**Project Fiche – IPA Annual Action Programme 2007 for Bosnia and Herzegovina – Construction of Sewage Collectors in Živinice**

## 1. Basic Information

**1.1 CRIS Number:**

**1.2 Title:** Construction of Sewage Collectors in Živinice

**1.3 ELARG Statistical Code**: 03.27 - Environment

**1.4 Location:** Bosnia & Herzegovina – Živinice

**Implementing arrangements:**

**1.5 Contracting Authority:** Delegation of the European Commission to Bosnia & Herzegovina.

**1.6 Implementing Agency:** Delegation of the European Commission to Bosnia & Herzegovina.

**1.7 Beneficiary:** (including details of project manager)
State Level:
Ministry of Foreign Trade and Economic Relations BiH
Mr. Reuf Hadžibegić
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Entity Level:
Ministry of Agriculture, Water Management and Forestry – FBiH,
Water Agency for Watershed of River Sava
Cantonal Level:
Tuzla Canton
Municipality Level:
Municipality Živinice
Public Communal Utility "Komunalno"

**Financing:**

**1.8 Overall Cost:** €1,500,000

**1.9 EU Contribution:** 100%

**1.10 Final Date for Contracting:** N+2

**1.11 Final Date for Execution of Contracts:** N+4

**1.12 Final Date for Disbursements:** N+5

## 2. Overall Objective and Project Purpose

**2.1 Overall Objective:**

The overall objective of the project is to contribute to implementation of environmental acquis in Bosnia and Herzegovina.

**2.2 Project Purpose:**

The purpose of this project is to protect the environment from the adverse effects of urban waste water by providing waste water collection systems in Živinice.

### 2.3 Link with AP/NPAA/EP/SAA

The 2006 BiH Progress Report states the following for water quality:

Some progress can be reported in relation to **water quality**. A Water Law which integrates the principles of the Water Framework Directive was adopted in both the Republika Srpska and in the Federation. Bosnia and Herzegovina has signed the International Convention for the Protection of the Danube River and the implementation is ongoing as foreseen. Collection of data in this area is not yet functioning well and reporting to the European Environment Agency is not systematic. *Poor water quality and insufficient waste water treatment remains a key environment challeng*e.

Article 108 of the SAA also emphasises the reduction in water pollution as a key environmental priority.

### 2.4 Link with the MIPD 2007-2009

The MIPD identifies as a result that the alignment of Bosnia & Herzegovina environment and water sectors to the acquis will be advanced. It also identifies as a programme the integration of environmental measures into regional and rural development, investments in environmental infrastructure, necessary institution building and awareness raising on environmental issues. This intervention is closely linked with this result.

The project is linked with MIPD under section 2.2.3. European Standards/2.2.3.2 Expected results and timeframe.

Tools for prioritization of environmental infrastructure investments and determination of measures for environmental protection will be operational. Generation of co-finance mechanisms for environmental infrastructure will be advanced. Enhanced investments in environmental infrastructure.

### 2.5 Link with National Development Plan

***The planned intervention is in line with the Entity Water Law, which is aligned with the EU Water Framework Directive, and in conformity with the National Environmental Action Plan, Poverty Reduction in BiH, as well as ongoing activities in the water sector.*** **2.6 Link with national/sector investment plans**

The proposed intervention is in the line with national investment plans regarding support to local authorities (e.g. cantons and municipalities) to ensure the protection and rational use of water resources. The Programme of public investments for BiH in the in period (2006-2008) also supports this project. In addition, the Water Protection Plan for Urban Wastewater in Bosnia and Herzegovina ranks Živinice as a priority agglomeration for investment in and urban wastewater treatment. The Plan was completed through the framework of an EU funded "Water Quality Management at River Basin Level" project.

## 3. Description of Project

### 3.1 Background and Justification

Bosnia and Herzegovina has harmonised its legislation with EU *acquis* on the environment water quality and special attention has be given to compliance with the EU Water Framework Directive, of which the overall objective is to ensure good water quality by reducing pollution, especially by the treatment of waste water from settlements.

The 2005 European Partnership sectoral policy on environment indicates the continuing strengthening of administrative capacity of the institutions involved in environmental protection and ensuring a functioning environmental monitoring system is in place.

The planning and construction of waste water drainage systems and wastewater treatment plants is a key priority of BiH's environmental policies, in line with the EU Water Framework Directive and other relevant standards of the European Union (e.g. Urban Waste Water Treatment Directive). Živinice is ranked high on list of priority measures for wastewater treatment in the Water Protection Plan for Urban Wastewater for Bosnia and Herzegovina.

At present untreated waste water and sewage produced in the municipality of Živinice flows into the river Oskova and Lake Modrac, a source of water for the wider region, including the town of Tuzla, with a total population of more than 250,000 inhabitants. This project is important for the protection of water quality in the BiH part of the Sava River basin.

Created artificially in 1964 by damming the river Spreča, Lake Modrac was intended to supply water for industry. Today it provides water to the power station and salt works in Tuzla, and also to the coke, soda and cement factories at Lukavac. Some of the water supplied to the coke factory is treated there, and after blending with groundwater, is sold as drinking water to Lukavac. The lake is polluted and it is not a major contributor to the three municipalities. However, it is now considered to be the most feasible long-term potable water source for the area.

Despite its importance of Lake Modrac both as the largest fresh water lake in the region, and as an important tourist and recreation centre, actions so far have been very limited to prevent further pollution. Commissioned by the EBRD, a report (environmental impact and feasibility study) prepared for the Danube Regional Investment Support Facility report (supported by EuropeAid) "Water and Wastewater Project (Protection of Lake Modrac) 2005", identified the level and sources of the pollution of the lake which discharges into the river Spreča and in turn into the River Bosna, then to the river Sava and ultimately to the river Danube, The protection of its ecology and environment is critical to the quality of life of the Tuzla Canton and beyond.

The current sewerage system in Živinice originates in the 1950s, and most was built before 1982. There are five outfalls into the river Oskava. No domestic waste water treatment is carried out at present, although some pre-treatment is performed, or is planned at some industrial sites.

The above report also identified the construction project with the highest priority as the provision of a waste water treatment plant and associated main collector sewers for domestic and industrial wastewater in Živinice. The report identifies that sewage from Živinice is by far the major contributor to the pollution of Lake Modrac.

This project will contribute to the implementation of the Water Framework Directive, and other related directives such as the Urban Waste Water, Drinking and Bathing Water Directives in Tuzla Canton. It will lead to the improvement the basic water quality in the following areas:

- Spreča, Oskova, Gostelja watercourses;
- Sprečko polje field groundwater; and
- Lake Modrac basin that is part of the water supply system of the wider region (Tuzla, Lukavac and Živinice)

The construction of the four sewage collectors represents the first phase of an integrated project to protect Lake Modrac from damaging pollution, to secure its future as a main source

of potable water in the Tuzla Canton. The four sewage collectors will provide the basis of long-overdue modern sewage and waste water treatment facilities for the municipality of Živinice. Future benefits are a continuous supply of fresh water from Lake Modrac, especially during the summer, when interruptions are frequent. According to the report mentioned above, the project will benefit approximately 250,000 inhabitants of which about 140,000 live in Tuzla.

### 3.2 Assessment of project impact, catalytic effect, sustainability and cross border impact

This project is part of a major water and waste water infrastructure initiative by Tuzla Canton to provide a population of 250,000 with an adequate water supply and waste water and sewage treatment facilities, at present woefully lacking. Its initial impact will be to resolve the area's major pollution problem, that of untreated sewage from the municipality of Živinice flowing into Lake Modrac, thus jeopardising its long term future as a major potable water resource of Tuzla Canton. The secondary impact is to transform the clean water supply situation to Živinice from today's unsatisfactory state, where interruptions are frequent. Also the elimination of pollutants from Lake Modrac, apart from clear environmental effects, will improve its attraction as one of the areas leading tourist and recreational resources. A third long term impact will improvements to the quality of water flowing from the rivers of Tuzla Canton into the Rivers Sava and Danube, which will achieve an important cross-border environmental objective.

### 3.3 Results and Measurable Indicators:

Results:

1. Municipality of Živinice connected to effective waste water and sewage treatment infrastructure.
2. Groundwater and surface water resources in Živinice Municipality are protected.

Indicators:

1. Four sewage collectors constructed.
2. Number of dwellings connected to municipal sewage network.
3. Water supply for the region is continuous and in accordance with water quality standards.

### 3.4 Activities:

This project will be implemented under one Works Contract and one Service Contract
Activity 1 – Construction of four sewage collectors;
Activity 2 – Supervision of construction works.
**Main Design** was completed and revised according to the respective BiH legislation in force.
The Works include: digging, placing of collector, covering up, and facility construction on the collector (shaft and siphon trap under watercourse). The works will be carried out continuously and undisturbed following procedure typical for this kind of facility and in line with technical conditions of construction within the Main Project.
To ensure the works are carried out in accordance to technical specifications and other requirements, an engineer will be appointed to supervise the works on behalf of the project beneficiary and contracting authority.

### 3.5 Conditionality and sequencing

Before start of tendering process, the Project Beneficiary must obtain the necessary construction/ecological permit(s) and relevant conformities needed for undisturbed project implementation. This should not be a problem since the land concerned is state/public property. The locations of the four collector sewers have already been identified and surveyed, as has that of the main waste water treatment plant.

### 3.6 Linked Activities

Feasibility Study for protection of Modrac Lake, called "Water and Wastewater Project" has been completed. The study covered the following three municipalities: Tuzla, Lukavac, and Zivinice. The study has been financed by the EBRD.

The Environment Impact Study was conducted within the "Water Quality Protection Project BiH", which was financed from the GEF grant funds. The Environment Impact Study covered all areas where works on collection and treatment of waste water are anticipated through the Project (Odzak, Trnovo, Zivinice, and Mostar). The project is financed by the World Bank.

This IPA intervention is part of a number of projects identified by Tuzla Canton for the protection of the Lake Modrac basin. This project has the highest priority (see 3.1 above). Other projects include the collection and treatment of domestic waste water from communities around the lake, and some longer term projects. These include: wastewater treatment for the municipalities of Banovići and Kalesija, river bed improvements, erosion protection and the restoration of coal mining areas. The Tuzla Canton is also planning improvements to the water quality of the whole river Spreča basin, and regards the provision of wastewater treatment facilities in Tuzla and Lukavac as important objectives. Phases II and III of the project (including Construction of Wastewater Treatment Plant) should be financed by the World Bank.

The Water Protection Plan for Urban Wastewater in BiH ranks Živinice as a priority agglomeration for investment in and urban wastewater treatment. The Plan was completed through the framework of an EU funded "Water Quality Management at River Basin Level" project.

### 3.7 Lessons learned

Experience obtained from past and ongoing infrastructure investments projects from the CARDS programme will be applied as much as possible. Experience gained from such programmes has shown that mutual cooperation with beneficiary partners in BiH and there full commitment during all phases of the project implementation is needed. Based on self evaluation those project (e.g. Integrated Border Management (IBM) Infrastructure) without proactive involvement of the local counterparts failed. However, the projects that have had full support of the local counterparts (e.g. Rehabilitation of the wild landfill in Knezevo or Bihac Waste Water Treatment Project) are being implemented with no delay,

This project is the first environment infrastructure project for BiH that will be financed from IPA assistance. It will help other relevant institutions in BiH to become familiar with the process of project preparation for future IPA projects. The institutions that will be included in the process are: Ministry of Foreign Trade and Economic Relations BiH, Ministry of Agriculture, Water Management and Forestry – FBiH, Water Agency for watershed of river Sava, Tuzla Canton, Municipality Živinice, Public Utility "Komunalno". **4. Indicative Budget (€)**

| Activities | TOTAL COST | SOURCES OF FUNDING | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CONTRIBUTION | | | | NATIONAL PUBLIC CONTRIBUTION | | | | | PRIVATE | |
| | | Total | % * | IB | INV | Total | % * | Central | Regional | IFIs | Total | % * |
| contract 1.1 Works contract | 1,300,000 | 1,300,000 | 100% | | 1,300,000 | | | | | | | |
| contract 1.2 Service/Supervisory Contract | 200,000 | 200,000 | 100% | | 200,000 | | | | | | | |
| **TOTAL** | | **1,500,000** | **100** | | | **0** | | | | | | |

* expressed in % of the Total Cost

Note: the cost of the project is based on the Feasibility Study - EBRD Danube Regional Investment Support Facility – Tuzla Canton (Municipalities of Tuzla, Lukavac and Živinice) Water and Wastewater Project – Protection of Lake Modrac – August 2005.

## 5. Indicative Implementation Schedule (periods broken down by quarter)

| Contracts | Start of Tendering | Signature of contract | Project Completion |
|---|---|---|---|
| Contract 1.1 Works Contract | Q2 2008 | Q4 2008 | Q1 2011 {including Defect Liability Period} |
| Contract 1.2 Service Contract | Q1 2008 | Q4 2008 | Q1 2011 {including Defect Liability Period} |

## 6. Cross Cutting Issues

### 6.1 Equal Opportunity

The principle of non-discrimination regarding nationality, gender, religion and race will be applied during tendering, contracting and implementation of this project.

### 6.2 Environment

This works project is specifically targeted at the improvement of the environment, and will be implemented in accordance with BiH and EC regulations and standards. The Environmental impact assessment clearly states the impacts of the project on each environmental aspect of the project.

### 6.3 Minorities

See 6.1 above.

## ANNEX 1: Logical framework matrix in standard format

| | | |
|---|---|---|
| LOGFRAME PLANNING MATRIX FOR Project Fiche | Programme name and number: Construction of four (4) Sewage Collectors in Živinice (including supervision over construction) | |
| | Contracting period expires | Disbursement period expires |
| | Total budget : 1,500,000 EUR | IPA budget: 1,500,000 EUR |

| **Overall objective** | **Objectively verifiable indicators** | **Sources of Verification** | |
|---|---|---|---|
| The overall objective of the project is to contribute to implementation of environmental acquis in Bosnia and Herzegovina. | Increase the number of inhabitants connected to sewage networks in Živinice municipality<br>Water supply for the region is continuous and in accordance with water quality standards. | Tuzla Canton – Živinice municipality statistics on infrastructure, environment, health and pollution. | |
| **Project purpose** | **Objectively verifiable indicators** | **Sources of Verification** | **Assumptions** |
| The purpose of this project is to protect the environment from the adverse effects of urban waste water by providing waste water collection systems in Živinice. | To protect of Spreča, Oskova, Gostelja watercourses as well as Sprečko polje field groundwater<br>To protect of Modrac lake basin that is a part of water supply system of wider region (Tuzla, Lukavac and Živinice)<br>Environmental protection of harmful influence, especially during summer, Water quality improvement to be used for recreation and fishing | Tuzla Canton – Živinice municipality statistics on infrastructure, environment, health and pollution<br>PAC issued<br>FAC issued | Land acquisition completed<br>Necessary permits issued, relevant ministries and other related stakeholders take an active role in project implementation |
| **Results** | **Objectively verifiable indicators** | **Sources of Verification** | **Assumptions** |
| Municipality of Živinice connected to effective sanitation infrastructure.<br>Groundwater and surface water resources in Živinice Municipality are | Increase the number of inhabitants population connected to sewage networks in Živinice municipality | Tuzla Canton – Živinice municipality statistics on infrastructure, environment, health and pollution | Tender process successful<br>Willingness of relevant ministries and other stakeholders to take an active role |

| | | | |
|---|---|---|---|
| protected. | Measurements of levels of pollutants in waters flowing into Lake Modrac. | | during the project implementation |
| **Activities** | **Means** | **Costs** | **Assumptions** |
| Activity 1 – Construction of four sewage collectors | Works contract with supervision | €1,500,000 | |

**Pre-conditions**

## ANNEX II: amounts (in €) Contracted and disbursed by quarter for the project

| **Contracted** | **1st Quarter 2008** | **2nd Quarter 2008** | **3rd Quarter 2008** | **4th Quarter 2008** | **1st Quarter 2009** | **2nd Quarter 2009** | **3rd Quarter 2009** | **4th Quarter 2009** | **1st Quarter 2010** | **2nd Quarter 2010** | **3rd Quarter 2010** | **4th Quarter 2010** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contract 1.1 | | | | 1.3 M | | | | | | | | |
| Contract 1.2 | | | | 0.2 M | | | | | | | | |
| **Total** | | | | **1.5 M** | | | | | | | | |
| **Cumulated** | | | | **1.5 M** | | | | | | | | |
| **Disbursed** | **1st Quarter 2008** | **2nd Quarter 2008** | **3rd Quarter 2008** | **4th Quarter 2008** | **1st Quarter 2009** | **2nd Quarter 2009** | **3rd Quarter 2009** | **4th Quarter 2009** | **1st Quarter 2010** | **2nd Quarter 2010** | **3rd Quarter 2010** | **4th Quarter 2010** |
| Contract 1.1 | | | | 0.15 M | 0.25 M | 0.20 M | 0.45 M | 0.23 M | | | | 0.02 M |
| Contract 1.2 | | | | 0.08 M | | 0.035 M | | 0.075 M | | | | 0.010 M |
| **Total** | | | | **0.23 M** | **0.25 M** | **0.235 M** | **0.45 M** | **0.305 M** | | | | **0.30 M** |
| **Cumulated** | | | | **0.23 M** | **0.48 M** | **0.715 M** | **1.165 M** | **1.470 M** | | | | **1.50 M** |

## ANNEX III Reference to laws, regulations and strategic documents

Reference list of relevant laws and regulations

1. Water Law, Official Gazette of RS 50/06,

2. Water Law, Official Gazette of Federation of BiH 70/06,

Reference to AP /NPAA / EP / SAA

Reference to MIPD

Reference to National Development Plan

1. Poverty reduction strategy PRSP (2007-2009),

2. National Environmental Action Plan BiH.

Reference to national / sector investment plans

1. Public Investments Program in the Federation BiH for 2007-2009

2. Water Protection Plan for Urban Wastewater BiH

*Feasibility Study:*

EBRD Danube Regional Investment Support Facility – Tuzla Canton (Municipalities of Tuzla, Lukavac and Živinice) Water and Wastewater Project – Protection of Lake Modrac – August 2005.

*Investment criteria:*

- Rate of return (cost benefit analysis has not been done. However, the financial assessment, showing that the project is justified, has been done within the feasibility study
- Co financing: There is no co-financing component
- Compliance with state aids provisions: This project is compliant with state aid provisions since the land and construction works concerned are state/public property.
- Ownership of assets (current and after project completion: After the project implementation, the constructed facility will be under the ownership of the municipal utility "Komunalno", namely, the municipality of Živinice.

The ownership of the land to be subject to collector construction is not an issue since the land concerned is state/public property; moreover, competent services have visited the routes of the future collector and surveyed the land.

After the project implementation, the constructed facility will be under the ownership of the municipal utility "Komunalno", namely, the municipality of Živinice.

Environmental Impact Assessment for Živince stage (see annexed)

**ANNEX IV: Details per EU funded contract (*) where applicable:**

For *works contracts*:

## *EIA Summary - Živinice*

Živinice is located approximately 1 km south of the city of Tuzla, southeast from the Modrac lake. River Oskova runs through the city, while upstream from Živinice stretches Gostelja, its tributary. Downstream of Živinice, the river of Oskova flows into the Spreča river, which flows in to the Modrac lake. On the opposite side, Spreča leaves Modrac lake and flows towards Doboj, where it ultimately flows into the Bosna river.

### 5.3.1 Water Management Issues in Živinice and vicinity

Throughout its history, Živinice and the entire surrounding region has had sporadic, i.e. discontinuing water supply, hence remains of the previous water supply systems and flood protection segments can still be found. With the industrial and commercial development of the region, coupled with the increase in population, water demands also rose, especially towards the end of the 19th and early 20th century. Government had organized research of the water supply issues, and had formed meteorological and hydrological station. City water supply, sewage and water protection systems had also been constructed. After 1945 more attention has given rise to organizations and utilities that deal with water supply requirements in a cross-cutting and multidisciplinary approach. However, the increased use of water in industrial processes has led to the increased level of pollution of waterways. As a result, a study was developed that clearly stated and analyzed the water supply needs in the entire BiH, with an emphasis on the Bosna river basin. A waterworks basis document for the Spreča river stressed the need to form a water accumulation for industrial water supplies, and this resulted in a decision to form the lake of Modrac.

**Table 01 Data for the Dam and Accumulation Modrac on the Spreča River – Cadastre of Accumulations – Energoinvest, Sarajevo 1982, and ¨Dams in Yugoslavia – ICOLD Dubrovnik, 1971**

| | | |
|---|---|---|
| Basin Area | | 1.944 $km^2$ |
| Average Annual Precipitation | | 964 mm |
| Average Flow (20-year flow) | | 15.5 $m^3/s$ |
| Annual runoff | | 489 $km^3$ |
| Specific runoff | | 8.0 l/s/km |
| Minimum measured flow | | 0.65 $m^3/s$ |
| Maximum measured flow | | 367 $m^3/s$ |
| Flood waters 0,1% | | 1.000 $m^3/s$ |
| **Accumulation** | Level of natural slowing down | 1. phase 200.0 m above sea level |
| | | 2. phase 203.5 m above sea level |
| | Minimum water level required for power production | 190.6 m above sea level |
| | Total volume of the accumulation | 1. phase 100 $km^3$ |
| | | 2. phase 183 $km^3$ |
| | Volume used for power plant | 1. phase 88 $km^3$ |

| | | |
|---|---|---|
| | | 2. phase 171 $km^3$ |
| | Area of the accumulation | 1. phase 1.700 ha |
| | | 2. phase 2.375 ha |
| | Maximum depth of the accumulation | 17.0 m |
| **Dam** | Height | 33 m |
| | Length at the dam crown | 205 m |
| | Concrete volume | 19 x $10^3$ $m^3$ |
| **Users** | Elektroprivreda Power Plant Tuzla | 1 $m^3/s$ |
| | Industry | 0.95 $m^3/s$ |
| | Biological minimum | 4.7 $m^3/s$ |
| **Users, as planned for 2000** | Elektroprivreda. Power Plant Tuzla | 2.5 $m^3/s$ |
| | Industry | 1.5 $m^3/s$ |
| | Water supply to settlements | 1 $m^3/s$ |
| | Water management minimum | 4.7 $m^3/s$ |
| | Total | 9.7 $m^3/s$ |

### 5.3.2 Landscape and Climate

The Spreča river basin borders with the Majevica mountain (966 m above sea level) to the north, and to the southeast, south and southwest with the mountains of Javornik (1,021 m above sea level), Konjuh (1,328 m above sea level) and Ozren (917 m above sea level).

The geological base of the dam is made up of serpentinite (magmatic rocks). The geological base of Majevica is traced back to the Cenozoic – Paleocene – Quternary period, while the base along Spreča is traced back to Neogenic period (Tektonika – Dr. I. Sokolić). The entire broader Tuzla region has been tectonically active through almost entire Cenozoic period, while the sedimentation phases were interrupted by phases of intensive tectonic activity and erosion. As a result, this area is rather suitable for research of geological history of Cenozoic period, and the different ground forming processes and mechanisms therein. Upon conducting research in the field, the measured sliding within the Spreča basin is believed to be a result of very recent activity. However, the rock mass as a whole has been more elastic rather than plastic over the time, and the deformities are very minor. The edges of the deep crevices are covered with layers that are of Tertiary age, which are elbow-bent, with wave-like crumples. The complex structure in the region of the Tuzla basin has been formed at the end of Tertiary and Quartiary period, while the frequent earthquakes indicate that this tectonic process is not yet completed.

The climate is of a moderate continental and semi-mountainous type. According to the data from the Meteorological station in Tuzla, the average monthly and annual temperatures are as follows:

**Table 2 Average Recorded Monthly and Annual Temperatures for Živinice region, ºC – Tuzla Station**

| I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | $T_{ave.ann.}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -0.7 | 1.7 | 5.7 | 10.4 | 14.8 | 17.7 | 19.3 | 18.9 | 15.4 | 10.6 | 5.6 | 0.9 | 10.0 |

Monthly and total annual precipitation for Živinice is given in the next table.

**Table 3 Average Monthly and Total Annual Precipitation for the Odžak region – Modriča station, l/m2 Tuzla station**

| I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | $P_{ann}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 64 | 59 | 66 | 82 | 99 | 120 | 101 | 90 | 69 | 60 | 76 | 78 | 964 |

### 5.3.3 Population, land use and type, forests and mineral resources in the Spreča basin

Based on the population count from 1991, the population of the Živinice region amounted to 54,653. Prior to the war, this municipality was above-average of the Republic BiH with regards to population density. Hence, the average population density from 1991 amounted to 188 inhabitants/$km^2$ while the average population density for BiH was 85 inhabitants/$km^2$.
One of the major influences to the varied population densities is the death and birth rate of the population at a given time period. Up to the beginning of the war, sudden and significant shifts occurred within the municipality with regards to the demographics and the social-economic and educational factors. In the time period from 1948 until 1991 the population count had almost tripled. In 1948 the predominant activities in the area were agriculture and cattle-raising, while in 1991 an insignificant percentage of population was active in these fields. In the last decade prior to the war one of the biggest population shifts had occurred, from rural areas to urban areas, as a result of sudden industrialization in the socialistic period.

**Table 4 Population Data for Živinice Municipality, Federal Institute for Programming and Development, March 2004**

| | Area | Number of Settlements | Population | Elevation above sea level |
|---|---|---|---|---|
| Živinice | 291$km^2$ | 29 | 52,616 | 217 m |
| Banovići | 185 $km^2$ | 19 | 28,820 | 333 m |
| Kalesija | 201$km^2$ | 28 | 34,931 | 256 m |
| | | Total | 116,367 | |

Živinice municipality takes up an area of 29,100 hectares, while the biggest percentage of the land is agricultural (37.9%), and forested (49.9%). Breaking down the types of agricultural land, the biggest percentage of total agricultural land is the plowed fields with the area of 8,003 ha (72.6%). The next category are the meadows with 1,392 ha (12.6%) and the pastures and orchards with 803 and 827 ha respectively. Most of the forested areas are comprised of general woodwaxen trees, oak, and hornbeam – beech.

Most significant mineral resources within the Živinice municipality are the coal mines. Beginning of coal extraction in Đurđevik, Višća and Bašigovci dates back to the first half of 20$^{th}$ century, while extraction of lignite coal in Majevica – Dubrave was started some 10 years ago. These mines produced approximately 2,3 million tons of coal prior to 1991, mostly for the needs of the Tuzla power plant, while currently they only produce approximately one fifth of that amount. The total underground reserves of coal are estimated at 60 million tons, and those of lignite at 100 million tons. Apart from coal mining, surface mines of limestone are becoming increasingly important because of production of

material used in the local construction industry (S. Gračanica, Podgajevi, Višća, Maline, etc.). Another significant resource is the quartz sand which has appeared as a result of coal mining at the Brnare mine. This resource could be a potential base for the development of industry in Živinice, as it can provide a replacement capacity, i.e. alternative to coal mining.

### 5.3.4 Project Design for the Expansion of the Sewer Collection Network and the Construction of a Wastewater Treatment Plant

Upstream from the Modrac accumulation, some 700,000 population equivalents – PE, release wastewater from three relatively bigger settlements with developed industrial and agricultural activities - Živinice, Banovići, and Kalesija. Živinice is the settlement which is the closest to Modrac, and hence can be considered as a priority for constructing wastewater collection and treatment systems. The major aim of this project component is to protect the Modrac accumulation.

Živinice municipality currently has approximately 47,500 inhabitants, while only 22,000 are connected to the wastewater collection system. Through the means of this project, an additional 32,000 inhabitants would be connected to the system, along with another 40 l/s (7,000 PE) of industrial wastewater. Wastewater (municipal and industrial – wood processing, slaughterhouses, milk farms, etc.) are currently released into the Oskova river at three different locations (Oskova flows into Spreča river, on which Modrac accumulation is located, while Spreča flows farther on into Bosna river).

The wastewater collection system of Živinice serves for multiple sources, thus the future wastewater treatment plant (WWTP) will have to process municipal wastewater, storm-water and industrial wastewater (wood processing Konjuh, poultry slaughterhouse Kokodžada, cattle slaughterhouse, Autoprevoz transport company, health institutions, smaller commercial and trade shops, all estimated to have maximum wastewater releases of 40 l/s). The issue of separation of stormwater and municipal wastewater will need to be resolved in the future, outside the scope of this project.

**Table 5 Wastewater Loading for Cities by the Modrac Accumulation,"Framework Waterworks Basis for BiH" - Sarajevo, 1994. Cities are shown with corresponding population equivalents**

| | Municipal Wastewater (PE) | Industrial Wastewater (PE) | Total (PE) |
|---|---|---|---|
| Živinice (Oskova river) | 14,817 | 2,000 | 16,817 |
| Kalesija (Spreča river) | 5,917 | 12,450 | 18,367 |
| Banovići (Turija river) | 15,867 | 2,050 | 17,917 |
| Đurđevik (Gostelja river) | 6,117 | 125 | 6,242 |
| Total | 59,343 PE | | |

The following activities are planned within the project documentation:

i. Expansion of the wastewater collection system
ii. Construction of an automated treatment plant with a capacity of 40,000 PE, including mechanical and biological treatment within the following units:
    1 Pre-clarifier
    2 Bar grate
    3 Pump station for raising wastewater
    4 Fine sieves
    5 Aerated sand-traps, grease-traps
    6 Aerated lagoons
    7 Sludge sedimentation tank, flow meter for treated effluent
    8 Chlorination station and tank, using NaOCl (Sodium hypochlorite) including a chlorine dozer
    9 Pumping station for recycled sludge and excess sludge
    10 Sludge thickening silos and sludge drying beds

Standard biological treatment with activated sludge is included, while different alternatives have been analyzed prior to the final decision making. An activated sludge process can later be expanded to include a unit for preparation and dosage of three-valent iron for phosphorus removal. Processing and stabilization of waste sludge includes aerobic stabilization processes, thickening and centrifuge (with or without using released gases for power production), followed by disposal on agricultural land or landfill. The plant shall include a control laboratory unit for analyses of influent, effluent, and efficiency of individual plant units.

During the plant design development, it is important to have in mind the flooding tendency at this location, in particular with respect to the plant load increase, prevention of sludge dissipation with torrents, and plant access in such circumstances.

The first phase includes construction of a collector network (3+1, including collection and transport of wastewater to the treatment plant site at the mouth of Oskova into the Spreča river).

The works planned include earthwork, (excavation, filling in, sand embankments, site clearing / vegetation removal), setting concrete, installation works (fences, units, processes etc.), masonry, painting, hydro-insulation, furnishings (doors, windows), plumbing, floor-setting, etc.

# COST ESTIMATION FOR ŽIVINICE

| Name | Lenght | Diametar | Price in KM |
|---|---|---|---|
| Collector I | L=2404,01 m | DN 1000 mm | 1.807.311,30 KM |
| Collector II | L=1972,74 m | DN 400 mm | 287.634,17 KM |
| Collector III | L=3407,43 m | DN 400; 500 mm | 679.264,05 KM |
| Collector North | L=1883,43 m | DN 400 mm | 256,617,43 KM |

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T o t a l : **3.030.826,95 KM**