about prevention of leaks and measures for clean-up and handling of toxic substances;
- Establishment of the reporting process about leaks, which involves informing of competent authorities;
- Keeping and maintenance of equipment (absorption material, absorption pads, pumps, buckets, and tanks for collection, levers and ropes) for response in case of leaks in the project zone, based on the types of leaks that could possibly happen;



- Evaluation of places and operations with high potential for leaks, with documenting of characteristics and quantities of oils, fuels and chemicals used and stored, frequency of delivery, handling methods, closeness of surface watercourses;
- Identification of procedures for safe removal of polluted materials collected from the spill;
- Provision of compensation and return of costs;
- Procedure for informing of the public when there is a serious leak, and actions that must be taken in order to avoid risks for health and safety; and
- Implementation of relevant procedure in order to ensure that the contractors with whom the sub-contract has been concluded will accept the Emergency Response Plan and that transport of toxic materials will be registered with the project office.

6.2 Social impacts mitigation measures

The mitigation measures are categorised as:

- Mitigation measures prior to construction,
- Mitigation measures in the phase of construction,
- Mitigation measures in the phase of operation.

All mitigation measures are given in table below. It is not possible to give cost estimate for all mitigation measures prior to finalisation of Expropriation Study.



Table 73. Social impact mitigation measures

Phase	Issue	Vulnerable groups/affected persons	Action to be taken/ Mitigation measure	Responsibility	Cost (€)
Pre-construction	Land acquisition and economic displacement	Private land owners (households and business) as identified by the EBRD Census Report and the Expropriation Study	Land acquisition to be carried out in accordance with the Expropriation Study (FBiH Law on Expropriation) and Livelihood Restoration Framework (EBRD) that can be prepared together or as separate documents. Compensation for loss of assets at replacement cost will be provided, and resettlement activities will be implemented with appropriate disclosure of information, consultation and informed participation in line with EBRD requirements. Identified vulnerable individuals will be assisted by social workers and legal advisers to represent them and their best interests, if needed.	Public Regional Company Plava Voda	Preliminary assessment: 517,367 €
Construction	Restrictions on land-use	Private land owners	Adverse impacts on land-use to be compensated in cash, as defined by the FBiH Expropriation Law. Compensation for occupation of land is determined in the amount and in the manner prescribed by the Law on Expropriation for established lease, i.e. determined to equal the amount of market rent. Also reinstate construction site after completion of works to original condition in accordance with good working practices listed under Environmental Mitigation Measures.	Public Regional Company Plava Voda	Estimate not available
Operation	Prohibition of building construction on pipeline right-of-way				
Operation	Health impacts	Schools, child day-care centres, hospitals, nursery homes, special care centres, as well as all residents of concerned municipalities especially Novi Travnik and Busovaca	Project will have positive impact on health by providing significant number of public institutions and citizens with high quality water thus no specific mitigation measures are necessary. Prohibit any construction on pipeline right-of-way in order to eliminate possibility of pipe breakage that could lead to transported water pollution.	Public Regional Company Plava Voda	No cost
Operation	Potential increase of water tariffs	Recipients of the social welfare benefits, retired, and Roma people, as well as people who will not be willing to pay	Consider introducing subsidies for water at municipal or cantonal level. Continue with the Public budget subsidies for water utilities and cross-subsidies related to tariffs that are set lower for residential consumers than for other consumer	Public Regional Company Plava Voda	Estimate not available



Phase	Issue	Vulnerable groups/affected persons	Action to be taken/ Mitigation measure	Responsibility	Cost (€)
			categories. Monitor affordability and implement mechanisms for anchoring the Company given in the ESIA.		
Operation	Preservation of amenity values	Citizens of Travnik and tourists	Implement project "Restoration and urban planning of Plava Voda greater area" related to reconstruction of cultural historical areas in location of Plava Voda which includes measure to construct cascades, decrease of bed slope to decrease flow velocity downstream from "Plava Voda" spring. Implement other environmental mitigation measures serving to preserve environmental flow.	Public Regional Company Plava Voda	Will be available when ToR gets prepared
Operation	Workers health and safety	Workers of Public Regional Company Plava Voda	Wear protective clothing while handling chlorine	Public Regional Company Plava Voda	500 €



6.3 Monitoring plan

Monitoring plan relates to:

- monitoring of emissions from the site during construction,
- monitoring of implementation of mitigation measures,
- monitoring of environmental and social conditions after the project is put in use.

Monitoring of emissions from the construction site and state of environment in the construction zone is related to monitoring of noise, dust emissions, and water pollution in construction zones located nearby watercourse. This monitoring will be subcontracted to laboratories that are authorised for monitoring and supervised by Supervising Engineer for environmental, health and social appointed by the Contractor.

Monitoring of implementation of mitigation measures includes supervision of implementation of good working practices. The Supervising Engineer for environmental, health and social issues together with representative of Public Regional Company Plava Voda will be responsible for monitoring of mitigation measures.

In order to ensure that the whole life cycle of the project satisfies environmental, health and safety criteria, the Contractor shall, during the procedure for selection of suppliers, request from all potential candidates to submit valid environmental and operation permits. The monitoring of this requirement is to be carried out by civil engineering and environmental inspection.

Monitoring of environmental and social condition after the project is put in use includes mainly analysis of water quality at Plava Voda spring, monitoring of flow downstream from the water intake in order to ensure that environmental flow is satisfied, monitoring of fish population, and monitoring of workers safety. This monitoring will be responsibility of Regional Water Utility Plava Voda or selected subcontractor.



Table 74. Programme of monitoring emissions from construction site

Potential impact	Which parameters is to be monitored?	Where will the monitoring of parameters are performed?	How will the monitoring be performed?	When will the monitoring be performed?	Cost	Who will monitor?
Elevated levels of noise that cause disturbance for nearby residents	Noise level	Near the nearby house in affected settlements, especially in Nova Bila, Stara Bila, Kremenik and Krčevine, Katići, Janjići, Putovići, Pribilovići, Hrastova Glavica. Monitoring is to be extended to other settlements in case of complains as well as to any other sites prescribed by environmental permit.	In accordance with YUS U.J6.039	Dynamic of monitoring is to be adjusted to the dynamics of construction - conduct monitoring at the time when the work is performed in specific section. Monitoring is to be performed once in the period of intense works at corresponding sections	100€/measurement	Authorised laboratory/company
Impact on water course downstream from Plava Voda intake up to the confluence with Lasva river	Turbidity, total suspended matter, mineral oils, dissolved oxygen, temperature, pH, conductivity, nutrient (ammonia, nitrites, nitrates, total N, total P) and hydrobiological analyses of quantity and quality of zoobenthos and phytobenthos	100 m downstream from water intake construction site	Hydro-biological and standard physical-chemical methods used by authorised laboratories	Hydrobiological analyses should be carried out at least once in three months and other analyses at least once a month in the period of construction works	250 €/sample	Authorised laboratory/company
Pollution of water and land with oils and fats, increase of suspended solids in a watercourse, etc. due to inadequate storage of	Turbidity, total and volatile suspended solids, mineral oils	Upstream and downstream of sections where the works are performed at watercourses of interest (Plava Voda downstream of the intake, Lašva, Bila, Kozica and Bosna rivers) as well as any other site prescribed by environmental	Standard physical and chemical methods used by authorised laboratories	Dynamic of monitoring is to be adjusted to the dynamics of construction - conduct monitoring at the time when the work is performed in specific section. Monitoring is to be performed soon after	250€/sample	Authorised laboratory/company



Potential impact	Which parameters is to be monitored?	Where will the monitoring of parameters are performed?	How will the monitoring be performed?	When will the monitoring be performed?	Cost	Who will monitor?
materials, disposal of waste, construction near or inside the river bed, and the like		permit.		the beginning of construction in specific section and after a complaint has been submitted		
Pollution from transport and earthworks dust	Control of vehicle coverage during the transport, control of the application of prevention measures to reduce dust-splash	Along the construction zone, especially in residential areas and near agricultural land	Visual monitoring	Daily	N/A	Supervising Engineer for environmental, health and social issues
Waste management	Waste type and quantity	Along the construction zone, especially in residential , at agricultural land and in forest areas	Visual and by measurement	Daily		Supervising Engineer for environmental, health and social issues



Table 75. Monitoring of implementation of environmental management provisions

Potential impact	Which parameters is to be monitored?	Where will the monitoring of parameters are performed?	How will the monitoring be performed?	When will the monitoring be performed?	Cost	Who will monitor?
Life cycle is not closed	Possession of valid approvals and permits for operation	For all suppliers of materials used during construction	Inspection of documentation provided by supplier in the selection procedure	During supplier selection procedure	Included in the monthly salary	Supervising Engineer for environmental, health and social issues
Water, air and soil pollution , increased noise levels	Compliance with good working practices from the Contract including supervision of emissions monitoring (compliance with the planned scope of tested parameters, sampling sites, sampling methods and frequency).	At all sections where works are performed	Visual inspection	Daily or unannounced inspection during construction works	Included in the monthly salary	Supervising Engineer for environmental, health and social issues, representative of Public Regional Company Plava Voda.
Waste management	Separate collection, transport, temporary storage and disposal of waste and other aspects defined by the Waste Management Plan.	At all sections where works are performed, especially temporary disposal sites and camps for workers	Visual inspection	Daily or unannounced inspection during construction works	Included in the monthly salary	Supervising Engineer for environmental, health and social issues, representative of Public Regional Company Plava Voda
Traffic regulation	Traffic regulation in accordance with the Agreement obtained from responsible road directorate	At the section along roads and at road crossings	Visual inspection and comparison with the Agreement	Daily monitoring at the time when the work is performed at specific crossing. Monitoring is to start soon after the beginning of construction in	Included in the monthly salary	Supervising Engineer for environmental, health and social issues



Potential impact	Which parameters is to be monitored?	Where will the monitoring of parameters are performed?	How will the monitoring be performed?	When will the monitoring be performed?	Cost	Who will monitor?
				specific section and finish when the section is completed.		
Impact on underground infrastructure	Execution of works in accordance with the Agreement obtained from responsible utilities/companies	At the section crossing underground installations	Visual inspection and comparison with the Agreement	Daily monitoring at the time when the work is performed at specific crossing. Monitoring is to start soon after the beginning of construction in specific section and finish when the section is completed.	Included in the monthly salary	Supervising Engineer for environmental, health and social issues
Staff safety during construction	Use of protection equipment, on-site work organization in accordance with regulations on safety at work	At all sections where works are performed	Visual inspection	Unannounced inspections during construction works	Included in the monthly salary	Supervising Engineer for environmental, health and social issues
Public safety	Signalisation, fencing of trenches and construction areas	At all sections where works are performed	Visual inspection	Unannounced inspections during construction works	Included in the monthly salary	Supervising Engineer for environmental, health and social issues
ROW reinstatement	Reinstatement of land and surrounding areas after completion of works in accordance with Reinstatement Plan	At all sections where works are performed	Visual inspection	Unannounced inspections during reinstatement works	Included in the monthly salary	Supervising Engineer for environmental, health and social issues
Preservation of amenity values	Construction of mild slopes and cascades	Downstream from "Plava Voda" water intake	Visual inspection	Prior to putting Regional Water Supply System in use	Included in the monthly salary	Supervising Engineer for environmental, health and social issues



Table 76. Monitoring of environmental and social conditions after the project is put in use

Potential impact	Which parameters is to be monitored?	Where will the monitoring of parameters be performed?	How will the monitoring be performed?	When will the monitoring be performed?	Cost	Who will monitor?
Decrease in drinking water quality at Plava Voda source	All parameters in accordance with Rulebook on Sanitary Conditions for Drinking Water (Official Gazette of B&H no. 40/10)	At Plava Voda spring and water discharge points intended for human consumption in all supplied municipalities: Travnik (Dolac-15 samples and Nova Bila 15 samples per year), Novi Travnik 15 samples per year, Vitez – 15 samples per year, Busovaca – 15 samples per year and Zenica – 94 samples per year ²⁵	Using standard methods for analysis	Plava voda spring: at least once per month. Water discharge points: At least once per month in each municipality. The final number of samples per month in each municipality should be determined respecting the total number of samples per year as indicated in column 3 (e.g. Dolac should choose on which months 2 samples should be taken to satisfy total of 15 samples/year).	500 €/sample	Authorised laboratory
Impact on ecosystem and amenity values due to the decrease in environmental flow	Flow in order to regulate abstracted water quality	Upstream and downstream from “Plava Voda” intake ²⁶	Measurement of flow by available methods	Daily	Included in the monthly salary	Engineer Responsible for managing water intake structure

²⁵ Number of sample is determined in accordance with Article 6 of Rulebook on Sanitary Conditions for Drinking Water (Official Gazette of B&H, no 40/10)

²⁶ At the same time, monitoring at Merdani gauging station should be continued by Water Agency for Sava river Watershed Area and data exchanged between two institutions.



Potential impact	Which parameters is to be monitored?	Where will the monitoring of parameters be performed?	How will the monitoring be performed?	When will the monitoring be performed?	Cost	Who will monitor?
Decrease in fish population in the Lašva River	Fish population	Along Lašva river downstream from convulsion with "Plava Voda"	Observation	During fishing season	N/A	Fisherman associations
Decreased affordability to pay for water	Affordability	Tracking data and trends on accounts receivable of municipal water utilities and monitoring of local economic data as proposed in the ESIA	Tracking data and trends	Continuous	Included in the monthly salary of water utility employees	Municipal water utilities in cooperation with Regional Company Plava Voda.



6.4 Monitoring affordability

The notion of affordability of water services is rather broad and covers economic and financial aspects, as well as social and political aspects. Water supply services are considered economically affordable if households can pay the water bill without a significant reduction of expenses for other essential goods and services. When analysing financial water affordability it is important to distinguish between a customer's ability to pay for services and customer's willingness to pay, which is also very much present in B&H. It should be noted that willingness to pay lies on the border between economic, social and political aspects.

As economic, social and political aspects tend to change over time which may have impact on rates and charges for water service, it is important to measure affordability of the customer bills. Monitoring of affordability will enable utility management and decision makers to be able to make informed decision regarding operating budgets, capital plans, rate structure and other important matters that affect the ability of the organization to fulfil its mission.

Recognizing that utilities in B&H are seldom equipped with the skills and other resources necessary to directly monitor and assess the affordability, the monitoring program proposed is to be based on several types of data that most utilities have available or can acquire easily.

The monitoring program should include:

- **Tracking data and trends on accounts receivable.** This data could include information on the amount of money owed for services billed and the "aging" of those billed amounts²⁷. This is indirect measure of affordability to the extent that a relatively large receivable balance or a rapidly increasing level of receivables suggests that customers are less able to pay. Similarly, if the balances past due are increasing with age, i.e., more time elapsed on average since the bill was issued, then this would be another indication that overall affordability is diminishing.
- **Monitoring of local economic data** available from various federal and municipal sources. Information on household incomes, unemployment rates, changes in the distribution of income and local business tax receipts can be useful in making inference regarding the affordability of water bills. The information obtained by monitoring of local economic data can be used to estimate e.g. the burden of payment for the family by calculating the share of water charges in the income of individual households or groups of households (deciles or quintiles, regions or cities, family types such as social security recipients), i.e. at the household level.

For any of the tracking methods, it is important to carefully evaluate the information. Because none of this data is precise measure of affordability, a review of the information and any related trends may assist in separating the effects of the utility bills from other possible causes of the observed trends.

²⁷ The aging of accounts receivables refers to the period of time that a bill has been unpaid after the bill was sent to the customer.



6.5 Feasible and achievable institutional covenants

The tariff model for the customers of Public Regional Company “Plava Voda (“the Company”) is still not developed, thus it is difficult to discuss about the affordability and achievable institutional covenants.

Generally speaking, the price of water supply and waste-water discharges in B&H is lower than economic price, and the sector is either subsidized by the entities, cantons or municipalities, or it suffers from insufficient maintenance that will jeopardize the water supply and wastewater systems in the long run. Illegal connections and inadequate systems for collecting the tariffs (low level of payment) are also adding to the problem of cost recovery. Due to the economic crisis and the poor service, there is, however, stiff resistance against increasing the tariffs.

On the other hand, water tariffs in B&H are subject to value added tax of 17%, which makes them less affordable to poor segments of the society. Many experts believe that water supply provides a social service and could be subject to a reduced VAT rate. Many European countries apply this measure to keep residential tariffs down. For example, Great Britain, Finland, and Switzerland exempt water services to residential customers from the VAT, while Belgium, Spain, France, Portugal, and Czech Republic tax these services at a lower rate (5% to 7%)²⁸. However, reduction in value added tax in B&H is subject to a wider economic reform and is not feasible to expect it will be implemented in near future.

Currently available subsidy schemes in B&H are:

- Public budget subsidies for water utilities;
- Cross-subsidies imply that communal service tariffs for residential consumers are set at a lower level than for other consumer categories.

It would be fair to expect that the currently available subsidy schemes will not be abolished and will be used in future as well unless the Company and municipalities make decision to introduce economic price for regional water supply based on the preliminary surveys on affordability and willingness to pay.

The step forward would be to work on improving cost recovery methods and decrease dependence on subsidies. This can be done by introduction of adequate accounting system and efficient billing and collection from the start of the Company’s operation in order to prevent occurrence of unaccounted for water as well as to constantly work on reduction of losses. All consumers should have water meters installed and the Company, together with municipal water utility companies, should continuously work on network maintenance and rehabilitation to avoid increased operational costs (e.g. pumping costs). The liaison with communities served should be established in order to provide them with regular and up-to-date information on quality of drinking water. Community programs that will initiate water conservation in everyday activities should be promoted. All this would in turn assure quality of services to their customers and possibly increase willingness to pay.

Proposed monitoring program should be immediately put in place in order to enable periodic review of tariff, with possible updating as conditions change.

²⁸ KEY ISSUES AND RECOMMENDATIONS FOR CONSUMER PROTECTION: Affordability, Social Protection, and Public Participation in Urban Water Sector Reform in Eastern Europe, Caucasus and Central Asia, OECD 2003



6.6 Mechanisms for anchoring the Company into society

Social acceptability is at the heart of success of every intervention. The Company activities must be visible to the community members. The recommended mechanisms are:

- Sending monthly information on drinking water quality stapled to water bills,
- Creating the “call center” that will provide information on work of the Company and its services,
- Setting up the web site with real time data on water quality and status of delivered water, as well as all other relevant information on the work of the Company and quality of services delivered,
- Presence in communities with community based programs, e.g. in schools aimed at water conservation, and alike,
- Formation of user groups and regular consultations, with meaningful participation of community stakeholders for each capital activity related to operation of the Company and delivery of services.

User group members should be formed in each municipality served and should include at least:

- Representatives from each Municipality,
- Representatives of all local communities (“mjesna zajednica”) at the territory of each municipality,
- Representatives of business sector (both large and small to medium enterprises),
- Representatives of education sector,
- Representatives of environmental and other social NGOs,
- Representatives of retired community members.

The care should be taken to satisfy gender equality and include poor and other marginalized groups.

The role of user group would be to act as a link between local communities and the Company. They should be voice of the community that will negotiate any changes in policy, services or tariffs with the Company and on the other hand spread information about Company’s work to the community members, thus possibly increase the willingness to pay.

It is expected that these mechanisms will espouse ownership, accountability (on both the utility and customer sides), and transparency thus directly increase willingness to pay for the water delivery services.

6.7 Capacity building programs

The Regional Water Supply System Plava Voda will be the first regional supply system of this kind in B&H, serving several municipalities at the same time. The Company will face many challenges in gaining managerial skills required to adequately manage demand and supply and ensure cost recovery for their services. The Company, will need capacity building programs related to many issues including:

- Regional utility management – new approaches to service delivery (accessibility and affordability of service, quality of product and service, accountability for service, sustainability of services, etc.),
- Pro-poor Water Governance,
- Local economic development,
- Monitoring and assessment of affordability,
- Reduction of unaccounted for water,



- Establishment of liaison with communities including communication methodologies – pro-community orientation.

The “EC project” has foreseen capacity building program for the Company that includes:

- establishment of accounting systems in accordance with international standards;
- establishment of financial management and corporate planning;
- advise on the appropriate organizational and staffing structure of the Company;
- provide guidance to the Company to obtain all consents and permits necessary for the start of the construction works;
- propose the main provisions of the Off-take Agreements between the Company and related Utilities and content of the Project Support Agreement between the Bank and the related Municipalities.

It is recommended to include these issues in the foreseen program as well. The capacity building program for the Company at the same time means the capacity building for municipal authorities who will have their representatives in the Company. Other representative from Municipality can be included as well in this capacity building program.

Local communities are not used to be asked for their opinion by public companies so they may find themselves in position not to know how to respond to the invitation and to simply ignore all efforts by the Company. Thus, the capacity building program for concerned community members, especially members of users group, should be organized. Capacity building takes time and costs money but results in a more inclusive dialogue. The program should be focused on explaining public engagement processes and motivation of groups to wish to participate, but also on providing groups with skills and capabilities required to respond and become fully involved.



7 ALTERNATIVES

7.1 “No project” option

The project will strengthen drinking water supply in densely populated areas and help to improve the living conditions of urban population. Recognizing that Zenica and Vitez are also industrial areas, the project will also ensure sufficient quantities of water to industrial enterprises as well.

Securing additional water sources to five municipalities will have short and long term positive impact on (i) improving hygiene and health conditions by providing high quality water to their consumers, (ii) bringing relief to the current pressure on existing wells and reduce the waiting period for supply during peak hours or the summer months; (iii) extending water supply without restriction and/or cuts to new connections (surrounding villages, residential buildings under construction, future industrial consumers); (iv) maintaining the economic momentum.

In the long-term, the “no-project” scenario might lead to a social and economic crisis in the area.

7.2 Alternative routes

In the area of Lašva valley (from Travnik Municipality to the confluence of the Lašva and Bosna River), in addition to construction of the “Plava Voda” regional water supply system, the implementation of two more large infrastructure projects have been planned: construction of the high-speed road and gas pipeline. Considering that this is a relatively narrow area, and that water supply pipeline route should be as close to the residential areas as possible, in the Preliminary Design phase of regional water supply system project implementation, the routes of the above mentioned infrastructure were analysed. In addition to the high-speed road and gas pipeline, within the Preliminary Design phase, the route of the Plava Voda regional water supply system designed in 1991 was also analysed.

The route of the gas pipeline and route of the regional water supply system from 1991 were analysed with purpose to select one of those routes as most favourable route alternative for regional water supply system, including the route of the regional water supply system designed during this project (“route from 2009”).

In the period of development of the concept of regional water supply system, the Preliminary Design of the high-speed road was developed, for the area from the “Lašvanska” intersection to the Vitez Municipality. Detailed Design for the area of Vitez Municipality, and Preliminary Design for the section Vitez-Donji Vakuf (Novi Travnik and Travnik Municipalities). The route of the high-speed road designed in the abovementioned documents was still considered as “preferred route”, with possibility of additional changes and supplements. Afterwards, the feasibility study that provided the techno-economic analysis and proposals of solutions for disputable sections within the „preferred” route was developed (Figure 18).

Considering that, in the period of development of regional water supply system concept, the route of the high-speed road was still not definitely adopted, it has not been considered from the aspect of placing the regional water supply system along it (in its safety zone or outside



of it, but parallel to the route of the high-speed road). Every connection to the route of the high-speed road, in terms of following it, was unrealistic and uncertain, as in that case with every change on this route, it would be necessary to change the route of the “Plava Voda” regional water supply system.

After analysis of the situation relating to the route of the high-speed road, in the phase of development of the concept of regional water supply system, it was concluded that it is necessary to carry out the analysis of the “preferred” route of the high-speed road, from the aspect of its position in space, and with objective to avoid possible spatial conflicts with selected new route of the main regional water supply system (avoiding placement of the route of the regional water supply system in the high-speed road base, through the future tunnels etc.)



Figure 18. Analysed routes for selection of the main transport pipeline of the Plava Voda regional water supply system



Table below gives a brief overview of advantages and disadvantages of the analysed alternatives.

Table 77. Advantages and disadvantages of analysed alternatives

Route alternative	Advantages	Disadvantages
Route of the gas trunk pipeline	Savings in earth works and expropriation	<ul style="list-style-type: none"> The gravitational water supply from the "Plava Voda" spring to the "Putovići" water tank is not possible Expensive construction – frequent changes in the level gradient, and level bends Impossibility to plan concurrent construction of both systems (water and gas) – uncertainty in terms of the date when the construction works may begin
Route of the regional water supply system from 1991	<ul style="list-style-type: none"> Gravitational water supply from the "Plava Voda" spring to the "Putovići" water tank is possible There are basic elements of the detailed design that could be used 	<ul style="list-style-type: none"> The construction will require a complete halt of or slow traffic on a very frequent road Difficult access and work conditions for machines In some parts of Travnik and Vitez Municipality, buildings were constructed on the route
		<ul style="list-style-type: none"> On certain sections, during construction, it is necessary to remove the asphalt from the M5 trunk road
Route of the regional water supply system from 2009	<ul style="list-style-type: none"> Gravitational water supply from the "Plava Voda" spring to the "Putovići" water tank is possible There are no structures on the route – the 	<ul style="list-style-type: none"> Difficult construction in narrow parts of abandoned railroad (Busovača Municipality) – difficult access for machines and disposal of material



Route alternative	Advantages	Disadvantages
	<p>constructed and inhabited parts are bypassed</p> <ul style="list-style-type: none">• In the part of the Lašva River valley, the asphalted areas were avoided• The expropriation process is reduced to a minimum (approx. 89% of the alignment is located on public areas)	

Taking into account the previous analyses of the route of trunk gas pipeline and its overall length of 41 km, it was assessed that the capital costs of the regional water supply system that would be placed along the same gas route, based on the unit prices (price /meter of pipes), and costs of construction of pumping stations for regional water supply system, would be significantly larger than the capital costs of regional systems that would extend along the routes from 1991 and 2009.

Considering that the route from 1991 is for approx. 368 m longer than the route from 2009, which is a small difference in relation to the overall length of the route (approx. 1%), the difference in capital costs for the route from 1991 and proposed route from 2009, based on unit prices (price/meter of pipe) proved to be irrelevant for making of the decision on selection of more favourable route. In addition to this small difference in length of the transport pipeline, which determines the capital costs, the analysis showed that there is no significant difference in the levels of these two routes that would cause larger difference in pressures in transport pipelines, and that the nominal pressures along both pipelines would almost be the same, which means that the costs would also be the same (price/ meter of pipe).

In addition to the analysis of capital costs based on unit prices of pipes, the analysis of shares of public and private property was made (expressed in meters of pipe) on the routes from 1991 and route from 2009. For the route from 1991, the data on total length of the route in Vitez Municipality was available (11.937 m), but not the data on shares of public and private property within this part of the route. For other municipalities, all necessary data was available. Results of analysis are provided in the table below.

Results of analysis have shown that the route from 2009 has smaller share of private property than the route from 1991, which is an advantage from the aspect of expropriation process and most probably from the aspect of capital costs of construction of regional water supply system.



Table 78. Analysis of shares of public and private property within the routes from 1991 and 2009 (without branches)

	Route of the main transport pipeline from 1991	Route of the main transport pipeline from 2009
Total length of the main route	33 323 (21 386*)	32 955
Public property (m)		
Travnik	7 805 (36.5%)	7 717 (23.2%)
Vitez	-	8 418 (25.6 %)
Busovača	1 913 (8.9%)	7 722 (23.5%)
Zenica	6 134 (28.8%)	5 508 (16.7 %)
Share of public property in the overall length of the route (%)	74.2 %	89 %
Private property (m)		
Travnik	562 (2.6 %)	484 (1.5%)
Vitez	-	2 471 (7.6 %)
Busovača	3 534 (16.5 %)	0 (0%)
Zenica	1 438 (6.7 %)	635 (1.9%)
Share of private property in the overall length of the route (%)	25.8 %	11 %

* Overall length of the route of main transport pipeline from 1991, from which the length of the route in Vitez Municipality was deducted

The abovementioned considerations and analysis of the three routes were presented to all municipalities participating in the Project, and the following conclusions were made:

- The route of the gas pipeline was assessed as unfavourable, as it does not provide for gravitational water supply from the Plava Voda spring to the “Putovići” water tank.
- The route of the regional water supply system from 1991 was assessed as unfavourable, especially because of necessary traffic interruptions on the existing M5 trunk road, during construction, and because of the newly constructed buildings along the M5 trunk road, process of expropriation and increased expenses of construction.

Based on the above, the proposed route from 2009 was selected as most favourable alternative.

In relation to the “preferred” route of the high-speed road, the selected route is close to this route only in the Busovača area. Taking into account the “preferred” route of the high-speed road, care was taken that the selected route of the regional water supply system is not passing through the road base or the planned tunnels. In 7 locations, the route of the regional water supply system is crossing the “preferred route” of the high-speed road, and in 3 sections (total length of 255 m), it is passing through the safety zone of the road. It is expected that in the phase of detailed design of “Plava Voda” regional water supply system, the route of the high-speed road will be finally defined, when it will be possible to make detailed comparison between the routes of these two large infrastructure projects on the territory of Busovača Municipality.



8 DIFFICULTIES DURING PREPARATION OF THIS PROJECT

During the preparation of this project the only difficulty project team has faced was scarcity of all type of data required to adequately describe environmental and social baseline conditions. The consultant has based its research mainly of physical plans of the area as well as data from Preliminary Design.

On of the limits to the assessment was the fact that main infrastructure project for gas pipeline Zenica-Travnik and highway on corridor Vc were still under development so that consensus on mutual alignment of these project is still not reached among the relevant institutions.



9 LAND ACQUISITION ISSUES

9.1 Legal framework for expropriation in FBiH

Expropriation is the dispossession or limitation of the ownership rights over the property for certain compensation, depending on the current market value of the property concerned. Conditions, manner and the procedure for expropriation of structures of public interest in the Federation of Bosnia and Herzegovina are regulated by the *Law on Expropriation (Official Gazette of the Federation of B&H, no. 70/7 of 1 October 2007)* and *Law on Amendments and Supplements to the Law on Expropriation (Official Gazette of the Federation of B&H, no. 36/10 of 16 June 2010)*.

According to the Law on Expropriation, the property may be expropriated in case of construction of a structure of public interest, as well as in cases when it is necessary to expropriate it due to execution of other works of public interest.

Expropriation may be carried out for the needs of the Federation of Bosnia and Herzegovina, canton, city, municipality, public companies and public institutions, which are all called expropriators. In special cases, the expropriation may define servitude for the benefit of the citizens, for purpose of installation of water supply pipes and sewers, electrical and telephone cables, gas pipelines and similar activities that are considered to be of public interest.

There are two basic types of expropriation:

- **Complete expropriation** where, after expropriation, all rights of the earlier owner over the concerned property are repealed, while the expropriation includes all structures located on the expropriated land,
- **Incomplete expropriation** which may define the right of servitude over certain property (land or building) which has no time limit as well as the lease of land for a limited period of time, but not longer than five years (for the purpose of e.g. extraction of sand, gravel, stone, research of mining deposits, etc.)

According to the Article 9 of Law on Expropriation, for some property, temporary occupation of land may be allowed for purpose of execution of preparatory activities for purpose of expropriation. This property may be used for accommodation of staff, machines, material, but not longer than one year.

For completely as well as for incompletely expropriated or for temporary occupied piece of property, the owner shall receive compensation in some other piece of property, and if the expropriator is not able to provide such piece of property, then the financial compensation shall be provided in the amount equal to the market value of the piece of property expropriated.

9.2 Other FBiH legislation relevant for expropriation

Land tenure and property rights²⁹ are regulated in following laws:

²⁹Information given in this chapter are taken from project "CAPACITY BUILDING FOR RESETTLEMENT IN RELATION TO TRANSPORT PROJECTS IN THE WESTERN BALKANS, JANUARY 2011 - Legal Analyses and Capacity Building Programme"



- FBiH Law on Land Registries (Official Gazette of FBiH 19/03, 54/04)
- FBiH Law on Construction Land (Official Gazette of FBiH 25/03, 16/04, 67/05)
- FBiH Law on Spatial Planning and Land Use (Official Gazette of FBiH 2/06, 72/07, 32/08)
- FBiH Law on Property Relations (Official Gazette of FBiH 6/98)

Land tenure and property rights in BiH, including the FBiH are influenced by two main factors – i) transition from socialism to capitalism and ii) the war during the 1990s, as a result of which many people became refugees or IDPs.

Property rights, which people have been deprived of in the course of the war, had to be restored or compensated for in cases where they could not be restored. The EC Enlargement Strategy Progress Report for 2010 for BiH states that the vast majority of cases of property repossession requests have been resolved.

The same report also states that property registers (land books and the Cadastre) remain largely unreliable. BiH is implementing reforms for the alignment of information on property rights recorded in land books and the Cadastre, however the progress is still slow. In some cases this also slows down expropriation procedures, as all outstanding issues regarding property registration have to be resolved before expropriation can be executed. Currently in both entities properties are registered under laws on land registries. FBiH is expected to pass a new law on land surveying and cadastre, while the RS has already done so.

As with other countries in the region BiH, including the FBiH is struggling with informal construction. The Law on Construction Land of FBiH enables legalisation of structures informally constructed on state owned land, for which construction permits can be issued retroactively by the municipal council, in line with the Law on Spatial Planning. The legalisation process is further regulated by cantonal decrees. The Law on Property Relations enables acquiring property rights over land and/or structures erected on someone else's land.

Important articles relevant for the protection of rights of vulnerable groups are to be found in Law on Social Protection, Protection of Civilian War Casualties and Protection of Families with Children (Official Gazette of FBiH 36/99, 54/04 and 39/06)

According to the Law on Social Protection, Protection of Civilian War Casualties and Protection of Families with Children (36/99, 54/04, 39/06), vulnerable citizens have the right to one-off financial payments if they find themselves in a situation of sudden and temporary need. One of these situations is listed as "forced migration". Citizens of FBiH are entitled to various forms of social welfare payments and some social welfare services, which are still largely underdeveloped.

FBiH currently has no law on social housing, however certain pilot projects are being implemented with donor assistance.

FBiH has a set of laws under which vulnerable groups can be assisted to improve their living standards (health, education, employment, etc.) and these laws should be used as a basis for developing resettlement programmes for vulnerable groups.

9.3 FBiH expropriation procedure

The expropriation procedure begins with filing of the Proposal for Determination of Public Interest. The future expropriator files this Proposal, as follows:



- to the Government of the Federation of Bosnia and Herzegovina, through the Federal Administrative Body, if the planned structure is located on the territory of two or several Cantons, and the corresponding decision is made in accordance with spatial planning documents of the Federation of B&H;
- to the Government of the Canton, through the Cantonal Administrative Body, if the planned structure is located on the territory of two or several municipalities within the same canton, and corresponding Decision is made upon reception of the formal opinion of Municipal Councils of respective municipalities;
- to the Municipal Council, through the municipal department for property and legal affairs, if the planned structure is located on the territory of one Municipality only, and decision is made in accordance with the spatial planning documents of the concerned municipality.

With the Proposal for Determination of Public Interest, the Expropriation Study must also be submitted, which contains the geodetic and cadastre plan of the expropriation area, data on the property for which determination of public interest is proposed, assessment of the property value, purpose of expropriation and other data necessary for determination of public interest.

After determination of public interest, future expropriator files the Proposal for Expropriation. The adoption of Proposal for Expropriation is precondition for municipality to enact the Decision on Expropriation. If the public interest has been determined by the Decision of the Government of the Federation of B&H, government of some canton or municipal council, the Proposal for Expropriation may be filed within two years as of the day when Decision on Public Interest was made. Expropriator may file the Proposal for Expropriation, after the public interest for construction of the structure or execution of works has been determined.

In case of disagreement between the land registry and state of the facts in the field, the expropriator shall, by means of public announcement, before filing of the Proposal for Expropriation, invite all property owners, in order to procure the necessary property without any dispute.

Upon the adoption of the Proposal, the responsible department of the municipality on the territory on which the concerned property is located, and for which the expropriation is proposed, shall enact the Decision on Expropriation. It is possible to file an appeal against this decision. The body responsible for appeals is the Federal Agency for Geodetic and Property-Legal Affairs.

The expropriator gains the ownership right for the concerned piece of property on the day of entry into force of the Decision on Expropriation if the earlier owner has been paid the compensation for the concerned property or given some other appropriate piece of property. In case of the opposite, the expropriator shall gain the ownership right on the day when the compensation has been paid, or after the earlier owner gains ownership rights over some other appropriate piece of property, unless he and user of the property agree differently.

Temporary occupation of land necessary for building of some structure or execution of works of public interest on some other piece of land may be requested by the Proposal for Expropriation or by special proposal. In the proposal for temporary occupation of land, the following must be indicated: purpose for which the temporary occupation of land is proposed, property that will be temporarily occupied, owner of the property and duration of temporary occupation. Temporary occupation shall be repealed as soon as there is no longer the need for that, and until the end of works on the main structure at the latest. The municipal Administrative department enacts the Decision on Temporary Occupation of the Land. It is possible to file an appeal against this decision. The body responsible for appeals is the Federal Agency for Geodetic and Property-Legal Affairs.



The expropriator shall pay costs of the expropriation procedure.

According to the Law on Expropriation, the value of compensation is defined according to different criteria. The basic condition for defining of the value of expropriated property is the market value of property expropriated.

Compensation for expropriated property (Article 45- 55 of Law on Expropriation) is generally in form of other appropriate piece of property that corresponds to the market value of the expropriated property in the same municipality or town. In this way, the owner of the property has similar conditions of use as those he had on the expropriated property.

In case of illegally constructed buildings, the owner has no right to compensation.

The owner may bring down the building and remove the material from the site until the deadline defined by the municipal Administrative department. On the contrary, the removal of the building shall be done and the owner will bear all the costs.

In case that the owner of the expropriated property does not accept other appropriate piece of property as a form of compensation, or if the expropriator may not provide the piece of property requested, the compensation shall be given in money, in the amount of market value of the concerned piece of property.

The market value is expressed in the price relevant for the area where expropriation is performed, and which may be achieved for a certain piece of property on the market, which depends on the relationship between supply and demand at the time when the value of the property was determined.

Personal and family circumstances of the earlier property owner shall be taken into account as the factor of increase of the defined compensation, if those circumstances are important for the material existence of the earlier owner, especially if, due to expropriation of a larger part or entire piece of land or business premises in which earlier owner was performing allowed business activities, his material existence is now questionable, as well as in case when due to expropriation the members of a family living on a farm have to move from the area where they used to reside.

Compensation for expropriated land covered by orchard is defined on the basis of the amount that would be given for the closest meadow in the same position, while the amount of compensation for the land covered by vineyard and orchard with intensive growing is defined on the basis of the amount that would be given for the closest piece of arable land in the same position. The compensation is also defined for the trees located on the expropriated land.

In addition to the above mentioned compensations for fruit trees and vine, the compensation is also defined for technical tree in accordance with the standards for giving of compensation for the forest tree, unless the earlier owner keeps the cut trees for himself. For the expropriated land located within a forest, the amount of compensation is defined on the basis of amount that would be given for the closest pasture in the same position. The compensation for the wood mass (ripe or almost ripe forest) is defined on the basis of the value of wood in logs determined in accordance with the price system. The amount of compensation is also defined for trees that have not reached the technical ripeness, i.e. for young seedlings and other older trees.

For the land used as agricultural, urban-construction and construction land, the amount of compensation in money is defined in accordance with the market value of such land, while the compensation for unfertile land, rocky land and the like, is defined in the amount that would be given for the pasture of the lowest class in the same cadastre municipality.



If until the transfer of ownership to the expropriator the earlier owner was not able to harvest the yield and pick the fruits, he shall receive the compensation for crops after deduction of necessary costs that he would have during harvest.

In case of incomplete expropriation (Article 56 and 57 of Law on Expropriation). The compensation can be paid as a lump sum for the whole period of lease or in several instalments paid at regular intervals. The compensation is calculated from the day when expropriator occupies the land. The expropriator is responsible for any damage to the landowner according to the general regulations on damage responsibility.

Compensation for temporary occupation of land (Article 58 of Law on Expropriation) is defined in the amount and manner defined in case of incomplete expropriation.

Upon the legal validity of the Decision on Expropriation, the municipal Administrative department shall, with no delay, schedule discussion for purpose of reaching an agreement about the compensation for expropriated property. The agreement on compensation for expropriated property must contain the form and the amount of compensation, as well as the deadline until which the expropriator must fulfil his obligations in terms of compensation.

If the agreement about compensation is not reached within two months as of the day of entry into force of the Decision on Expropriation, the municipal Administrative department shall, with no delay, send the abovementioned Decision with all relevant documents to the competent court in the jurisdiction of which the expropriated property is located, for purpose of defining of compensation. The competent court shall, in its line of duty, in extra-judicial proceedings, decide on the amount of compensation for the expropriated property.

Costs of the procedure for defining of the compensation shall be borne by the expropriator. These costs are defined by the court, depending on the success of the parties involved in the procedure.

Upon the legal validity of the Decision on Expropriation, all mortgages, leases, personal servitudes, or all real mortgage and similar activities, shall cease, except for the real servitudes that shall continue after the purpose of expropriation has been fulfilled.

Registration of the ownership and other real rights over the expropriated property as well as over the property given as a compensation to the earlier owner shall be done on the basis of the legally valid Decision on Expropriation and proofs about the paid compensation, if the Decision above defined the compensation in money, i.e. on the basis of proof on gaining of the ownership of earlier owner over some other appropriate piece of property upon the request of expropriator or earlier property owner.

9.4 EBRD expropriation procedures

The EBRD expropriation rules are addressed by *Performance requirement (PR) 5 Land Acquisition, Involuntary Resettlement and Economic Displacement* of the 2008 Environmental and Social Policy. The key rules can be summarised as follows:

- Feasible alternative project designs shall be considered to avoid or at least minimise physical and/or economic displacement;
- Negotiated settlements are encouraged to acquire land rights wherever possible, **even if there are legal means to gain access to the land without the seller's consent;**
- Adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to land should be mitigated by: (i) providing compensation (in cash or replacement property) **for loss of assets or access to**



- assets** at full replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- In cases where land acquisition affects commercial structures, the affected business owner should be compensated for (i) the cost of re-establishing commercial activity elsewhere, (ii) lost net income during the period of transition, and (iii) cost of the transfer and reinstallation of the plant, machinery and other equipment, as applicable.
 - Economically displaced persons who are **without legally recognisable claims** to land should be compensated for lost assets (such as crops, irrigation infrastructure and other improvement made to the land) other than land, at full replacement cost.
 - The livelihoods and standards of living of displaced persons should be improved or, at a minimum, restored to pre-project levels;
 - All persons affected by physical and economic displacement will be entitled to moving allowance. In addition, vulnerable individuals / families are entitled to specific resettlement assistance;
 - Affected persons shall be given the opportunity to participate in the negotiation of the compensation package. The consultation should continue during the implementation, monitoring, and evaluation of compensation payment;
 - The grievance mechanisms are to be established in accordance with PR 10, as early as possible in the process, to receive and address in a timely fashion specific concern about compensation.
 - Where project involves the loss of public amenities, the client shall undertake meaningful consultation in accordance with PR 10 with the locally affected community to identify and agree upon a suitable alternative where possible.

9.5 Gap analysis and proposed response

The detailed gap analysis is given in the Appendix 7. The key points that should be taken into account while implementing expropriation procedure in FBiH:

1. Development of resettlement/livelihood restoration plans (RAP/LRF) and implementation of census/socio-economic survey.

FBiH legislation does not require development of resettlement/livelihood restoration plans and implementation of socio-economic survey. Law on Expropriation requires development of Expropriation Study which contains only census of properties for which determination of public interest is proposed as well as information about geodetic and cadastre plan of the expropriation area, assessment of the property value, purpose of expropriation and other data necessary for determination of public interest. For the purpose of this project, the LRF and census/socio economic survey should be prepared and should include all requirements from PR 5.

2. Compensation and resettlement assistance for owners and occupants of land/residential structures without formal legal rights;

According to the Law on Expropriation, the owner of the property with formal legal rights is the only category entitled to compensation for loss. In order to satisfy EBRD rules, the LRF should address owners of the property without formal legal rights and provide them with appropriate rights to expropriation as defined by PR 5.

3. Livelihoods restoration assistance for economically displaced person without formal legal rights on business structures/physical assets;



According to the FBiH Law on Expropriation, only formal owner of a business structure is entitled to compensation for that structure (cash or replacement property) and for loss of income until he/she is able to restore business activities (Article 54 of the Law). In order to satisfy the EBRD rules, the LRF should address economically displaced person without formal legal rights on business structures/physical assets and provide them with appropriate rights to expropriation as defined by PR 5.

4. Other resettlement assistance, including specific assistance for vulnerable groups;

In order to satisfy the EBRD rules, all persons affected by physical and economic displacement will be entitled to moving allowance. In addition, vulnerable individuals / families will be entitled to specific resettlement assistance.

5. Provision of compensation at replacement value (market value plus any registration, administrative and transfer taxes).

Compensation for affected formal properties will be provided at replacement value, which is calculated as the market value of a property (defined by the FBiH Law on Expropriation) plus transaction costs which include any registration, administrative and transfer taxes (the EBRD requirement). Replacement value of informal properties will be calculated as the construction value of the properties (i.e. the cost of building materials, cost of construction works, etc.).

6. Information disclosure and public consultation with affected persons regardless of their legal right over the property

The Law on Expropriation does not require public consultation prior to expropriation. The Stakeholders Engagement Plan should be prepared and implemented.

7. In case of Loss of public amenities, undertake meaningful consultations with the locally affected community.

The Law on Expropriation requires consultation with property owners in case of disagreement between the land registry and factual state in the field in order to procure the necessary property without any dispute. No consultations are required in case of loss of public amenities. In order to satisfy the EBRD rules, the Stakeholders Engagement Plan should be prepared and implemented

9.6 Land acquisition issues related to “Plava Voda” system comparison of FBiH legislation and EBRD procedures

On its route, the regional supply system will pass through private and state owned land. The information on the need for land expropriation, obtained from the concerned five municipalities, together with estimation of expropriation costs, is presented in the following table. Approximately 79% of the pipeline by length will be built on public property.



Table 79. Expropriation estimates

	Length of corridor (m')							Total for exprop. (m ²)*	Cost estimate (KM)**
	Public land						Private (m')		
	Zone 1 (36 KM/m ²)	Zone 2 (30 KM/m ²)	Zone 3 (24 KM/m ²)	Zone 4 (18 KM/m ²)	Zone 5 (12 KM/m ²)	Zone 6 (6 KM/m ²)			
Travnik	404.34	1,855.3 6	6,771.01				1,332.4 1	10,363.1 2	280,688.04
	1	2	3	4	5	6	Private (m')	Total for exprop. (m ²)*	Cost estimate (KM)**
Novi Travnik				5,337.2 5			528.15	5865.4	90,357.68
	1 (18KM/ m ²)	2 (16.5KM /m ²)	3 (14.5KM /m ²)	4 (12KM/ m ²)	5 (9KM/ m ²)	6 (6KM/m ²)	Private (m')	Total for exprop. (m ²)*	Cost estimate (KM)**
Vitez	3,625	1,371	1,799	2,658		510	2,827	12,790	250,685.00
	1	2	3 (18KM/ m ²)	4 (18KM/ m ²)	5 (13.5KM /m ²)	6 (9KM/m ²)	Private (m')	Total for exprop. (m ²)*	Cost estimate (KM)**
Busovača			126	8,133.9 1			4,755.2 7	13,015.1 8	283,275.51
	All zones						Private (m')	Total for exprop. (m ²)*	Cost estimate (KM)**
Zenica	5,589						640	6,229	106,875.00
TOTAL	38,180						10,082. 83	48,262.7	
%	79%						21%	100	

*Total expropriation area is calculated by multiplying length of corridor (m') with 1 m' estimated trench width

**1 KM = 1,98553 EURO

If analysing this project in the light of the FBiH Law on Expropriation and EBRD rules, the following may be concluded:

- No resettlement or physical displacement or people will be required as the alternative project designs were considered to avoid physical displacement as well as tearing down of physical structures. The design team took into consideration all suggestions of municipal representatives proposed after the preliminary meetings with land owners;



- Having in mind that the route of the regional water supply system is partially passing through the privately owned land, it will be necessary to initiate the land expropriation procedure;
- Based on the preliminary survey, the concerned land can be categorised as agricultural lands (plough-fields, meadows, and orchards);
- For the purpose of placement of the main transport pipeline and its branches, it is necessary to carry out the **incomplete expropriation** of privately owned parcels that are located within the pipeline route;
- For the purposes of building of permanent structures such as pumping stations and water tanks, it is necessary to carry out complete expropriation of the privately owned parcels positioned in location of planned structures. It is to be noted that municipal representatives suggested locations for permanent structures. The Census Report reveals that no problems are expected with regard to expropriation;
- There is a possibility that it will be necessary to temporarily expropriate the land for purpose of construction of access roads and placement of staff, machines, material, but not longer than one year. For this purpose, mainly public land will be expropriated;
- Considering that the project will be implemented on the territory of two cantons – Central Bosnia and Zenica-Doboj Canton, the Proposal for Determining of Public Interest will be filed to the Government of the Federation of Bosnia and Herzegovina. The Proposal is to be filed by the expropriator – Public Water Utility Company Plava voda. With this Proposal, it is also necessary to file the Expropriation Study, the content of which is prescribed by the Law on Expropriation;
- In the phase of preparation of the Proposal for Expropriation, it is necessary to inform all private owners about planned activities, and try to, by mutual agreement, solve all the issues relating to the value of the compensation for expropriated land. On the pipeline route, there are different categories of land including the land covered by orchards, land covered by forests, arable land etc., and the corresponding compensations must be defined in accordance with provisions of the Law on Expropriation and price list established by the municipalities.
- The Proposal for Expropriation needs to have the content and annexes prescribed by the Law on Expropriation.
- Considering the EBRD rules, it is necessary to prepare the LRF according to PR 5 in the early phase of the expropriation process. The expropriator should prepare the LRF independently or as an inseparable part of the Expropriation Study.
- After the legal validity of the Decision on Expropriation, the municipal administrative department shall, with no delay, schedule discussion for purpose of reaching an agreement about the compensation for expropriated property.
- The compensation should be calculated at replacement cost (market value plus any registration, administrative and transfer taxes).
- Consultations with the local community should be carried out concerning loss of public amenities. It is to be noted that one stage of consultations is already carried out in the framework of national EIA/environmental permitting procedure carried out by Federal Ministry of Environment and Tourism in March 2011.

The project is still at the Preliminary Design stage. This means that the exact positioning of permanent structures that will require complete expropriation (pumping stations and water reservoirs) is still not precisely defined and consequently the question about the ownership



of land is not accurately known. The common effort of the designers and investors has been done already during the preliminary design, in order to place the majority of the constructions on public land and/or relocate it along the private land after the negotiation between the private owner and municipality representatives.

The exact locations and information regarding land ownership will become more certain in the phase of development of the Expropriation Study which is to coincide with the Main Design. It is recommended to include LRF in the Expropriation Study to guarantee that the expropriation will be carried out completely according to the EBRD rules and procedures. It is the project objective to fully compensate all owners for the loss of their assets and livelihood regardless of their legal ownership over land and assets. The preparation of Expropriation Study is at present in its preliminary phase.



10 APPENDICES



APPENDIX 1. MAP OF THE LAYOUT OF WATER SUPPLY SYSTEM



APPENDIX 2. MAP OF GEOLOGY



APPENDIX 3. MAP OF LAND USE



APPENDIX 4. MAP OF URBAN AREAS



APPENDIX 5. MAP OF INFRASTRUCTURE SYSTEMS



APPENDIX 6. MINUTES FROM THE MEETINGS WITH AFFECTED PERSONS GROUPS



REPORT OF THE MEETING

Project:	Plava Voda Regional Water Supply System		
Project ref No:		Date:	10 March 2010
Report prepared by:	Vildana Goković	Venue:	"Lutvina kahva" Restaurant, Travnik
Present:	Ms. Irem Silajdžić		
	Mr. Nijaz Zerem		
	Ms. Vildana Goković		
	Mr. Indir Melić		Secretary of the Sport Fishing Association "Travnik"
	Mr. Dragan Jojić		President of the Sport Fishing Association "Vitez"

REPORT FROM THE MEETING

1.	<p>The purpose of the meeting: To familiarize the representatives of sport fishing associations that the project of construction of Plava Voda Regional Water Supply System is planned, as well as to hear their opinions on this issue.</p>
	<p>Ms. Silajdžić briefly presented the planned project of regional water supply system construction and asked the present fishing club representatives to give their comments and opinions with regard to the possible negative impacts on fish species that may be found in this area.</p> <p>Mr. Jojić said that the planned project will not pass through the fishing area, which means that there will be no direct negative impact on the fish.</p> <p>Mr. Melić said that Sport Fishing Association "Travnik" has fishing rights contract for the Plava Voda spring with the Central Bosnia Canton for a period of 10 years. Plava Voda represents the fish spawning site (a type of protected area) from its source to the confluence with the Lašva River, and fishing is prohibited in this area. He expressed his concerns in terms of environmental flow requirements not being fulfilled during periods of low water levels (summer period).</p> <p>On the other hand, both of them think that this project has a great value due to the water needs in their respective municipalities, but they hope that their fishing associations will receive annual compensation in form of fry that can be planted in the river.</p> <p>Ms. Silajdžić thanked Mr. Jojić and Mr. Melić for their time and willingness to cooperate.</p>



REPORT OF THE MEETING

Project:	Plava Voda Regional Water Supply System		
Project ref No:		Date:	10 March 2010
Report prepared by:	Vildana Goković	Venue:	"Lutvina kahva" Restaurant, Travnik
Present:	Ms. Irem Silajdžić		
	Mr. Nijaz Zerem		
	Ms. Vildana Goković		
	Mr. Hasan Dervić	The owner of the "Lutvina kahva" restaurant	

REPORT FROM THE MEETING

1.	<p>The purpose of the meeting: To familiarize the owners of the restaurants in the vicinity of the Plava Voda spring that the project of construction of Plava Voda Regional Water Supply System is planned as well as to hear their opinions on this issue.</p>
	<p>Ms. Silajdžić briefly presented the planned project of a regional water supply construction to Mr. Dervić and asked him to give his opinion or to ask any questions about future water supply system.</p> <p>Mr. Dervić said that although the planned project will not threaten the existence of his restaurant, it will threaten the existence of the capacity of the Plava Voda spring, but on the other hand, the inevitable fact is that this water is essential for the people in other municipalities. He thinks that Plava Voda will lose its value because Travnik has always been known for this spring and even today the tourists in Travnik first visit this well-known spring. As an individual he has no intention to disapprove the project, but his personal opinion is that the water abstraction should be carried out below the restaurants in order to preserve the beauty of Plava Voda. Otherwise, the Plava Voda spring will be turned into a "brook".</p> <p>Ms. Silajdžić thanked Mr. Dervić for his comments and willingness to have the meeting.</p>



REPORT OF THE MEETING

Project:	Plava Voda Regional Water Supply System		
Project ref No:		Date:	10 March 2010
Report prepared by:	Vildana Goković	Venue:	"Plava Voda" Tavern, Travnik
Present:	Ms. Irem Silajdžić		
	Mr. Nijaz Zerem		
	Ms. Vildana Goković		
	Mr. Edin Nuhbegović		The owner of the "Plava Voda" tavern
	Ms. Bahrija Behlić Memeledžija		The owner of the "Plava Voda" tavern

REPORT FROM THE MEETING

1.	<p>The purpose of the meeting: To familiarize the owners of the restaurants in the vicinity of Plava Voda source that project of construction of Plava Voda Regional Water Supply System is planned as well as to hear their opinions on this issue.</p>
	<p>Ms. Silajdžić briefly presented the planned project of a regional water supply construction to Mr. Nuhbegović and Ms. Behlić Memeledžija and asked to hear their opinions or to ask any questions about future water supply system.</p> <p>The owners of the "Plava Voda" were not very much concerned about the water level of the Plava Voda spring. They were primarily interested to find out where the route of the future regional water supply system will pass i.e. whether the construction site will usurp the area which belongs to their tavern and whether the construction works will be carried out during the tourist season.</p> <p>They were informed that the route of the "Plava Voda" regional water supply system will pass behind the "Plava Voda" tavern, therefore the construction works will not usurp the area belonging to their tavern.</p> <p>Ms. Silajdžić thanked Mr. Nuhbegović and Ms. Behlić Memeledžija for their time and willingness to have this meeting.</p>



APPENDIX 7. EXPROPRIATION GAP ANALYSIS



Gap Analyses - Legal Framework for Expropriation and EBRD's PR 5

(taken from the project "CAPACITY BUILDING FOR RESETTLEMENT IN RELATION TO TRANSPORT PROJECTS IN THE WESTERN BALKANS, JANUARY 2011 - Legal Analyses and Capacity Building Programme")

Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
Involuntary resettlement	The term involuntary resettlement refers to physical displacement and economic displacement. Displacement can be full, partial, permanent or temporary.	<p>FBiH legislation in general, including the Expropriation Law of the FBiH, does not recognize the term involuntary resettlement.</p> <p>Issues related to land acquisition in the public interest are regulated by the Expropriation Law of the FBiH.</p>	The law focuses on properties and assets which may be expropriated and restrictions which may be placed on property rights, in the public interest. The law indirectly covers physical and to a certain extent economic displacement (i.e. access to land based incomes), but only for affected people who have formal legal rights.	Gaps regarding physical and economic displacement, as well as displacement of those who do not have formal legal rights to the land and structures which they occupy are discussed further in the table.
Land acquisition / restriction of access	<p>Involuntary resettlement occurs as a result of:</p> <ol style="list-style-type: none"> 1. Land acquisition, which includes: <ul style="list-style-type: none"> • outright purchases of property • purchases of property rights (i.e. rights of way) 2. Imposition of restrictions that result in people experiencing loss of access to physical assets or natural resources. 	<p>Outright purchases of immovable property (land, residential and other structures) are defined by the Expropriation Law as "complete" expropriation (Article 7).</p> <p>"Incomplete" expropriation includes the instigation of an easement over the immovable property or a lease of land for a defined period of time (Article 8). Temporary occupation of land (up to 1 year) is also possible when needed for construction or other works associated with the project for which expropriation is being sought (accommodation of workers, materials, machines, etc.) (Article 9).</p> <p>In addition, if it is determined that the expropriation of a part of the owner's</p>	Restrictions that result in people experiencing loss of access to physical assets or natural resources are not covered by FBiH legislation.	Solutions for overcoming restrictions that result in loss of access to physical assets or natural resources, have to be considered and defined, on a case by case basis, for a particular project.



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
		property would result in the owner having no economic interest in using or not being able to use the remainder of the property, that remaining part of the property will also be expropriated, at his request (Article 11).		
Scope of impact (project design)	Consideration of feasible alternative project designs to avoid or at least minimize physical and/or economic displacement, while balancing environmental, social, and financial costs and benefits.	According to the Law on Spatial Planning and Land use of FBiH, various social issues are to be considered in the development of all planning documents such as spatial plans, urban plans, regulation plans, projects, etc. The Decree on a Unique Methodology for the Development of Planning Documents provides a more detailed overview of issues which are to be considered in developing each of these plans, e.g. rural / urban development, growth of population, social infrastructure, social characteristics of the population, etc. without specifically mentioning resettlement / expropriation.	The FBiH laws do not specifically require the consideration of feasible alternative project designs to avoid or minimise displacement. In practice, resettlement and expropriation are avoided or minimised during project design, in the context of minimising costs.	Ensure that minimisation of physical and /or economic displacement is investigated during project design and maximised to the extent practically possible. Whenever possible, integrate the consideration of resettlement issues in the EIA process..
Planning process	Implementation of a census and a socio-economic baseline assessment within a defined affected area, to identify the persons who will be displaced and determine who will be eligible for compensation and assistance. Preparation of the Resettlement Action Plan or Livelihood Restoration Framework. During the development of the RAP/LRF, affected persons (including host communities) should be informed and consulted on the development of compensation packages, eligibility requirements, resettlement assistance, suitability of proposed resettlement	According to the Expropriation Law, the request for determining public interest and subsequently the proposal for expropriation, have to include an expropriation study (a detailed list of properties to be expropriated, their location, information about individuals who have formal legal rights on these properties and valuation reports). The proposal for expropriation also has to be accompanied by extracts from the Cadastre or other public documents (land registries) specifying all rights on the affected properties (Article 22, 24).	FBiH legislation does not require the development of specific resettlement / livelihood restoration plans, nor the implementation of a census / socio-economic survey. All affected people are informed about the proclamation of public interest and have the right to appeal. However, only those with formal legal rights are informed about the	The implementation of a census / survey and development of a RAP/LRF for each project which requires land acquisition (physical or economic displacement) is necessary. This process needs to ensure all categories of affected people (not only those with formal legal rights) are informed and consulted in a meaningful way. If vulnerable groups are identified during the survey, it may be necessary to make special provisions to include them in the



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
	<p>sites and the proposed timing.</p> <p>Special provisions should be made for consultations with vulnerable groups.</p>	<p>Ownership or other formal legal rights on land and structures are recorded in the Cadastre and Land registries³⁰. All issues regarding property rights have to be resolved before the decision on expropriation is passed (Article 27); in case of disputes, the affected parties turn to the court to decide who will receive compensation.</p>	<p>submission of the request for expropriation, have the right to appeal against it and are invited to negotiate compensation packages. All other categories of affected people are not involved in the expropriation process. In addition, there are no requirements for making special provisions for informing / consulting vulnerable groups.</p>	<p>consultation process.</p>
Cut off date	<p>In the absence of national government procedures, the date of completion of the census and assets inventory represents the cut-off date for eligibility.</p> <p>Individuals who move into the project affected area after the cut-off date will not be eligible for compensation and other types of assistance.</p> <p>Information regarding the cut-off date will be well-documented and disseminated throughout the project area.</p>	<p>According to the Expropriation Law all persons who have formal legal rights on land and structures, as registered by the Cadastre and/or Land registries, are entitled to compensation.</p> <p>Valuations (inventory) of properties / assets, have to take place before the request for expropriation is submitted (so that this request can include a bank guarantee for the amount needed for compensation – Article 24).</p>	<p>All persons who do not have formal legal rights on land and structures located in the project area are not eligible for compensation or resettlement assistance according to the Expropriation law and therefore there is no cut off date for eligibility.</p>	<p>The date when the census is carried out should be agreed with the implementing agency and specified in the RAP/LRF as the cut off date for eligibility for compensation and resettlement for all persons who do not have formal legal rights on land and structures located in the project area.</p> <p>Affected people must be informed about the cut off date.</p>
Negotiated settlements	<p>Negotiated settlements are encouraged to help avoid expropriation and eliminate the need to use governmental authority to remove people forcibly.</p>	<p>Negotiated settlements are explicitly encouraged by the Expropriation Law (Article 23). Proof that the beneficiary of expropriation attempted to reach a settlement with the affected owner has to be submitted with the request for expropriation (Article 24). The last instance in which settlements can be concluded is within two months after the final decision on expropriation has</p>		<p>Negotiated settlements should be explicitly encouraged in the RAP/LRF, for all affected categories of population.</p>

³⁰ The Cadastre focuses on information about technical characteristics of the land and structures and the Land Registry records rights on properties (land and structures).



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
		been issued. During this period, the municipal authorities are obliged to facilitate negotiations and to encourage the conclusion of a compensation agreement; if such an agreement is not reached, the case is referred to the relevant court to pass a decision on compensation (Article 60 to 64).		
Compensation at replacement cost	Compensation for lost assets will be provided at replacement cost, usually calculated as the market value of the assets plus the transaction costs related to restoring such assets (registration and transfer taxes). Depreciation of structures and assets should not be taken into account.	<p>Compensation under the Expropriation law is determined in accordance with the prevailing market price after taking into account the value of land (agricultural or land in urban areas), cost of structures (residential and business) & installations, orchards and vineyards, crops, forest land, pastures and timber (Article 49 to 53).</p> <p>Compensation is also provided for instigation of an easement, a lease and for temporary occupation of land (Article 56 to 58).</p>	<p>The law does not specifically mention compensation for the costs of any registration and transfer taxes. All costs associated with transfer of property rights to the beneficiary of expropriation are borne by that entity. In practice, when replacement property is provided, the beneficiary of expropriation bears these costs for registering the new property in the name of the affected person. However, when compensation is paid in cash, these costs are not included in the compensation package.</p> <p>Although the law also does not mention depreciation of structures and assets, these are typically taken into account during valuations.</p>	<p>THE RAP/LRF must describe the valuation method in detail and specify that compensation will include the registration cost in the Cadastre Office, or other relevant register, any administrative fees, and/or transfer taxes.</p> <p>Depreciation of structures and assets should not be taken into account during valuations.</p>
Compensation in kind / cash	Compensation in kind will be offered in lieu of cash compensation where feasible.	According to the Expropriation law, compensation to those who have formal legal rights is provided in the form of replacement property (Article 45). However, compensation can be		



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
		provided in cash, on request of the person who has formal legal rights and if a suitable property cannot be identified (Article 46).		
Provision of adequate housing / shelter with security of tenure	<p>Adequate housing is measured by quality, safety, affordability, habitability, cultural appropriateness, accessibility and locational characteristics. Should offer access to infrastructure and services.</p> <p>Security of tenure exists if resettled persons are protected from forced evictions, to the greatest extent possible.</p> <p>New resettlement sites built for displaced persons will offer improved living conditions with security of tenure.</p>	For persons with formal legal rights, compensation for residential or business structures, provided in kind has to correspond to the value of the expropriated property (taking into account location, structure and size, quality, etc. - Article 45). Property rights on the new property are formally transferred based on the final decision on expropriation and proof that compensation has been provided/paid, providing security of tenure (Article 68).	<p>The law does not recognise persons who do not have formal legal title and therefore does not foresee the provision of adequate housing with security of tenure for this category of affected people.</p> <p>The expropriation law does not include any provisions about resettlement sites. However FBiH has a developed system of rules / regulations / standards for construction of residential and other permanent structures, as well as standards pertaining to resettlement sites (access to infrastructure).</p>	<p>During the development of the RAP, affected people should be consulted in defining standards for adequate housing.</p> <p>Those that do not have formal legal rights to properties have to be resettled to appropriate accommodation and have to have security of tenure, i.e. through signed contracts. Such contracts must include all members of the affected household, to ensure that they are all protected from forced evictions.</p>
Other resettlement assistance	Relocation costs (moving allowances). Specific resettlement assistance for vulnerable groups.	According to the Law on Social Protection, Protection of Civilian War Casualties and Protection of Families with Children, vulnerable citizens have the right to one-off financial payments if they find themselves in a situation of sudden and temporary need (Article 28). One of these situations is listed as "forced migration" (Article 18). This payment is approved and administered through responsible municipal institutions (local self government and CSW).	Provision of relocation costs and specific resettlement assistance for vulnerable groups are not foreseen by the Expropriation law.	<p>Arrange for relocation costs to be compensated in cash or organise transport for people and all of their belongings / assets (specify in the RAP).</p> <p>Vulnerable groups should receive assistance in accordance with their specific needs. This should be done in cooperation with municipal social service departments. At a minimum, vulnerable groups</p>



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
				should have access to documentation, education, health and social services. Specific assistance has to be defined on a case by case basis for a particular project.
Eligibility for compensation / resettlement and entitlements in case of physical displacement	<p>Category 1 - those who have formal legal rights to the land</p> <p>Category 2 - those who do not have formal legal rights to land at the time of the census, but who have a claim to land that is recognised or recognisable under the national laws</p> <p>should receive:</p> <ul style="list-style-type: none"> • Compensation for land at full replacement cost • in the case of physical displacement, replacement property of equal or higher value, with equivalent or better characteristics and advantages of location or cash compensation at full replacement value and relocation assistance. <p>Category 3 - those who have no recognisable legal right or claim to the land they occupy</p> <p>should receive:</p> <ul style="list-style-type: none"> • Compensation for structures that they own and occupy and for any other improvements to land at full replacement cost • in case of physical displacement, a choice of options for adequate housing with security of tenure and resettlement 	<p>The Expropriation law foresees cash or in kind compensation for land, improvements to the land and structures (residential or business), for those who have formal legal rights (Category 1).</p> <p>The owner of illegally constructed structures (Category 3), is not entitled to compensation. The owner can tear down the structure and salvage the materials, if not, he/she will bear the costs of clearing the affected land (Article 45).</p>	<p>Those who have a claim to land that is recognised or recognisable under the national laws (Category 2) are also not recognised by the Expropriation law. Those who have no recognisable legal right or claim to the land (Category 3) are explicitly not entitled to compensation.</p> <p>At present there are no laws regulating social housing in FBiH, only a few pilot projects financed by international donor organisations.</p>	<p>Provide assistance to persons in Category 2 to acquire a formal legal status before expropriation (over land and structures), in which case they move into Category 1 and are entitled to compensation as per the Expropriation law. Applicable laws are:</p> <ul style="list-style-type: none"> • Law on Construction Land of FBiH – Cantonal Decrees (legalisation of structures erected by the owner of the land or on state owned land) • Law on Property Relations (acquiring property rights over land and/or structures erected on someone else's land) <p>In case of physical displacement, at a minimum, provide some form of social (low rent) housing for Category 3. Calculate the construction value of their structures and reduce their rent to correspond to the value of the structure they owned or pay cash</p>



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
	assistance			compensation. This category is typically the most vulnerable, therefore resettlement assistance must be provided (see below).
Vulnerable groups	<p>The RAP should specifically take into account any individuals or groups that may be disadvantaged or vulnerable – consultations and relocation assistance.</p> <p>Vulnerable or ‘at-risk’ 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 claim or take advantage of resettlement assistance and related development benefits. Special measures in terms of consultation and development assistance may be needed to allow such groups to participate in resettlement planning meaningfully and to benefit from development opportunities.</p>	Compensation could exceed the assessed market value of properties, if specific personal or family circumstances of the project affected person deem it necessary to ensure that his/her livelihood is protected, especially if expropriation affects agricultural land or business space in which the owner performed a legal business activity. (Article 47).	There are no special requirements in FBiH legislation for organising consultations and relocation assistance for vulnerable groups. However, persons who are homeless are entitled to social welfare assistance, which includes placement in shelters and access to other services available under the FBiH social welfare law.	During the census, it is necessary to identify vulnerable groups and assess their needs related to resettlement and relocation assistance, including access to specific services. Consultations can be held in the form of focus groups to consult with and address the needs of specific groups. Social welfare and other appropriate services should be involved in resettlement planning and implementation to ensure that vulnerable groups have access to all services available to them under the laws of FBiH (social welfare, education, health care).
Joint property	Ensure that the documentation for ownership or occupancy and compensation is issued in the names of both spouses or women single head of households, as relevant to each situation, and that other resettlement assistance, such as skills training, access to credit and job opportunities are equally available to women and adapted to their needs.	All people (men and women) have equal rights in the FBiH (Section II, Article 2 of the FBiH Constitution), including the possibility to have formal legal rights on properties. According to the Family Law, if formal legal rights over properties / assets have been acquired during the marriage, the law assumes they are shared equally between the spouses, unless a different agreement is formally registered with the court (Article 251, 252).		<p>Specify in the RAP/LRF that compensation must be shared between spouses according to title documentation or the Family Law in the silence of title documentation.</p> <p>Ensure that all programmes, including those related to livelihoods restoration are equally accessible to both men and women (specify in the RAP/LRF).</p>
Legal assistance	Displaced people should be provided, where possible, with legal assistance to enable them	There is no requirement for providing free legal assistance to persons	Some municipalities have departments that provide	Affected people should be informed about and provided



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
	to complete administrative requirements prior to land acquisition and, if needed, to seek redress from the courts.	<p>affected by expropriation or resettlement, under the Expropriation law. However, each court or administrative decision must contain instructions on available legal remedies.</p> <p>The Law on Free Legal Assistance is currently in the parliamentary procedure in BiH. The draft law foresees the provision of free legal assistance to citizens who are unable to secure these services by themselves.</p>	<p>free legal assistance to the most vulnerable citizens. This includes provision of legal advice but also court representation.</p> <p>Apart from that, there are a number of NGOs in FBiH providing legal assistance, particularly to the most vulnerable groups of population.</p>	with access to free legal assistance, either through municipal or other relevant departments or through NGOs (specified in the RAP/LRF).
Timing of compensation	Compensation (alternative housing and/or cash compensation) has to be provided prior to relocation.	According to the Expropriation law, a condition to start expropriation is the existence of a bank guarantee, in the assessed total sum for payment or proof of the existence of replacement properties (Article 24). The signed agreement on compensation (decision on compensation) has to include the timing and rate at which cash compensation will be paid or in kind compensation provided (Article 26).		
Loss of public amenities	Where a project involves the loss of public amenities, the client shall undertake meaningful consultation with the locally affected community to identify and agree upon a suitable alternative where possible.		There is no specific requirement in FBiH legislation for consulting affected communities regarding loss of public amenities.	The institutions tasked with setting up and maintaining specific public amenities which are affected by land acquisition, should consult local communities on how to replace them (specify in the RAP).
Eligibility for compensation / livelihood restoration and	<p>If land acquisition causes loss of income or livelihood</p> <p>Category 1³¹ and Category 2, should receive:</p>	The Expropriation law foresees cash or in kind compensation for land (including agricultural land, orchards and vineyards, crops, pastures, forest	Those who belong to Category 2 and Category 3 are not entitled to any compensation or livelihood	Provide assistance to persons in Category 2 to acquire a formal legal status before expropriation (over land and structures), in

³¹For definitions of Category 1, 2 and 3, see "Eligibility for compensation / resettlement and entitlements in case of physical displacement", earlier in the table.



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
entitlements in case of economic displacement	<ul style="list-style-type: none"> compensation for loss of assets or access to assets, at full replacement cost replacement property of equal or greater value, or cash compensation at full replacement cost <p>Category 3, should receive:</p> <ul style="list-style-type: none"> Loss of assets, other than land, at full replacement cost <p>All three categories should receive:</p> <ul style="list-style-type: none"> compensation for the cost of re-establishing commercial activities elsewhere compensation for lost net income during the period of transition compensation for the costs of the transfer and reinstallation of the plant, machinery or other equipment transitional support based on a reasonable estimate of the time required to restore their income-earning capacity, production levels, and standards of living additional targeted assistance (credit facilities, training, or job opportunities) and opportunities to affected persons whose livelihoods or income levels are adversely affected (owners of businesses and employees are eligible) 	<p>land and timber) and business structures / physical assets, for those who have formal legal rights (Category 1).</p> <p>Those who have formal legal rights are also entitled to compensation for lost profit from the day they loose access to the expropriated property to the day they receive replacement property or cash compensation (Article 54).</p>	<p>restoration assistance, including lost net income, by the Expropriation law.</p> <p>In addition, all three categories are not entitled to costs of re-establishing commercial activities, transitional support, or other targeted assistance.</p> <p>There is no specific legal requirement for organising or compensating the costs of transporting equipment.</p> <p>Assistance to off-set any loss of a community's commonly held resource is also not specifically regulated by FBiH legislation.</p>	<p>which case they move into Category 1 and are entitled to compensation as per the Expropriation law. Applicable laws are:</p> <ul style="list-style-type: none"> Law on Construction Land of FBiH – Cantonal Decrees (legalisation of structures erected by the owner of the land or on state owned land) Law on Property Relations (acquiring property rights over land and/or structures erected on someone else's land) <p>In case of economic displacement, provide those belonging to Category 3 with access to adequate commercial space, with security of tenure, to restore their economic activities and livelihoods.</p> <p>Ensure that all categories are promptly compensated in cash or in kind (before they loose access to their properties / assets), so that lost net income and the need for transitional support are minimized / avoided.</p> <p>Arrange for relocation costs to be compensated in cash or organise transport of equipment and other assets.</p>



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
				Facilitate access to existing services which could assist the affected persons whose livelihoods or income levels are adversely affected to restore their living standards. This could be done in cooperation with the FBiH Employment Agency.
Grievance procedure	<p>The grievance mechanism will be set up as early as possible in the process, to receive and address in a timely fashion specific concerns about compensation and relocation that are raised by displaced persons and/or members of host communities, including a recourse mechanism designed to resolve disputes in an impartial manner.</p> <p>The grievance mechanism, process, or procedure should address concerns promptly and effectively, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, at no cost and without retribution.</p>	There is no specific requirement for establishing an independent grievance mechanism, according to the Expropriation Law or other FBiH legislation. The law does foresee rights of affected citizens (those with formal legal rights) to appeal at many stages of the expropriation procedure, beginning with administrative and judicial appeals (i.e. against the decision on public interest (Article 16), the decision on expropriation (Article 30), regarding compensation (Article 60).	In practice, affected people communicate with the expropriation beneficiary (a designated person / department), in connection to their specific grievances and with the aim of reaching a compensation agreement, before filing appeals with the relevant administrative authorities or courts.	Define a project specific grievance mechanism in the RAP/LRF. Depending on the scale of the project or the general vulnerability status of affected families, involve any available institutions in the process, e.g. the ombudsman, human rights groups, etc.
Information disclosure and public consultation	<p>The client should summarize the information contained in the RAP and/or the LRF for public disclosure to ensure that affected people understand the compensation procedures and know what to expect at the various stages of the project (for example, when an offer will be made to them, how long they will have to respond, grievance procedures, legal procedures to be followed if negotiations fail).</p> <p>Consultations will continue during the implementation, monitoring and evaluation of compensation payment and resettlement.</p>	Those who have formal legal rights are informed throughout the expropriation process (i.e. that a request for expropriation has been submitted (Article 25); before the decision on expropriation is passed, the municipal office in charge of expropriation has to invite the affected person with formal legal rights to a meeting to present any facts which may be relevant for expropriation (Article 27).	<p>The Expropriation law does not require public consultations to be held with any categories of project affected people, prior to expropriation.</p> <p>Once the expropriation process is initiated, only those with formal legal rights are informed and consulted through a one on one negotiation process.</p>	Plans for consultations with all project affected people, including host communities, should be agreed with them and incorporated in the RAP/LRF.



Issue	EBRD policy requirements	Provisions of FBiH law	Gap / Comment	Proposed response
Monitoring	Monitoring of the RAP / LRF will be carried out in accordance with PR 1.		There are no requirements for monitoring the expropriation / resettlement / livelihoods restoration process, under FBiH legislation.	Define indicators and monitoring mechanisms in the RAP / LRF.