Request for proposal
Provision of Technical Documentation for Dams with Accumulations „PAMBUKOVICA“ on Ub River and „KAMENICA“ on Tamnava River
RFP No. UNOPS-SFRS-2015-

Section 4: UNOPS terms of reference

I. Background:

“Serbia Rehabilitation Support after Floods” project has been prepared in cooperation with the Government of the Republic of Serbia, and close coordination with its European Integration Office (SEIO), and the Norwegian Ministry of Foreign Affairs, as a response to devastating floods that hit Serbia in May 2014.
The overall objective of this action is to contribute to the efforts of the Government of Serbia to support the municipalities affected by May 2014 floods to restore living and working conditions. By extending assistance for rehabilitation of public buildings of primary importance (kindergartens, schools, health and cultural institutions) this project will directly aid the recovery process in the municipalities that suffered from the floods.
The specific objective of the project is to support the citizens of the municipalities affected by the floods to restore their living conditions, and to establish normal functioning of kindergartens, schools, health and cultural institutions.
The project will deliver five results:

- **Result 1**: Working conditions restored to normal in up to 12 kindergartens and schools in municipalities affected by the floods
- **Result 2**: Provision of services restored to normal in up to 18 health care institutions affected by the floods
- **Result 3**: Functioning of up to five cultural institutions affected by the floods restored to normal
- **Result 4**: Additional equipment provided for up to eight schools that are reconstructed from other funding sources but not fully equipped.
- **Result 5**: Enhanced capacities of the Government of Serbia Office for Flood Affected Areas Assistance and Recovery to manage and monitor recovery process in the flood affected municipalities

The final beneficiaries of the action are Public water management company JVP Srbijavode, Kolubara Mining Company (Kolubara MC), Ministry of Agriculture and Environment, The City of Belgrade (municipalities: Obrenovac and Lazarevac,), Koceljeva, Ub, Lajkovac, Mionica and Ljig, Local businesses, citizens, professional circles and media outlets.

The project will closely cooperate with the key stakeholders in order to achieve the planned results: the Government of Serbia Commission for Damage Assessment, the SEIO, the Office for Flood Affected Areas Assistance, the line ministries (the Ministry of Construction, Transport and Infrastructure, the Ministry of State Administration and Local Self Government, the Ministry of Health); local self-governments, and the Public water management company JVP Srbijavode.

II. Justification

One of the Project’s results is provision of specific expertise regarding flood response/recovery identified by the Office.
Development of Technical Documentation for two dams with accumulations:

1. “**Pambukovica”** on Ub River (the right tributary to Tamnava River belonging to Kolubara river basin) in Municipality Ub and
2. ”**Kamenica”** on Tamnava River (the left tributary to Kolubara River) in Municipality Koceljeva

both for multifunctional purposes will contribute to the reduction of flood related risk in the Kolubara River Basin as well as for water supply of the areas and irrigation of agricultural crops.
The assessment of the contribution of the dams and reservoirs to the national flood protection system as well as for water supply and irrigation of agricultural crops have previously been made in Water management master plan of Kolubara river basin from 1977, where those two dams were recognised as the crucial facilities for flooding management, water supply, improvement of the quality of water in low level waters period and irrigation of agricultural crops.

- **The Pambukovica dam** is envisaged to be located approximately 15 km upstream from Ub municipality and represents the only location in this zone suitable for dam construction and reservoir and the only location that has sufficient capacity for flood prevention and water supply for irrigation and other purposes. There are no significant facilities in the future accumulation area. Approximately 2.5 km upstream from the barrier place river Ub is transected by regional road Valjevo – Šabac, the most significant road in this area. After the floods in May 2014, when river Ub caused great damage to the infrastructure in Ub municipality and to the agriculture land, the activities for planning and design of facilities with the primary purpose of flooding protection have been intensified. Pambukovica dam is the most significant facility with this purpose in this part of the basin, upstream from Ub Municipality. The probability of a 100-year flood volume is estimated to approximately 10 million cubic meters of water, and Pambukovica dam enables a retention space of similar volume (reservoir holding approximately 15 million cubic meters of water). In accordance with contemporary water management policy to plan and construct dams and reservoirs as multipurpose facilities, Pambukovica dam will not only have a basic role in protection against flooding, but will also enable irrigation of agriculture land and the usage of water for other purposes.
- **The Construction of Kamenica dam** is located approximately 10 km upstream from Koceljevo Municipality, between Kamenica and Goločelo and represents the only location in this zone suitable for dam construction with accumulation of sufficient capacity for flood prevention and water supply for irrigation and other purposes. There are no significant facilities in the future reservoir space except the regional road Koceljeva-Osečina which will be in the influence zone of the future dam due to low level of the road compared to the Tamnava water level. Kamenica dam enables a retention space for approximately 15 million cubic meters of water. The development of this Project will contribute to the development of the national, regional and basin-level Flood Risk Management Plan and to contribute to the reduction of flood related risk in the Kolubara River Basin specifically to protection of Municipality Koceljevo as well as reduce the risk for future flooding for the Kolubara mines and Obrenovac Municipality

III. Immediate objective(s):

To assist local municipalities in response to disasters caused by floods by preparing Technical documentation for future funding of the dams" Pambukovica" and "Kamenica" - facilities for flood protection and for the local water supply for irrigation and other purposes.

IV. Scope of consultancy

The design company will, under the direct supervision of UNOPS Infrastructure advisor and the SERBIA FLOOD REHABILITATION SUPPORT project team engineers and overall supervision of SERBIA FLOOD REHABILITATION SUPPORT Project manager, develop the Technical documentation, which, according to the Law on Planning and Construction (and other relevant regulations) is required for the building permits for the dams and accumulations "Pambukovica" and "Kamenica"

The Designer will produce:

1. Conceptual Design with necessary field studies described in Annexes 1 and 2
2. Preliminary design with Feasibility Study
3. Design for the building permit

4. Environmental impact assessment all in accordance with content defined in the Law on environmental impact assessment and in the already existing Strategic Environmental impact assessment Study, which is part of the Spatial Plans for Ub and Koceljeva that will be provided;
5. Detailed Design for construction works

The purpose and the general contents of technical documentation for each of the aforementioned stages is defined by Rulebook on contents, procedure and manner of inspection of technical documentations by class and purpose of facility ("The Official Gazette of the Republic of Serbia", No. 23/2015 published on 2nd March 2015) and Rulebook on amendments and additions to the Rulebook on contents, procedure and manner of inspection of technical documentations by class and purpose of facility (published in "The Official Gazette of the Republic of Serbia", No бр.77/2015 on 9th September 2015, which came into effect on 10th of September2015) – hereinafter the Rulebook.
For the facilities in question, the conditions for location permit and building permit are issued by the Ministry in charge of urban planning (facilities listed in Article 133, the Law on Planning and Construction).
The purpose of the preparation of technical documentation is creating conditions for issuing a building permit.

1. Conceptual design

Conceptual design is a requirement for the location conditions. According to the Law on Planning and Construction "location conditions are issued by resolution, for facilities for which building permits are issued by this Law, and which have all the conditions and data required for preparing the technical documentation, in compliance with the valid planning document" (location conditions can be issued for several cadastral parcels, on condition that the investor is obliged to join the cadastral parcels before issuing location conditions in accordance with the Law).
Conceptual design should contain basic spatial and technical-technological characteristics of the facility with the purpose of examining its interaction with the environment – review of planned concept of the facility, with the review and listing of all relevant data for location conditions.
The main purpose of the Conceptual design is fulfilling all conditions required by regulations for submitting a request and issuing location conditions.

2. Preliminary design with Feasibility Study

Preliminary design is done for the purpose of preparing feasibility study and is subject to state revision (professional control).
Feasibility study determines the spatial, ecological, social, financial and economic justification of the investment for the selected alternative, elaborated by the preliminary design based on which the decision on the justification of investment is made.

The preliminary design comprises compatible designs determining: purpose, position, shape, capacity, technical-technological, functional, and representational properties of the facility and gives a framework for fulfilment of basic requirements for a facility. For facilities listed in the Article 133, the Law on Planning and Construction, preliminary design further elaborates the concept of the facility given in the concept design and the location conditions.
Revision of the preliminary design is performed by the State Revision Committee and it examines the concept of the facility from the aspect of the suitability of the location with a view to the type and the purpose of the facility; the effect on the environment; seismic, geological, technical, traffic, energy and other conditions; technical-technological properties of the facility; technical-technological and organizational solutions for constructions; contemporariness of technical solutions and their harmonization with the development programmes in this area, as well as other conditions required by regulations for construction of a facility.

General purpose of Preliminary design is to determine spatial, environmental, social, market and economic justification of construction of the facility in question. The practical purpose of preparing technical

documentation is to solve all technical issues on a sufficient level of reliability and precision, involving issues which remained unresolved in the previous stage in order to use this technical documentation to prepare the planning documents and continue developing technical documentation in accordance with the Law on Planning and Construction (Main design and Final design).
Preliminary design should determine the suitability of the location regarding the type and the purpose of the facility, the conditions for construction with a view to measures for environmental protection, seismic, geodesy, technical, traffic and other conditions, technical-technological properties of the facility, technical-technological and organizational solutions for construction of the facility and the like.
In that sense, technical documentation in question should be prepared based on performed studies (geodesy, hydrometeorology, geology and the like) and harmonize it completely with the location conditions. Apart from that, Preliminary design should be prepared in accordance with the regulation based on the Law on Planning and Construction and other laws and regulations which directly or in other ways affect the basic requirements for facility, professional rules and the basic requirements for the facility.
Preliminary design should reveal if there is need for additional investigations that should be performed in the following stages of the elaboration of technical documentation.

3. Design for building permit

Design for building permit comprises compatible designs which define the position and the capacity of the facility on the building lot, its functionality with a view to technological and other requirements, spatial shaping, selection of construction system, dimensioning of main elements of construction, general materials selection, installation and equipment, and which fulfil the requirements from the location conditions, basic requirements of the facility etc.
Principal goal of the design for building permit is the acquiring of the building permit.
In accordance with the Law on Planning and Construction, the designs for the building permit are subject to technical control, which will be contracted separately. Technical control of the design for building permit is the report on compatibility with all conditions and regulations contained in the location conditions, the Law and other regulations, technical norms, standards and quality norms, as well as with the measures contained in the report of the State Revision Committee, and compatibility of all parts of technical documentation; compatibility of the design with the results of previous studies; assessment of the appropriate soil for founding of the facility; inspection of the validity and accuracy of technical and technological solutions and the construction solution of the facility; stability and safety; rationality of the project materials; effect on the environment and adjacent facilities.
Designs for building permit should contain appropriate surveys for founding of the facility; analyses of validity and accuracy of technical and technological solutions for the facility and the construction solution of the facility; stability and safety; rationality of the project materials; effect on the environment and the adjacent facilities.

1.1 Content of the Conceptual Design

Concept design should be prepared in accordance with the Rulebook, with view to the fact that it refers to the facility that requires fulfilment of water conditions and consequently should contain the following:

- Main book - Volume 0 of the Conceptual design, according to the contents defined in Chapter 1.1.1
- Conceptual design, according to the contents defined in Chapter 1.1.2.

1.1.1 Main book – Volume 0 of the Conceptual design

Volume 0, that is - Main book of the Conceptual design should be prepared in accordance with the Rulebook and should contain the following:

- Cover page of the Volume 0 of the Conceptual design,
- Contents of the Volume 0 of the Conceptual design,
- Contents of the technical documentation,
- General information about the facility and the location

1.1.2 Conceptual design

Conceptual design (for facilities) should contain all parts required for location conditions, according to the professional rules. Accordingly, for the facility in question this part of the Conceptual design should contain:

- General documentation comprising cover page (with the required contents) and the contents of the conceptual design
- •Conditions on location where the facility will be constructed: morphology, hydrometeorology, psamology and the like.
- **The program of geotechnical field research on the location of the dams "Pambukovica" and "Kamenica" as per Anex 1.**
- The program of geodesic recordings for the purposes of technical documentation for dam and reservoir "Pambukovica" and "Kamenica" as per Anex 2

- Presentation of the spatial and other limitations relevant to the choice and adoption of basic spatial and functional properties
- Water management, balance analyses and adoption of basic parameters of the dams and accumulation (macro location and height performance, class and type of the facility, effects and fulfilment of determined water management functions)
- Selection and presentation of technical solution of the dam, accumulation and dam facilities (which should contain technical description, presentation of the basic parameters of the facility, site layout and disposition plans, maps, characteristic cross sections etc.)
- Presentation of the concept of accumulation protection against erosion (technical works and facilities, biological measures etc.)

2.1 Content of the Preliminary Design and Feasibility Study

Preliminary design should comprise several required parts, namely:

- Volume 0 of the Preliminary Design, according to the contents defined in Chapter 2.1.1.
- The analysis and the presentation of conditions and limitations for the construction of facility, as defined in Chapter 2.1.2.
- Accumulation Design according to the contents defined in Chapter 2.1.3.
- Dam and dam facilities – hydraulic engineering design, the contents defined in Chapter 2.1.4.
- Hydro-mechanical Equipment and Electric Installations Design, the contents defined in Chapter y VI.5.
- Technical Monitoring of the Facility Design, the contents defined in Chapter 2.1.6.
- Accumulation protection against erosion design, the Contents defined in Chapter 2.1.7.
- Construction organization design according to the Contents defined in Chapter 2.1.8.
- Expropriation of land and property, the Contents defined in Chapter 2.1.9.
- Summary bill of quantities, according to the Contents defined in Chapter 2.1.10.
- Feasibility study, according to the Contents defined in Chapter 2.1.11.

2.1.1 Volume 0 of the Preliminary design

Volume 0 of the Preliminary design should be prepared in accordance with the Rulebook and, accordingly, should contain the following:

- Cover page of the Volume 0 of the Preliminary design,
- Contents of the Volume 0 of the Preliminary design,
- Decision of appointment of Chief designer,
- Statement of the Chief designer of the Preliminary design,
- Contents of the technical documentation,
- Information about the designers,
- General information about the facility and location
- A brief technical description

2.1.2 Analysis and review of conditions and limitations for the construction of the facility

This part of the design requires the analysis and the review of conditions relevant for realization of the facility in question:

- Spatial, water management, planning and other restrictions on the partition, in the zone of the reservoir and in the river basin with special emphasis on the description of compliance with the location permit

- Hydrological and meteorological conditions:

  - Review of climate regime and meteorological conditions and parameters; (rain, snow, wind, air temperature, analysis of days with extremely low and high temperature, evaporation from water surfaces, etc.)
  - Review of runoff water and water balance in the basin;
  - The flow regime at hydrological stations and relevant profiles for historical hydrological sequence (medium series of daily, monthly and annual data, daily flow duration curve, the probability of occurrence and distribution of intra flows);
  - Low water regime at hydrological stations and relevant profiles for historical hydrological sequence (probability of occurrence of the minimum annual flow, duration of low waters, the probability of occurrence of minimum mean monthly flow and defining a guaranteed flow);
  - High water on the relevant profiles for historical hydrological sequence (probability of occurrence of maximum annual flow, hydrograph high waters probabilities.

- The engineering geological, geotechnical, hydrogeological and seismological conditions:

  - The review and assessment of used engineering-geological, hydrogeological, geotechnical and other investigations, as well as the results of completed research works for the purposes of the Preliminary design;
  - Review and analysis of geological structure of the wider area;
  - Review (and analysis) of geotechnical (engineering-geological and hydrogeological) conditions for the location of the facilities;
  - Review and analysis of geotechnical (engineering-geological and hydrogeological) conditions in the area of accumulation, especially water permeability reservoir conditions, as well as the evaluation of slope stability;
  - Review and analysis of reserves and quality of local natural and recyclable building materials;
  - Review (and analysis) of potential sites for the disposal of dredged material;
  - The review and analysis of seismic and tectonic conditions in the analysed locations

The report should contain textual and graphic part. Graphic part should include geological maps and relevant geological profiles, appropriate for the level of the technical documentation

- Psamology conditions:

  - Review and analysis of relevant maps and investigations (topography maps, hydrology maps, geological and petrological composition of the terrain, usage of soil etc);
  - Analysis of surface runoff and water balance in the area of the river basin;
  - Analysis of the sediment load and sediment deposition in the accumulation.

2.1.3. Accumulation Design

This part of the design requires the analysis and the review of the following:

- Criteria, contacts, mandatory discharge, requirements according to the Law on Water;
- Water management, balance sheet analysis and dimensioning of the reservoir space (dead space, usable volume, volume for receiving floods);
- Review of basic parameters of accumulation (typical levels: minimum, normal and maximum gradient, surface and volume curves) and water management effects;

- Technical solution of protective structures (referring to the possible need to protect the regional road Valjevo – Šabac or regional road Koceljeva-Osečina);
- Evaluation (preliminary analysis) of slope stability of the accumulation;
- Graphic documentation: clear map of the reservoir, with marked elevations of normal slowdown and all other structures, facilities and systems (roads, settlements, etc.).
- Programme of additional research works (if necessary).

2.1.4 The dam and dam facilities – hydraulic engineering design

This part of the design requires the analysis and technical review of the following:

- Design criteria for each section of the design documentation

Design solution of the dam and evacuation facilities (including the analysis of alternatives and the selection of the type of facilities): dams / barrier construction; injection curtain, facilities for evacuation of high water - dressing and waterfall, bottom outlet, outlet for a guaranteed flow, water intake, diversion tunnels);

- Solution for the access road to the dam, water intake and other important points of the facility;
- Hydraulic analysis and calculations of hydraulic structures;
- Static analysis and calculations of facilities;
- Bill of quantities of main construction works;
- Graphic documentation: clear map/ dam and reservoir disposition, with marked elevations of normal slowdown and other structures and systems (roads, settlements, etc.) and technical drawings of the dam and other facilities with a sufficient number of maps and investigations and characteristically cross sections for a precise bill of quantities of works and its control (partition structures, evacuation facilities, water collection structure etc.).
- Programme of additional research works (if necessary).

2.1.5 Hydro-mechanical Equipment and Electrical Installations Design

This part of the design requires the analysis and the review of the following:

- Solution for spillway equipment and bottom outlet (layout, type and characteristics)
- Solution for water collection equipment for water supply (layout, type and characteristics);
- Specification and an estimated cost of hydro mechanical equipment;
- The scheme and concept, layout, equipment selection and calculations, description of the elements of electrical installations;
- Indoor, outdoor and emergency lighting, description and disposition representation;
- Solution for grounding and lightning protection systems;
- Analysis of the connection of the facilities to the network
- Theoretical drawings and single line diagrams of electrical equipment and
- Specification and cost estimate for electrical equipment and installations.

2.1.6 Technical observation of facility design

Monitoring the behaviour of facilities during operation/work requires technical observation project which includes:

- The type of sizes to be monitored;
- The concept of technical surveillance solutions;
- General requirements for the installation of instruments;
- Equipment specification
- Bill of quantities;

- The dynamics of the measurements and observations in individual phases of construction and operation;
- Technical drawings and cross-sections of the dam and dam facilities with planned arrangement of instruments and devices for technical surveillance.

2.1.7 Accumulation protection against erosion Design

This part of the Preliminary Design, referring to the protection of the accumulation against erosion should contain the following:

- Concept of the solution for protection of the accumulation against erosive sediments,
- Hydraulic and static calculations,
- Bill of quantities for technical and biological works separately,
- Effects of construction works on the lifespan of the reservoir and;
- Necessary graphic attachments.

2.1.8 Site Organization Design

This part of the Preliminary design referring to Site Organization should contain the following:

- Preparatory works: structures for construction and housing (construction site facilities, warehouses, workshops, dormitories with related infrastructure); borrow pits of construction materials; construction site temporary roads for construction works; dump for dredged material with the access roads, etc;
- The concept of the river diversion during construction;
- The concept and technology of major works;
- Dynamic plan of works;
- Unit prices of major construction work, the calculation of the preparatory works;

2.1.9 Expropriation of land and property Design

This part of the Preliminary design, referring to the expropriation of land and property, requires the identification and classification of property and land which will be come within the zone of influence of the construction and exploitation of property, and perform the estimate of costs for temporary and permanent expropriation. Unit prices of expropriation should be adopted based on the current market data. Actual expropriation activities are the obligation of the Beneficiary/the Owner.

2.1.10 Summary Bill of quantities

This part of the Preliminary design requires a bill of quantities of works and costs:

- Bill of quantities for construction works,
- Bill of quantities for equipment and installations (with specifications),
- Bill of quantities for technical observation of the facilities (with specification of equipment),
- Institutional investment (costs of expropriation, research and design / consulting services, supervision and costs of the investor).

The report in question should show the appropriate recapitulation of all investments.

2.1.11 Feasibility study

Feasibility study is done in accordance with the Rulebook on the contents, scope and manner of producing prefeasibility study and feasibility study for construction of facilities („The Official Gazette of the Republic of Serbia", No. 80/2005) and should contain specifically:

1. Main data on the investor and the authors of the study
2. Introduction

3. The tasks and the purpose of the investment
4. Description of the facility
5. Analysis of the development opportunities of the investor
6. Methodology basis used for the production of the study
7. Technical-technological solution in the Preliminary design
8. Market aspects
9. Spatial aspects
10. Environment aspects
11. Economic costs
12. Economic gains - Benefits
13. Financial efficacy with the assessment of profitability and income statement
14. Social-economic analysis and assessment
15. Analysis of sensitivity and investment risks
16. Analysis of financing resources, engagements and dynamics
17. Analysis of organizational and staffing potentials
18. Conclusion on justification of the investment

3.1. Contents of the Design for building permit

Starting from the aforementioned objects and objectives, Design for building permit should contain the following parts:

- Volume 0 for building permit, according the contents defined in section 3.1.1.
- Review of conditions and limitations for the construction of the facility, according to the contents defined in section 3.1.2;
- Accumulation Design, according to the content defined in section 3.1.3;
- The dam and dam facilities - Hydro Design, according to the contents defined in section 3.1.4;
- Design of the Hydro-mechanical Equipment and Electrical installations, according to the contents defined in section 3.1.5;
- Design of the Technical Observation of Construction, according to the content defined in section 3.1.6;
- Site Organization Design, according to the content defined in section 3.1.7;
- Summary Bill of Quantities, according to the content defined in section 3.1.8;

3.1.1 Volume 0 for building permit

Volume 0 for building permit, should be made in accordance with the Regulations and, accordingly, should contain the following parts:

- Cover page of Volume 0 for building permit,
- Contents of Volume 0 for building permit,
- A decision on the designation of the Chief designer,
- Statement of the Chief designer of the project for building permit,
- Statements of authorized persons
- Contents of technical documentation,
- Information on designers,
- General information on the object and location,
- Copies of obtained consents, if they are prescribed by Law and
- A brief technical description with special focus on compliance with the Location Conditions

3.1.2 Review of conditions and limitations for the construction of the facility

In this part of the project a display of the conditions and limitations relevant to the realization of the object, should be made:

- Spatial, water management, planning and other restrictions on the partition, in the zone of the reservoir and in the river basin with special emphasis on the description of compliance with the Permit

- Hydrological and meteorological conditions:

    - Review of climate regime and meteorological conditions and parameters; (rain, snow, wind, air temperature, analysis of tropical and frosty days, evaporation from water surfaces, etc.);
    - Review of runoff water and water balance in the basin;
    - The flow regime at hydrological stations and relevant profiles for the historical hydrological (medium series of daily, monthly and annual data, daily flow duration curve, the probability of occurrence and distribution of intra flows);
    - Low water regime at hydrological stations and relevant profiles for the historical hydrological (probability of occurrence of the minimum annual flow, duration of low waters, the probability of occurrence of minimum mean monthly flow and defining a guaranteed flow);
    - High water on the relevant profiles for the historical hydrological sequence (probability of occurrence of maximum annual flow, hydrograph high waters probabilities.

- The engineering geological, geotechnical, hydrogeological and seismological conditions:

    - The review and appraisal of used engineering-geological, hydrogeological, geotechnical and other bases, as well as the results of completed research works for the purposes of this preliminary design;
    - Review (and analysis) of geological structure of the wider area;
    - Review (and analysis) of geotechnical (engineering-geological and hydrogeological) conditions in the premises;
    - Review (and analysis) of geotechnical (engineering-geological and hydrogeological) conditions in the area of accumulation, especially water permeability reservoir conditions, as well as the evaluation of slope stability;
    - Review (and analysis) of reserves and quality of local natural and recyclable building materials;
    - Review (and analysis) of potential sites for the disposal of dredged material;
    - The Study of seismic hazard in the framework of which a review and analysis of seismic and tectonic and seismic conditions in the analysed locations of objects, should be given.

The report shall contain textual and graphical part. Graphic should include geological maps and relevant geological profiles, appropriate to the level of technical documentation.

3.1.3 Accumulation Design

In this part of the project the following review shall be made:

- Criteria, contacts, mandatory discharge, water requirements;
- Water management, balance sheet analysis and dimensioning of the reservoir space (dead space, usable volume, volume for receiving floods);
- Review of basic parameters of reservoirs (typical levels: minimum, normal and maximum gradient, curve of surfaces and volumes) and water management effects;
- Technical solution of protective structures (referring to the possible need to protect the regional road Valjevo – Šabac or regional road Koceljeva-Osečina);
- Evaluation (preliminary analysis) of slope stability in the storage area;
- Graphic documentation: overview of accumulation chart, with marked elevations of normal slowdown and the specification of all other facilities, structures and systems (roads, settlements, etc.).
- The exploration - design works during the construction (incl. Stage of project development for performance).

3.1.4 The dam and dam facilities - Hydro Design

In this part of the design the following review shall be made:

- Design criteria for each area of the project documentation, compliance with the location conditions;
- Solution of dam and evacuation facilities: dams / barrier structures, injection curtains, facilities for the evacuation of high water - dressing and waterfall, bottom outlet, outlet for a guaranteed flow, the project for water supply, facilities for the river diversion during construction);
- Solution for driveway to the dam and other important points of the facility;
- Hydraulic analysis and calculations of hydraulic structures;
- Structural analysis and calculations of facilities;
- Bill of Quantities of main construction works;
- Graphic documentation: overview chart of dam and reservoir, with marked elevations of normal slowdown and the specification of all other facilities, structures and systems (roads, settlements, etc.) and drawings of technical solution of dam and other facilities with a sufficient number of bases and characteristic cross sections for good bill of quantities of works and its control (partition structures, evacuation facilities, gathering body, etc.).
- The programme of exploration - design works during the construction (incl. Stage of project development for performance).

3.1.5 Hydro-mechanical Equipment and Electrical installations Design

In this part of the project the following review shall be made:

- Solution for spillway equipment and bottom outlet (layout, type and characteristics);
- Solution for equipment of clutch for water supply (layout, type and characteristics);
- Specification and an estimate of hydro mechanical equipment;
- The scheme and concept, layout, equipment selection and calculations, description of the elements of electrical installations;
- Indoor, outdoor and emergency lighting, description and dispositional representation;
- Solution for grounding and lightning protection systems;
- Analysis of ways of connection of object to the network
- Dispositional drawings and single line diagram of electrical equipment and
- Specification and calculation of electrical equipment and installations.

3.1.6 Design of technical observation of the structure

In order to monitor the behaviour of structures during the operation the project of technical surveillance should be done, and it should include:

- The type of sizes to be monitored;
- The concept of technical surveillance solutions;
- General requirements for the installation of instruments;
- Equipment specification
- Bill of quantities;
- The dynamics of the measurements and observations in individual phases of construction and operation;
- Characteristic dispositional drawings and cross-sections of the dam and dam facilities with orientation arrangement of instruments and devices for technical surveillance.

3.1.7 Site Organization Design

The Design relating to the Site Organization should include the following:

- Preparatory work: objects of commercial and residential building sites (construction site facilities, warehouses, workshops, residential buildings with related infrastructure); borrow pits of construction materials; construction site temporary roads for construction works; dump for dredged material with the access roads, etc;
- The concept of the river diversion during construction;
- The concept and technology of major works;

- Dynamic plan of works;
- Unit prices of major construction work, the calculation of the preparatory works;

3.1.8 Summary Bill of Quantities

As part of the design a detailed bill of quantities of all works and costs should be given:

- Bill of Quantities for civil works (with Specifications),
- Bill of Quantities for equipment and installations (with Specifications),
- Bill of Quantities for technical surveillance of facilities (with equipment specification)
- Institutional investment (costs of expropriation, research and design / consulting services, supervision and costs of the investor).

In the present report appropriate recapitulation of all investments should be given.

IV. Bases for Preparation of Technical Documentation

Bases for preparation of respective technical documentation, according to this Terms of Reference, are:

1. Present relevant technical and planning documents
2. Results of geological surveys conducted for the Project for performance of the construction of the barrier on the torrential on the River Ub and on the River Tamnava
3. The results of geodesic recordings completed for the Project for performance of the construction of the barrier on the torrential on the River Ub and on the River Tamnava
4. Cadastral bases - cadastral plans and excerpts from immovable property
5. Location (and other) conditions
6. Results of purposeful geotechnical works **which are to be carried out in the framework of Terms of Reference according to the program listed in Annex 1 to this Terms of Reference**
7. Results of geodetic works which **are to be carried out in the framework of Terms of Reference according to the program listed in Annex 2 to this Terms of Reference**

Other requirements:

- Relevant technical documentation should be developed in accordance with the regulations of the Republic of Serbia for these types of buildings as well as prepared well and professionally, in accordance with modern professional achievements and existing national laws that regulate this matter.
- In all stages of project design the designer's duty is to cooperate with the Employer's team of professionals and act according to any comments by the Employer's representative team member as well as to consult with representatives of the Employer, through professional meetings and presentation of solutions and other intermediate results, in order to find optimal project solutions.
- All available details and information necessary for the preparation of project documentation, whose security is the responsibility of the Contractor, shall be made available and used. Contractor shall conduct the procedure and obtain location (and other) conditions in accordance with the legislation.
- During the preparation of technical documentation, the designer will be obliged to submit relevant information in order to develop regional planning documentation.
- Conceptual design should be developed on the basis of existing material and data (Chapter IV, points 1 to 4).
- Geological surveying and exploration works (according to the program listed in Annex 1 and 2) should be carried out for the preliminary phase of the project and used in the preparation of the project for the building permit.

- In the event that during the development of technical solutions architect or professional and technical control of the project come to a conclusion / opinion that the existing fund of information is not enough, the Contractor will consider the need to expand the content and scope of research.
- The designer has an obligation to participate actively in the processes of professional and technical control of technical documentation, including corrections and / or additions to all projects, according to agreed notes and suggestions.
- The design shall be developed and submitted in 6 (six) hard copies and one e-copy on CD
- Technical control consultancy will be selected through separate tender procedure and will be available to the designer from the beginning of designing process.
- The Designer shall act as per technical control instructions as well as the instructions of relevant institutions
- The Designer shall also be under the obligation to obtain the Building permit and all necessary approvals from relevant authorities.

These services should include but not be limited to the following:

- Site visits, which include meeting with relevant officials, analysis of the relevant technical and planning documents should there be any. Prior to starting activities on development of the Technical Documentation, Project programme needs to be defined by selected Designer and approved by the Employer, user and owners representatives.
- The content of the Technical Documentation must comply in full with the Planning and Building Law as well as with all professional standards and regulations. In accordance with the ToR (Project programme), all available facts and information about the locations and the site visit of the facility the designer will prepare detailed Project brief (ToR for the detailed design) The ToR (Project programme) and the Project Brief must be approved and signed by the Employer, user and owners representatives.
- The Technical Documentation shall include but not be limited to the Bill of Quantities for entire Construction with accuracy of +/- 3% and with the clear distinction of stages for implementation reflected in the drawings and in the BoQ, Technical Description including the assessment of the existing state of the building and works to be performed and necessary technical drawings.
- Detailed project design shall be used for purposes of tendering and subsequent execution of works on construction; therefore it is essential that the Design contains all necessary executive details which will enable smooth construction process, with the clear distinction of stages for implementation reflected in the drawings and in the BoQ,
- Designer shell obtained all necessary technical conditions for developing Construction
- Design as well as approvals issued by relevant institutions.
- The Designer shall ensure that the Design shall enable the beneficiary/owner of the building to obtain the necessary permits/licenses where necessary for the commencement of works. Given this, Designer shall provide any documentation needed for building permit or commencement of works for each stage

V. Outputs:

- The Outputs shall be delivered in **five stages**, with progress reports for the activities:

The **First Stage** will presume completion of:

1. Technical description of the facilities for the World Bank in **three weeks** from the contracting date

The **Second Stage** will presume completion of following set of documentation:

2. Expropriation of land and property Design
3. Environmental impact assessment
4. The program of geotechnical field research on the location of the dams "Pambukovica" and “Kamenica” as per Anex 1.

5. The program of geodesic recordings for the purposes of technical documentation for dam and reservoir "Pambukovica" and “Kamenica” as per Anex 2
6. Conceptual design with necessary field studies described in Annexes 1 and 2

The **Third Stage** will presume completion of following set of documentation:

7. Preliminary design with Feasibility Study
8. State Revision of the Preliminary design

The **Fourth Stage** will presume completion of following set of documentation:

9. Design for Building permit with the clear distinction of stages for implementation reflected in the drawings and in the BoQs according to the legal Acts issued by relevant institution, and the technical control of the design for the building permit, and acknowledged by the Office for Reconstruction and Flood Relief.

The **Fifth Stage** will presume completion of following set of documentation:

10. Detail Design for execution of construction work with the clear distinction of stages for implementation reflected in the drawings and in the detailed BoQs

Work plan for above listed activities to align with time schedule which is part of this ToR

- Electronic copy of the Design and estimates and 6 hard copies

The Designs will remain the intellectual property of UNOPS.

VI. 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

VII. 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 six month period from January 2015 to end June 2016. 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

Annex 1 - The program of geotechnical field research on the location of the dams "Pambukovica" and "Kamenica"

PAMBUKOVICA

In the previous period geological research were carried out in order to develop basic geological map sheet Vladimirci 1: 100,000 and a earmarked geotechnical investigations on the site of the future dam.

Data from document Basic Geological Map Vladimirci indicate that, on the intermediate station and the retention area lower triasic limestone exists, for the most part covered with thick, meter, deposits of eluviation-delluvial origin. Limestones are of layered texture, with occurrences of olitic parties, some places are much karstified and modified. In the wider area are not registered larger, regional, fissure structure. On the large, eluviation-talus, blanket frequent smaller gullies are formed, of meter dimensions whose length is 1.0-1.5 km.

Purposeful research found that eluviation-talus deposits reach a thickness of 2.0-3.0 m, and in their basement limestone is spreaded. They build surface, meter thick crust of decay, debris-sandy composition. Alluvial terraced sediments are composed of sandy gravel to gravel sand.Percentage of tiny fraction is not greater than 10%. They build alluvium and low terrace widths up to 30 meters. Thickness is 1.5-3.0 m.

Perceiving the established geological-geotechnical parameters, types of planned facilities, ie. its sensitivity to the geotechnical conditions, the drafting of three exploration wells, conducting investigations in boreholes, geophysical works, laboratory testing and engineering geological mapping of retention space, in order to obtain appropriate geotechnical data for the construction project of the dam and retention basin on the river Ub. Also, investigations on potential borrow pits on geological building materials are foreseen, bearing in mind that it is likely that the project will predict dam made of earth. Exploration works should be done by the project of purposeful geotechnical research, as regulated by normative acts (Law on Mining and Geological Exploration, Official Gazette of the Republic of Serbia No. 88/2011 of 24.11.2011.). Contractor provides Audit for Project of geotechnical research with specific purpose.

The objectives of future research are to define the depth of propagation solid rock, or limestone and that, within these sediments, their quality is estimated, and also thickness of the crust. In addition, forecast of the impact on surface on the stability of banks would be given, which would spell the eventual karst phenomena. Predicted geotechnical investigations should demonstrate the availability of the surrounding terrain for opening of borrow pits for geological and building materials.

Exploration drilling and works in boreholes would determine the quality and depth of propagation of solid, unchanged limestone. The development of eight exploration wells, which would be carried out in the area of

the riverbed of the river Ub is foreseen (two boreholes), and the two banks (three boreholes on each bank), and prognostic depth of each well is about 30 m. Exploration drilling should be adjusted to the required works as it is necessary to perform water permeable (WP) tests, with use of Ligeon procedure (min. 8x10 experiments).

Engineering geological mapping of drilled core would allocate geotechnical environment and the properties, quality, the environment would be macroscopically determined. To envisage 8 Rock quality designation tests (RQD tests)

To execute experiment uniaxial tensile in max 80 samples

Geophysical research would aim to do 2D terrain models along the defined profiles at a speed of elastic waves and geoelectric resistance. Past experiences show that eluviation-talus deposits, alluvial terraced sediments possess the speed of elastic waves of up to 1.0 km / s, rarely 1.0-1.5 km / s, bark of decay is characterized by speed of elastic waves of 1.5-2 5 km / s, a solid rock with speeds of over 2.5 km / s, with speeds of over 3.7 km / s indicate a strong, tough rock. Likewise, the 2D model by geolectric resistance may indicate the quality of the rock mass resistance because of over 10,000 Ωm·m are characteristic of dense, slightly cracked stones while resistances below 100 Ωm·m are inherent to soil and water bearing limestone. In this sense, the vital statistics reveal cavernous zones in limestone.

Refractive tests would be conducted on 4 longitudinal profiles (towards the bed), the two would be in the area of alluvial and terraced terrain, and one on the left, that is. the right side of the partition. Two profiles would be performed in straight forward direction at the distance of 50-100 meters

Geolectric profiles or geolectric scan of terrrain would be conducted in two longitudinal profiles in the sides of the partition (on the same profiles where refraction testing is also conducted).

Engineering geological mapping of retention terrain would register geodynamic phenomena, exogenous, process, and it would result in Engineering Geological Map of retention basins (including the barrier place).

Summarizing the results of previous studies with the results of examination by geophysical and engineering-geological mapping in this program Study on the results of geotechnical studies would be done, and this Study would be a geological basis for the construction project.

Exploratory trenching would be done in the area of alluvial terraced sediments and eluviation-talus deposits, upstream from the barriers. Exploratory trenching in the area of river sediments should be done in a triangular arrangement (left bank, three trenches at an approximate distance of 10-15 m) while the investigation trenching on eluviation-talus deposits would be done by a rectangle measuring approximately 150x35 m (left side, four profiles a distance of about 50 m and two trenches on each side). The walls of the trench would be engineering geological mapped, and representative samples would be taken from excavated material.

Laboratory tests should include testing of samples of solid rocks and soil from borrow pits. The examination of solid rock would determine uniaxial strength, bulk density and porosity of samples tested, and testing of soil from borrow pits would include cover size analysis, determining the limits of plasticity and Proctor's experiment.

Specification of works for Pambukovica

No.	Description of works	M. unit	Quantity
1	Preparation of Project of purposeful geotechnical explorations		
2	Exploratory drilling	m	240
3	Engineering-geological mapping of the core	m	240
4	Rock Quality Designation tests	test	8
5	WP tests	test	30
6	Geophysical refractive tests along the 4 longitudinal and 2 transverse profile	m	1800

7	uniaxial tensile tests	test	80
8	Geophysical scanning of terrain along the two longitudinal profiles	m	600
9	Engineering-geological mapping of the terrain	ha	5
10	Exploratory trenching	piece	11
11	Laboratory testing of soil samples from the borrow pit of alluvial terraced sediments (grain size distribution)	test	3
12	Laboratory tests of soil samples from borrow pits of eluviation-talus deposits (grain size distribution, plasticity limits, Proctor experiment)	test	8
13	Laboratory tests of solid rock (uniaxial strength, bulk density, porosity)	test	3
14	Study on the results of geotechnical studies with technical control		

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Geological investigations were carried out in the previous period in order to develop the Basic Geological Map of the lithosphere Vladimirci, 1:100000. Data from the documentation BGM Vladimirci indicate that at potential dam sites there are Paleozolic metamorphic rocks, Devonian and Carboniferous to be precise. They are covered with several meters thick deposits of the eluvial-delluvial origin. The Paleozoic rock masses are presented by metamorphosed clastic sandstones and shales, with the possible occurrence of limestone. No larger, regional faulty structures were registered in the wider area. Occasional/permanent watercourses, tributaries of the Tamnava River, formed on the thick eluvial-delluvial covering.

On the visit to potential dam sites and retentive area, the findings that the ground is mostly covered with thick deposits of the eluvial-delluvial origin were confirmed, as well as that the basic rock has a relatively thick zone of weathering crust. Due to this, occurrences of instability were also registered, more precisely, the conditionally stable slopes (fossil landslides?).

Engineering geological reconnaissance of the wider area of potential dam sites with the primary aim to detect the occurrences of geodynamic, exogenous processes (landslides, ravines, screes, the occurrences of unstable slopes, etc.) would be carried out at the beginning in order to select the dam profile.

Bearing in mind the type of facilities and expected geological and geotechnical conditions, the investigations are planned that would include exploratory boring, sample testing by the Point Load method, engineering geological mapping of the drill core and surface storage ground, geophysical, refractive investigations, execution of the exploratory cuts and geological mapping of their walls, laboratory testing of soil and rock samples. Investigations would be done by the Design of special purpose geotechnical investigations, as regulated by the normative acts (Law on Mining and Geological Explorations, Official Gazette of the Republic of Serbia No 88/2011 of 24 November 2011). The Client provides the revision of the Design of special purpose geotechnical investigations.

The objectives of the future investigations are, first of all, to define the depth of spreading of solid rocks i.e. preserved metamorphic rocks, and to define the quality of solid rocks by depth. In addition, an estimation of the impact of surface storage on the stability of the banks would be given, any possible occurrences of active and old landslides would be determined. Since most likely a rock-filled dam will be adopted, the objective of the future investigations is also to determine perspective borrow pits of geological building materials.

The aim of the **exploratory boring** is to precisely define the thickness of the Quarternary sediments, to determine the lithological tape and depth of spreading of high-quality, preserved metamorphic rocks, and to obtain samples, specimens for laboratory experiments, by means of drilled core. In addition, the hydraulic conductivity experiments would also be carried out in the bore holes by the Lugeon Test in order to define the sealing curtain.

Geophysical investigations should define the ground by the speed of elastic waves along the defined profiles. In this way, a reliable prognosis of the position and thickness of eluvial-delluvial deposits, the depth of the spreading of the weathering crust, and the quality of metamorphic rocks could be made.

Perform experiments of the uniaxial compressive strength on max. 80 samples

Engineering geological mapping of the ground would be used to register all occurrences of the exogeneous processes, and in the case of detection of the metamorhic rocks outcrops, detailed mapping of fissures would be carried out.

Exploratory cuts would be done mechanically up to the maximum depth of 4.5 m and they would be used to determine the lithological composition of potential borrow pits of geological building materials.

Laboratory testing of soil samples, taken from the excavated material from the cuts, would determine the granulometric composition, plastic properties and optimum moisture of the clay materials.

The exploratory boring would be carried out on eight bore holes (3 in the left side, 3 in the right side and 2 in the area of the bed). The expected depth is 15 meters because it is expected that at that depth compact unchanged metamorphic rocks will be found. The exploratory boring should be adjusted to the quality of the rock mass i.e. it should be done with proper diamond crowns and sufficiently fast rotation in order to avoid excess pressure on the rock and its fracture.

Water permeability tests are carried out in every bore hole upon reaching the solid rock mass (after leaving the Quaternary deposits and the complete fracture of the weathering crust) so the need for 32 experiments is expected.

Engineering geological mapping of the core should provide the litho-structural pillar of each borehole with separated geotechnical environments. The separation would be based on the lithological type, freshness and degree of cracking.

Refractive ground testing would be carried out on 3 longitudinal profiles (in the direction of the bed), on in the area of the bed, one on the left, and one on the right side of the dam site. Two profiles would be carried out perpendicularly at a distance of 50-100 meters from each other.

Engineering geological mapping of the ground would result in the development of the engineering geological map with the assessment of the retention basin slopes stability.

The results of the planned investigations would be presented in the Study of results of performed geotechnical investigations which would define the geotechnical conditions for the preparation of the construction design.

Exploratory cuts would be carried out in alluvial terraced sediments, eluvial-delluvial deposits and Neogene sediments which would, after the engineering geological mapping of the walls of the cuts, define the lithological composition of the said formations, macroscopically define the properties and state of the present lithological units, up to the depth of 3.0-4.5 m. The cuts would be distributed at the vertices and the centre of the rectangle at an approximate distance between the cuts of 15-25 m.

Laboratory experiments would include the testing of the samples of solid rocks and soil from the borrow pits. The investigation of solid rocks would determine uniaxial compressive strength, bulk density and porosity of the samples tested, and the investigation of the soil from the borrow pits would include the granulometric analysis, determination of plasticity and the Proctor test.

Specification of works

No	Description of works	Unit	Quantity
1.	EG reconnaissance of the wider area of potential dam sites with the primary aim to detect the occurrences of geodynamic, exogenous processes (landslides, ravines, screes, the occurrences of unstable slopes, etc.).		

2.	Preparation of the Design of special purpose geotechnical investigations		
3.	Exploratory boring	m	120
4.	Engineering geological mapping of the core	m	120
5.	Hydraulic conductivity experiments	test	32
6.	Geophysical refractive investigations along 3 longitudinal and 2 transverse profiles	m	1500
7.	Testing of rock samples by the test of uniaxial compressive strength	piece	80
8.	Engineering geological mapping of the ground	ha	5
9.	Exploratory cuts	piece	12
10.	Laboratory testing of the soil samples from the borrow pits of alluvial terraced sediments (granulometric composition)	test	5
11.	Laboratory testing of the soil samples from the borrow pits of eluvial-delluvial deposits and Neogene sediments (granulometric composition, plasticity, Proctor test)	test	10
12.	Study of the results of performed geotechnical investigations with technical control		

Annex 2 - The program of geodetic recordings for the purposes of technical documentation for dam and reservoir "Pambukovica" and "Kamenica"

For the development of technical documentation for dam and reservoir "Pambukovica" and "Kamenica" it is necessary to carry out the following geodetic works:

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No.	Description of works	Unit measure	Quantity
1	Geodesic (terrestrial) recording and making of situation plan of the the partition in scale 1: 500	ha	5
2	Aero-Photo (or similar) recording and making of situation plan using the photo grammetric method of the future accumulations, in scale 1: 2500	km2	2

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No.	Description of works	Unit measure	Quantity
1	Geodesic (terrestrial) recording and making of situation plan of the the partition in scale 1: 500	ha	6
2	Aero-Photo (or similar) recording and making of situation plan using the photo grammetric method of the future accumulations, in scale 1: 2500	km2	6