

## TERMS OF REFERENCE

For producing technical documentation of Conceptual Solution, Design for Construction Permit and Execution Design for Protection from Erosion and Torrents in the Vlasina river basin.

### 1. INTRODUCTORY NOTES AND ISSUES

River Vlasina is the right tributary of South Morava and it is made up of several legs with sources at the top of the forest zone, below Pancin grob and its source is under the Vlasina lake dam. The biggest tributaries of Vlasina River are: Tegosnica, Luznica, Pusta reka, Gradska reka and Bistrica.

- River basin surface area is  $A = 994 \text{ km}^2$ .
- The length of the main flow is  $L = 70 \text{ km}$
- Typical discharge is:
  - Through Vlasotince
    - $Q_{1\%} = 759.0 \text{ m}^3/\text{s}$
    - $Q_{2\%} = 591.0 \text{ m}^3/\text{s}$
    - $Q_{5\%} = 436.0 \text{ m}^3/\text{s}$
  - through Crna Trava
    - $Q_{1\%} = 326.0 \text{ m}^3/\text{s}$
    - $Q_{2\%} = 264.0 \text{ m}^3/\text{s}$
  - At river confluence
    - $Q_{1\%} = 142.0 \text{ m}^3/\text{s}$
    - $Q_{2\%} = 121.0 \text{ m}^3/\text{s}$

“Vlasina” reservoir was built in the upper part of the Vlasina river basin for the purposes of the system of Vlasina hydro power plants located along the river Vrla and flowing into South Morava. The river basin is characterized by steep slopes and high-mountain peaks. The natural terrain characteristics are conditioned by geological structure that is diverse and with inhomogeneous distribution along the river basin. The bigger part of the river basin is characterized by forests on steep slopes and mixed hilly and mountainous management implemented during the erosion protection development fifty years ago. Barren land is not so represented but it still exist.

Flooding of river Vlasina in 1988 affected the Vlasina river basin and part of the Nisava river basin. According to the degree of destruction and affected surface area it still represents a disaster of unprecedented scale. Numerous bridges were destroyed and damaged as well as parts of the main and regional roads, structures for water supply of Nis, Babusnica and Vlasotince, energy structures and other infrastructure. A great number of houses was demolished or damaged. The central part of Vlasotince was destroyed. Flooding from November 2007 once again greatly damaged the Vlasina river basin. The greatest damage occurred due to the collapse of bridges and roads as well as the destruction of water supply facilities for Nis, Babusnica, Bela Palanka etc.

#### 1.2. Works executed on development of the Vlasina river-bed and river basin

Regulation of Vlasina river was done in phases according to the project “Kosovoprojekt”, OOUR “Hidrotehnika”, Belgrade in August 1979. Regulation works were executed on 416 m at the section from km 1+478.558 to km 1+894.89. The construction continued in 1982 with the regulation works on 699 m at the section from km 2+399 to km 2+800 (right river bank) and from km 2+300 to km 2+598 (left river bank). The next phase of construction took place in 1984 and regulation works were performed on 911 m, at the section from km 1+894.89 to km 2+299 (left river bank) and from km 1+894.84 until the quay wall on the right river bank.

A dam (barrier) was built in Vlasotince in 1982 according to the “Main Design for the Barrier on the Vlasina River”; designing office “Kosovoprojekt”, OOUR “Hidrotehnika”, Belgrade from August 1979. The Vlasina river bed was designed for  $Q_{1\%}=628 \text{ m}^3/\text{s}$ ,  $Q_{2\%}=525 \text{ m}^3/\text{s}$ . In the documentation “General Design for Erosive Areas Development” done by the Institute for Water Management “Jaroslav Cerni” it is stated that regulation is not done according to the design, that the cascades were made and that the fall of the regulated bed was altered. After the disastrous flood Creager profile was also made in Vlasotince. In the Vlasina river bed passing through Crna Trava a regulation was performed from rock in cement mortar with cleaning of the deposited sediments. The damage caused by the high waters was rehabilitated.

The following works were performed on tributaries in the Vlasina river basin:

- Barriers in the Tegosnica river bed
- Barriers in the Krusevicki stream bed
- Barriers in the bed of Brajkov dol
- Barriers in the Orasac stream bed
- Barrier system in Lukaceva valley
- Barriers in the Crnotravacki stream bed
- Barriers in the Stojkovacki stream bed
- Barriers in the Prilepacki stream bed
- Regulation in the bed of Puskin valley in Vlasotine
- Regulation in the Konopnicka river bed in Konopnica

On the river Luznica that is the right tributary of Vlasina a regulation was made through Babušnica. Furthermore, works were conducted on regulation of Bucjanka into Radinjinca and regulation of Ravna river into Strelca. Numerous barriers were set up in the river bed of Bucjanka, Masuricka river, Ravna river, Rajjinska river, Balvan stream and Zli Do stream.

### 3. GOAL AND TERMS OF REFERENCE

- The designed works aim to protect the river basin from erosion and prevent the torrential floods with the application of the *Concept of Integral Development of Torrential Sub-river Basins*. The designed works should include biological, bio-technical and technical works.
- The biological works should involve the combination of the basic elements of vegetation: grass, shrubs and tall vegetation in order to prevent the erosion of the surface layer, reduce the surface runoff and increase the forest coverage coefficient.
- Bio-technical works, depending on topographic conditions and geo-mechanical characteristics, should involve the possibility to terrace the sides of valleys, to make steps, contour trenches, wattle-works etc.
- Technical works should involve the construction of stockpiling-consolidation barriers, gabion barriers, thresholds, cascades, line regulation structures etc. In case there is a need to design technical works in the river bed itself, the planned structures should be tied up to the existing regulations and structures, and the project documentation should be harmonized with the existing technical documentation for the development of the Vlasina river-bed.
- Terms of reference involve the production of technical documentation for the Execution Design for Protection from Erosion and Torrents in the Vlasina river basin. Before the Execution Design there should be the production of technical documentation for the Conceptual Solution in order to obtain the location requirements and then comes the Design for Construction Permit for Protection from Erosion and Torrents in the Vlasina river basin in order to get the construction permit.

### 4. MAPS FOR DESIGN

#### 4.1. Existing technical documentation

- „General design (I phase) – Design for urgent works for reduction of damage from erosion and torrential floods in the Vlasina and Nišava river basins”, produced by the Institute for Water Management “Jaroslav Černi” Belgrade, in 2011.
- The “General design with pre-feasibility study for the development of South Morava from Grdelica to confluence with Western Morava” produced by the Institute for Water Management “Jaroslav Černi” Belgrade, in December 2005 provides the maximum annual discharge values for Vlasina river:  $Q_{0.01\%}=2440 \text{ m}^3$ ,  $Q_{0.1\%}=1608 \text{ m}^3$ ,  $Q_{1\%}=759 \text{ m}^3$ ,  $Q_{2\%}=591 \text{ m}^3$ ,  $Q_{5\%}=436 \text{ m}^3$ ,  $Q_{10\%}=304 \text{ m}^3$ ,  $Q_{20\%}=219 \text{ m}^3$  и  $Q_{50\%}=63.4 \text{ m}^3$

#### 4.2. Survey maps

Survey maps should be made in accordance with the current regulations in order to provide the data for the design and execution of works on the structures. For production of technical documentation in question the cadastral and topographical plans will be used at the appropriate scale, to show the position of the structures: technical, bio-technical and biological and the detailed layout drawings for the design of structures.

#### 4.2.1. Survey maps for designing technical works

For desing of technical works (transverse and longitudinal) the following is required:

- To set up an operational polygon along the right or left bank (according to the situation in the field) of the treated river section and its breakpoints should be linked to the state survey network.
- To survey the cross sections from the polygon points, approximatively perpendicularly to the existing flow, at a distance of 20 m by terrain breakpoints, water breaches, highest depths of the river-bed and high banks, encompassing the width of around 40 meters (20 meters left and 20 meters right from the axis of the existing course).
- To make a layout drawing based on the data of the surveyed detailed points i.e. to map the surveyed detailed points and form a detailed location plan showing the river-bed by water breaches and banks for positions, of all structures on the riverbanks.
- The layout drawing must contain cadastral land plots. Water soil should be separately marked on the drawing. All points should be connected to the state survey network.
- The layout drawing and the cross sections must have the marked water supply network, sewage, postal cables with their elevations and all other installations if they exist. The existing structures like local and forest road, gaps etc. should be surveyed in detail.

#### 4.2.2. Survey maps for designing bio-technical works

While designing the bio-technical works it is necessary to provide the exact location (xy coordinates) of the planned structures on the layout drawing (cadastral-topographic map).

#### 4.2.3. Survey maps for designing biological works

While designing the biological works it is necessary to show the surface area on which the protective biological works of afforestation and grass cultivation are planned on the layout drawing (cadastral-topographic map). For designing the biological works on the state-owned land (forest and agricultural land) the planning documents should be used (The Fundamentals of Forest Management and Agricultural Land Management Plans).

### 4.4. Geological maps

For the purposes of producing technical documentation, a borehole or an open pit should be made in places of future barriers 3 meters deep from the existing bottom of the river-bed. For separate sections -layers, samples should be taken and tested in the laboratory. Interpretation of obtained results on geotechnical characteristics of the sections that appeared should be shown in a separate study that is the integral part of technical documentation for protection from erosion and torrents in the Vlasina river basin. The geotechnical study should contain:

- overview and explanation of the investigative works programme,
- detailed overview of results obtained through laboratory testing,
- overview of geological and hydro-geological features of terrain,
- overview of geo-technical features of terrain on locations of designed structures,
- calculation of static and filtration stability of soil and defining the conditions for foundation engineering and construction of technical structures for protection from erosion and torrents.

### 4.5. Hydrological maps

For the purposes of producing technical documentation, it is necessary to perform hydrological calculation of high waters from different return periods for watercourses within Vlasina river basin. This calculation should be done with the newest methods for un-investigated river basins using a solid series of data from the closest rain gauge stations for  $Q_{1\%}$ ,  $Q_{2\%}$  and  $Q_{5\%}$ . For calculated water  $Q_{1\%}$  should be adopted. The opinion of Republic Hydro-meteorological Service of Serbia is required for the obtained results.

### 4.6. Hydraulic maps

Based on the completed geodetic, geological and hydrological mapping as well as the obtained required opinions, requirements and consents from the competent institutions, a hydraulic calculation should be done with the previous analysis of the existing terrain and structures on the said sections, with calculated high water. Based on

the calculated water level and longitudinal falls, the structures for retaining the eroded sediments should be designed as well as the stabilization of the bottom of the river –bed, having in mind the characteristics of the Vlasina River, the damage caused by torrential watercourses and sediments.

## 5. ACTIVITIES ON DRAFTING DESIGNS AND THE CONTENT OF DESIGNS

### 5.1. Conceptual solution

Conceptual solution for protection from erosion and torrents in the Vlasina river basin should contain:

- The main book of conceptual solution consisting of the basic content from Annex 1, *Rulebook on content, manner and procedure for preparing and performing control of technical documentation by class and purpose of the structure* (“Official Gazette of RS”, number 23/2015):
  - Data on name and address of the Investor for the building of structure
  - Excerpt from the court registry for the company that developed the design
  - Authorizations for designing for persons participating in the design development
  - Decision on determining the main and responsible designer
- General documentation of Conceptual solution consists only of the mandatory content specified in Article 28 of the *Rulebook*, from Annex 9.
  - Textual documentation of Conceptual solution contains the technical description of designed structures
  - Numerical documentation of Conceptual solution contains the overview of structures with their use and number of functional units
  - Graphic documentation of Conceptual solution contains the graphic annexes at appropriate scale:
    - layout drawing with the position of structures on the location, shown outline, dimensions, characteristic elevation points, distance from the neighbouring plots and neighbouring structures (1:1000–1:200),
    - plans, characteristic cross-sections and appearance of structures (1:500–1:200).
  - Graphic documentation of Conceptual solution for line regulation structures contains the graphic annexes at appropriate scale:
    - layout drawing and longitudinal profile of the route (1:25000–1:2500),
    - general dispositions of larger structures,
    - characteristic cross sections (1:100–1:25).
- Conceptual solution for engineering structures contains only those parts that are necessary for issuing of location requirements, according to the rules of profession.
- Obtaining the complete documents (information on location, copies of plans, certificate of title, topographic - cadastral mapping etc.) necessary for issuing location requirements.
- Obtaining of location requirements.

### 5.2. Design for Construction Permit and Execution Design

Design for construction permit is developed in order to obtain the decision on construction permit. The design for construction permit has to contain the statement of the main designer, responsible designer and the person executing technical control, confirming that the design was done in accordance with the location requirements, regulations and rules of profession.

**Execution** project is developed for executing the construction works. The **Execution** design is a set of harmonized designs determining construction, technical, technological and exploitation features of the structure with equipment and installations, technical, technological and organisational solutions for the construction of structure, investment value of the structure and conditions for maintenance of the structure. The **Execution** design has to contain the statement of the main designer and responsible designers confirming that the design was done in accordance with the location requirements, construction permit, design for construction permit, regulations and rules of profession.

Design for Construction Permit and Execution Design for Protection from Erosion and Torrents in the Vlasina river basin should contain:

- General documentation for the design,
- Terms of reference verified by the Investor,
- Textual documentation:

- Technical report:
  - Description of river basin and river bed
  - Basic parameters of the river basin
  - Overview of the main problems in the river basin, on the main watercourse and tributaries
  - Hydrographic features of the river basin (hydrographic map)
  - Geological features of the river basin (geological map)
  - Pedologic features of the river basin (pedologic map)
  - Manner of soil usage (Map of soil usage)
  - Erosion in river basin (Map of erosion)
- Bill of quantities - BoQ
- Estimated BoQ
- Technical conditions for execution of works
- Numerical documentation:
  - Coordinates and levels of geodetic points that will be used during the construction
- Workplace safety measures
- Measures for prevention of negative impacts on the environment in the period of works execution
- Survey maps (topographic - cadastral maps)
- Clear map of the area at the scale of 1: 25 000
- Hydrologic calculation (maximum water discharge)
- Calculation of production and carrying through the sedimentation
- Concept of designed solutions with explanation for adopted solutions for protection from sedimentation
- Order of executing works
- Graphic annexes:
  - Layout drawing, scale of 1:1000
  - Longitudinal section, scale of 1:100/1000
  - Cross section, scale of 1:100
  - Drawings of transverse structures scale of 1:100
  - Structure details, scale of 1:20

**NOTE:**

- The Investor does not have at his disposal other technical documentation specified in the part 4.1. The existing technical documentation. The Investor had insight into the stated technical documentation during the work on individual cases. It is presumed that technical documentation is to be found at local governments or competent public enterprises that were entrusted with the tasks from this area.
- All necessary requirements for design stipulated in the Law on Planning and Construction, will be obtained by the designer on behalf of Public Water Management Company “Srbijavode” at his own expense, which involves the preparation and submission of request and production of offprints and documents needed to get the requirements, opinions and consents that they will obtain with authorization (proxy) issued by the PWMC “Srbijavode”. The costs of the document preparation will be calculated in the price of production of technical documentation through the specification of works compliant with the terms of reference.
- The financier is obliged to perform the technical control of project documentation after the production of technical documentation for the Design for Construction Permit so that after the commission for technical control provides a positive opinion the designer may continue to obtain other acts (water consent) and construction permits and start with production of the **Execution** Design.

The Design is made in 6 printed copies and 2 digital copies on CDs. The digital copies are submitted so that one copy is in PDF format and the other contains the text in Word, tables in Excel, databases in Access, drawings in DWG and spatial data in Shape format. The design is accompanied by submitted originals of all collected requirements, consents, opinions, solutions and maps (copies of plans and certificates of title) during the production of technical documentation.

Deadline for the production of design is one year from the day of mutual signing of the contract for the production of design.

**II. Activities:**

Activities include, but are not necessarily limited to these tasks:

- Before submitting the offer it is **mandatory** to perform introduction meeting in order to note the type and scope of work required for the developing Technical Documentation.

- Desk research and consultations with stakeholders during the initial activities

### III. Inputs:

Contribution of the UNOPS Project Team:

The UNOPS Project Team shall ensure that the selected designer is forwarded all the available documentation, facts and information about the site

Contribution of the Consultancy:

- The Consultancy must meet all the mandatory criteria specified in ANNEX B

Other Conditions for Key and Non-key experts

- One of the Key Experts shall be appointed as a Team Leader.
- Due to a large number of stakeholders/beneficiaries of the proposed Technical Documentation, and the need to harmonize the proposed measures with the spatial plans, as well as, to implement the solution in the Water Information System (WIS) of Serbia, it is expected that the documentation will be prepared in the Serbian language, while the final report will be prepared in English, as well.
- The Consultancy should be registered in Serbia with a sufficient number of employees due to the relevance for the provision of the all phases of Technical Documentation.
- Excellent communication skills and stakeholder management experience

### Timing:

The consultancy will be conducted over the Twelve month period from May 2016 to end April 2017. Time Schedule is conditioned by beneficiary obligations (according time schedule – Annex 3)

### Reporting:

Inception Report after 3 weeks of being contracted

Interim Report

Final Report

Updates as requested