

**BALANCE PROGNOSIES OF SURFACE WATER OF TURIJA  
RIVER CATCHMENT AREA FOR THE CONSTRUCTION OF  
THERMAL POWER PLANT**

**Dr. sc. Izet Žigić,  
Dr. sc. Dinka Pašić-Škripić  
Faculty of Mining-Geological-Civil engineering  
University of Tuzla  
University Street 2, Tuzla  
Bosnia and Herzegovina**

**Mr. Nihad Žunić  
Mr. Safer Mušanović  
RMU Banovići  
Bosnia and Herzegovina**

**ABSTRACT**

*Balance prognosies of surface water in the upper catchment of river Turija, emerged from the need for insight into the total amount of surface and underground waters in the vicinity open pit Turija. Research was conducted in order to estimate a factor for making decisions about the possibility of building thermo-block in this region. This was the first step in determining the balance of water in this part of the river catchment, and represents the basis for creation and implementation of an integrated program of hydrometeorology and hydrological research conditions prevailing in the area.*

**Key words:**

**1. INTRODUCTION**

In the period after the Second world war intensely is performed the construction of energetic objects and develop using electricities on spaces of former Yugoslavia, and thereby and on spaces of Bosnia and Herzegovina. The usage of energy resources firstly started with the exploitation of hydroenergy. A significant capacities on Drina and Neretva were built, and last years has been intensified the construction of mini hydroelectric plants on the higher smaller water current capacities next to 5MW. Intensive, primarily the industrial development, as well as the growth of standard of population, demands growing quantities electricities so are, consideration on given conditions of available capacities, will accept in the production take over thermoelectric power plants ("Tuzla", "Kakanj", "Gacko", "Ugljevik", "Stanari"-in the construction), who and in the future will present the support for the power supply in Bosnia and Herzegovina. The marked shortage of water on specific localities where our significant reserves of coal are, demands the effort that ensures the water for thermoelectric power plants, and that did not disrupt the main growl of water and do not imperil other users of water (Banovići).

For needs of construction of thermoenergetic block in the area of Banovići, activities were started in creating documentations, by what have been performed and previously study surveys of availability of the underground and surface waters, whose basic results have been presented in this work.

## **2. LIMITATIONS IN RESEARCHES**

Exploitation of coal in the area of Banovići has lasted across fifty years, by what for needs of geologic and mining projects, were performed different researches. In once the half life have been performed and systematic observations of hydrometeorologic conditions which has ruled on this area. Unfortunately, this measures stops and quantity of water which stays on excavations, where has been finished the exploitation, or also where still goes on the trough of coal, has been determined indirectly across data draining this space.

And such data are not registered in the continuity, in other words down the whole year, these cannot represent and be reliable when estimating the total summary of assets and liabilities of water.

Because of unfavourable hydrogeological characteristics of sediments which builds this area, do not exist more significant accumulations of ground-waters and larger sources which would form water currents, except the river Turija.

On the open-pit mines where has been finished the exploitation of coal, craters are remaining in which time surface accumulations in waterproof sediments were formed, mainly from atmospheric rainfalls and melting of snow. On the observed area are separated three larger accumulations: Luke, Bešin and Ramići, whose total volume around 1,64 millions m<sup>3</sup> has been kept. Accumulation Luke has the average depth three meters and in her at least accumulates surface waters, while the accumulation Ramići has the average depth of eighteen meters and largest volume of accumulated water from across 1,1 million m<sup>3</sup>.

From the constant waterflows, next to Turija, more significant is Razlaštica and Dubljenac, who pours in in accumulations Ramići and Luke. Summary of assets and liabilities of surface waters in the upper precipitation area of the river Turija, will be made after executed weather and hydrological measurements in the period of minimally one hydrological year, and towards the program research given on the basis of data obtained this previously research. Obtained data in preliminary phase of research indicates that significant quantities of surface waters in existing accumulations are existing, but with unreliable conditions of the continuous intake recharge.

## **3. MAIN CHARACTERISTICS OF COAL MINE**

The coal basin Banovići is situated in the upper confluence of river Spreča, afar from Tuzla 35 km. This bearing of brown coal is the biggest in northeast Bosnia and one from biggest in Bosnia and Herzegovina.

Bearing of coal is situated between the mountain Konjuh, which makes the south border, and Spreča fields which makes the north border. Investment place of coal, obtained hole and surface exploitation, is performed mainly for the thermoelectric power plant Tuzla, industrial manufacturers nationally and abroad, as well as for households.

Area of open-pit mining „Turija“ is situated in the north part of Banovići basin, which is separated from the neighbouring serpentinic reef, whose tops are: Borovica, Stražbenica, Miletina, Osoje and Jelenjak

Towards data of the yearly quantity of rainfalls for Bosnia and Herzegovina, sector zone is realized, towards which basin of Banovići would fall to the zone where middle yearly quantities of rainfalls move within limits from 1000-1200 mm.

Coal mine Banovići in the hydrograph sense is located between the river of Krivaja in the south and rivers Spreča northwards, so appropriately this and all smaller surface flows of this area belongs to confluences of these two rivers. The main recipient of the given field is the river Turija, which generally flows in direction east-west to the junction with the river Seona, when changes the direction of flow in the south-north. Quantity of water in the river Turija is measured between middle and minimal water level (oktobar) amounts about 8 m<sup>3</sup>/mins, then rivers Draganja, Litva, Radina, Oskova across the river Gostilje belongs to Spreča watershed. They make one branch of this watershed, whom water parting of general direction stretches the south-north.

## **4. WATERSHED AREA OF RIVER TURIJA**

Estimated watershed surface which gravitates in the dug up space PK "Turija" brings out 6,8 km<sup>2</sup>.

Development of mining works on the open-pit mining „Turija“ from times of openings to-date as well as the time of suspension of work during the war the precipitation area of open-pit mining has

changed, these necessary executes again the defining of precipitation area for the purpose by more efficient drainings.

On the basis of the geographic conditions and position of mining works the space was limited from which water unites towards the excavation. Analysing of precipitation area of open-pit mine Turija this area can be divided into: north, south and east precipitation area.

The north watershed area includes north side of open-pit mine Turija which on the situation map has been presented with two watershed surfaces (P1 and P2).

The south watershed area includes south side of open-pit mine Turija which on the situation map has been presented by watershed surfaces (P3 and P5).

The east watershed area includes east side of open-pit mine Turija which on the situation map has been presented the by watershed surface (P4).

In the area of PK,,Turija “exist three significant accumulations of water which emerge the execution of mining works on PK,,Turija . In this accumulations exists the inflow of the smaller constant and occasional water currents. These accumulations are lakes: Polje (surfaces 36.707 m<sup>2</sup>), Luke (surfaces from 68.658 m<sup>2</sup>) and Ramići (surfaces from 62.148 m<sup>2</sup>).

Next to these accumulations exist basins for the draining inside the open-pit mine, from which constantly significant quantity of water were scooped using pump facilities.

In water accumulations Polje, Luke and Ramići has been taken measurements and so are established average depths of accumulations, and on the basis of measured surfaces the determination of water quantities in accumulations were defined such as is presented in the table number 16.

*Table 1. Water quantities in accumulations Luke, Bešin i Ramići*

<b>Ordinal</b>	<b>Accumulation</b>	<b>Area (m<sup>2</sup>)</b>	<b>Average depth (m)</b>	<b>Water quantity (m<sup>3</sup>)</b>
<b>1</b>	Luke	36 707	3	110 121
<b>2</b>	Bešin	68 658	6	411 948
<b>3</b>	Ramići	62 148	18	1 118 664
<b>UKUPNO</b>		<b>167 513</b>	<b>-</b>	<b>1 640 733</b>

In mentioned accumulations PK,,Turija “exist constant and occasional influxes of water current. From constant water currents significant is: Razlaštica and Dubljenac which flows in accumulations Ramići and Luke. Occasional appearances of rivers is because of abundant rainfalls and rash melting of snow and these water currents periodically changes the quantities of water in accumulations.

## **5. CONCLUSION**

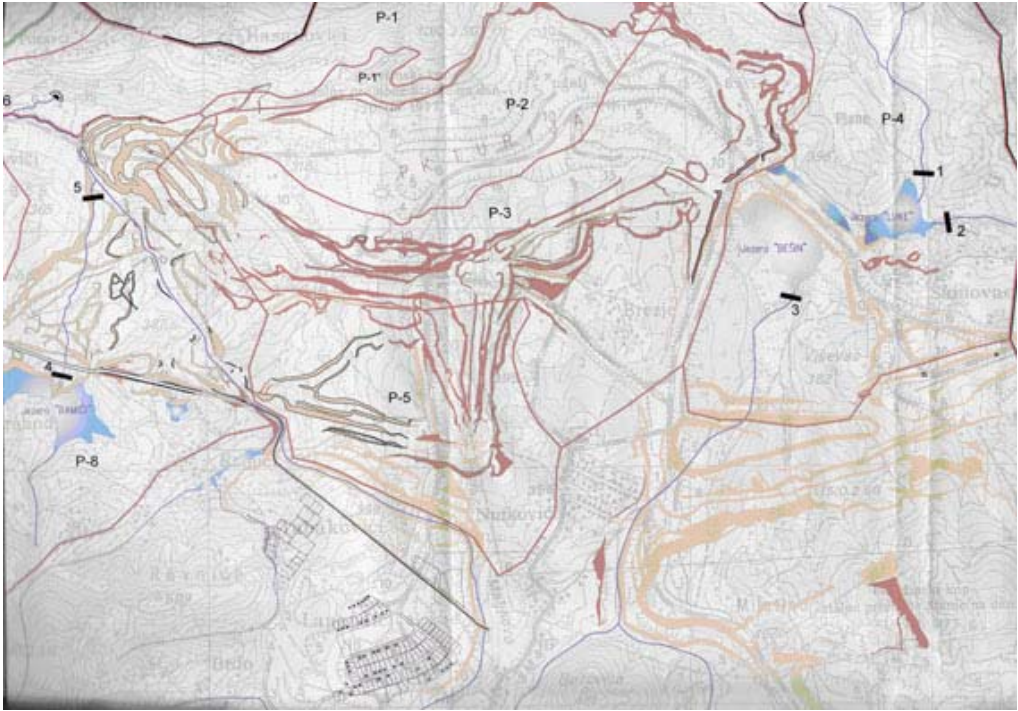
The total volume all three more significant surface accumulations of water on the given area brings out around 1,6 millions m<sup>3</sup> water, whose intake recharge mainly has been binded by rainfalls which can not be the solution in view of secure of sufficient quantities of water for the thermoelectric power plant.

For the reliable determining of total summaries of assets and liabilities of surface water it is necessary to establish observation of the rainfalls in the area of PK Turija. At all places of adds and draining the water it is necessary to execute hydrometric measurements on stable topplings, minimally in the period of one hydrological year, as well as tracking the qualities of water.

Venture activities on the research around the construction of accumulation in the canyon of Turija (the uninhabited area), which only presents the sure source of indispensable quantities of water (possibly and minienergetic potential). Average waterflow of these rivers is around 8 m<sup>3</sup>/mins., and the preliminary analysis one from variants shows that it is possible to afford across 5 millions m<sup>3</sup> of water in such accumulation.

## **6. REFERENCES**

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*Figure 1. Watershed area map of the river Turija*