RIVER FLOW AND ECOLOGICALLY ACCEPTABLE FLOW

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River flow is a category of river regime, conditioned by the regular average long-term state of mutual physical and geographical processes and phenomena, which are directly measured for each river flow on a certain cross-section. After a series of direct measurements, a correlation between flow and water level can be found indirectly, although river flow and water levels are not in a completely direct function.

Flows as well as other elements of the river regime are defined as average, high and low flows. In addition to them, the potamological literature recognizes very high and very low flows, which are called date flows and water levels.

The categories of discharges expressed in this way are not recognized by the Law on Waters of the Federation of Bosnia and Herzegovina, as well as the Rulebook on Determining Ecologically Acceptable Flow, which, among other things, regulates minimum discharges. On the basis of these Laws and Regulations in Bosnia and Herzegovina, Environmental Impact Studies are designed for the construction of mini hydro power plants (SHPPs) which usurp very clean and drinkable water from tributaries of the n-th order from sub-mountain and mountain streams, leaving them permanently. without water.

Key words: flows; river flow, water body; average flows; high and very high flows; low and very low flows; environmentally acceptable flow; biological minimum.

INTRODUCTION

River water flows is a very important category of river regime which determines the abundance of river flow with water for the purpose of its valorization. All surface and ground waters that touch a certain water flow from the catchment area participate in the flowing waters. Their quantity depends on a number of natural geographical elements, especially climate and geological material. Moderately warm and humid climate with an even amount of precipitation and a water-resistant geological base of the basin enabled greater contact and flow on the measuring transverse or humid profile of the watercourse.

Potamological literature defines the elements of watercourses, which differ significantly from those treated by the Law and Regulations in the field of water in Bosnia and Herzegovina. Thus, legislation treats currents as a "water body". It remains unknown that in physics, liquid and gaseous fluids are treated by bodies. The context of the Rulebook refers to the flow of water through the transverse profile, defined by the shape of the riverbed and the current height of the water level, expressed in m^3 and water flow velocities expressed in seconds. Therefore, running water or streams should not be equated with terms that have a static form by nature.

The set goals of the Rulebook determining the ecologically acceptable flow (EPP) expressed through several points of general sense "determine the maintenance or restoration of the structure and function of aquatic and water-related ecosystems, contributing to preventing water degradation and achieving environmental goals through sustainable water use" (http://www.voda.ba/uimages/zakoni/Pravilnik250713.pdf). The cited Rulebook on the EPP declaratively and in certain elements incompletely and vaguely sets environmental goals that are reduced to general views such as: "preventing deterioration of water bodies, achieving good ecological potential and good chemical status of artificial or heavily modified water bodies" and the likewise, which will be discussed below.

From the European Union (EU) Water Directive, some determinants have been adapted to our conditions, so the general term in ecology "Ecological flow" (the amount of water needed for aquatic ecosystems to continue undisturbed life) in Bosnian is translated as "Ecologically acceptable flow", in order to normalize the amount of minimum water flow and thus neglect the essence of the functioning of natural diversity.

Environmental impact assessment projects in the abstraction of water from streams for the needs of SHPPs are mainly based on elements of minimum flow, which according to EU Directives is not regulated by the strict requirements of hydrological science. True, the mentioned directives recognize the continuation of the survival of streams even after the decisions on water abstractions from them have been made, which is not the case with us. In this regard, almost all EU countries have prescribed rigorous measures from fines to bans on the operation of these facilities, which do not comply with the prescribed norms on minimum flow.

MATERIAL AND METHODS

The paper detaily analyzes the elements of the river regime, especially the flow, which is relevant for the explanation of terms and analysis of the title of this paper. River flows are closely related to the categories of water levels and runoff, which are directly dependent on the present physical-geographical factors, and especially the isohyetic regime. Therefore, flows are observed in the networked system by natural geographical elements in order to understand the essence of the law and the regularity of their functioning.

Flows are the most relevant elements of the river regime for any hydraulic works. All its plots are the subject of study of the potamology. For the purposes of this paper, special attention is given to ecological flow, and especially to minimal flows.

The given research is based on fundamental potamological elements and their interactive hydroecological functions. The essence of hydroecological research, in addition to empirical views, is also based on the method of content analysis, which refers to examples of water intake of advanced countries of the European Union.

In Germany, in addition to the concept of minimum water flow, defined by law, the literature also uses the minimum water discharge (Mindestwasseabflus) or the minimum amount of water (Mindestwassermenge). Certain uses of water (ie dams and drainages) are only permitted if a minimum water flow is guaranteed. The determination of the minimum water flow depends on the natural geographical factors of the basin, so they are individually analyzed in sample consequential relations and connections for each stream. The minimum flow is not determined as an annual average but an average by seasons.

Austria uses the term ecologically necessary minimum flow (Der ökologisch notwendge mindestabflss) for ecological flow, which has been regulated in the Water Act since 1959. The ecologically necessary minimum flow is determined in relation to the hydromorphological condition of the surface basin, so it is determined for each basin separately, which is regulated by the objectives of surface water protection. The water in the liquid is considered to be in good condition if the morphological and hydrological criteria are not disturbed.

The ecological minimum in France is defined as the biological flow (débit minimum biologique), and sometimes the minimum residual flow (débit minimum résiduel). The Environmental Act defines it as the minimum flow rate that guarantees the permanent life, circulation and reproduction of species living in a given water at a time when water works are current.

The calculation of the minimum biological flow is performed by experts whose costs fall on the future operator and is one of the documents for the permit. The minimum flow rate must not be less than 1/10 of what is called a "reference module". The reference module or average multi-year water flow is calculated for each stream by direct measurements at determined locations, ie hydrological stations. The French Water Law provides for the Manual on Environmental Protection which defines the profile of the list of experts authorized to perform inspections.

Czech legislation uses the term minimum residual river water flow, which allows main management and ecological functions inside water. The compliance of the values of the minimum residual flow is monitored by the authorized institutions on the basis of which the use permits are issued. The minimum residual flow must be determined by seasons, and in some cases even by months. The values of the minimum residual flow are based on the daily average flow of one climate period. If the length of a period of one climatic period is not possessed, then the length of one decade is taken for the shortest hydrological period, on the basis of which the minimum residual flow is determined.

RIVER FLOW

Flow measurement

The flow of river flow is the amount of water expressed in m^3 that flows through the transverse or wet profile of the riverbed to the instantaneous water level in every second and is expressed in m^3/s. Flow is a function of the wetted profile surface and the average river water velocity:

[$Q = SpVpr$ (m^3/s)] in which Q is the flow; Sp - surface of the wet profile and Vpr - average water velocity through that wet profile.

The procedure for determining the surface of the wet profile, most often at the water meter station, is reduced to the direct field measurement of river water depths and river bed widths on the surface of the current water level. On smaller watercourses, such as those where mini hydropower plants are designed, a mechanical procedure for measuring the depth and width of watercourses is used to obtain the shape of a wet profile.

The average velocity of river water on the measured surface of the wet profile is determined by the hydrometric wing. The process of measuring the average speed requires several measurements at different depths and locations on the wet profile on the basis of which a graph of the speed distribution on that profile is obtained. The arithmetic mean of the velocity distribution on the wet profile is the average water velocity through the transverse profile of the river bed. The average speed can be measured by other methods, which are less accurate and do not deserve special mention in this paper.

The flow is closely related to the water level, although it does not have to be its direct function, especially in riverbeds with irregular morphography of the wet profile. Therefore, at the time of direct flow measurement, water level values must be registered. If the direct flow measurement is performed at the time of low, average and high water levels, whereby, at the time of the measurement, the corresponding water levels were registered, it is possible to construct a flow curve or a consumption curve. The flow curve in the coordinate system is the function of the flow (m^3/s) along the abscissa and the corresponding water levels (cm) per ordinate in a scale approximately at an angle of 45°. The flow curve makes it possible to determine the flows according to the read water levels on a daily basis.

Flow categories

The arithmetic mean of the measured daily flows in one month are the average monthly flows. According to them, average annual flows are calculated, and on the basis of annual flows, long-term flows are determined as an arithmetic mean. High and low flows are determined from a series of long-term flows. High flows represent the arithmetic mean of all recorded above average flows. Similarly, average low flows are determined, which are the arithmetic mean of a series of recorded lower flows compared to the average.

In addition to the mentioned flows, extreme flows must be determined, which can be very high flows and very low flows. They are also called date flows in addition to the entered number (m^3/s) of very high or very low flow and they are entered on the dates of their occurrence, which are valid until the appearance of a new date extreme high or very low flow. It is very important to emphasize that the modern hydrological literature does not recognize the category of ecologically acceptable flow, which will be discussed below.

THE MOST IMPORTANT PHYSICAL AND GEOGRAPHICAL FACTORS OF THE RIVER FLOW

Influence of climatic elements and phenomena on the river flow

From the categories of river regime, the most significant are the flow, water level and flow off of water from the basin into the river course. When the river regime is processed, then the above-mentioned elements of it are always processed, which are mutually conditioned by causal connections and relations. River regimes depend on a number of physical-geographical factors, so they differ during the year, season and months. Average minimum levels and flows regularly occur during the hydrological summer, and on average the maximum during the colder period of the year depending on climatic types.

The most important factors of the river regime are: climatic, geological, morphological, vegetation and anthropogenic.

The river regime is conditioned by the regular long-term state of mutual physical-geographical processes and phenomena, in which climate plays a dominant role. It is primarily defined by temperatures and precipitation, so these climatic parameters are crucial for the formation and condition of river regimes. As vegetation is an indicator of climate and climate types, then are rivers also product of climate, which was discussed in the scientific hydrological literature more than a century ago (Spahić, M. 2013).

From the very simple assumption, that the water balance makes a difference from inflow and evaporation, then it is obvious that precipitation is the most important factor of the river regime. Precipitation in the river regime is treated through their annual height expressed by months and seasons. The amount of precipitation is determined for each basin from the isohiet maps.

The distribution and structure of precipitation are essential assumptions of the river regime. At the same annual precipitation, through the rivers it flow much more water in the years when more precipitation is released during the colder period of the year. This period is characterized by less evaporation, so the contact from the basin is greater.

The intensity of precipitation significantly affects the inflow. Rainfall near rivers with smaller basins comes very quickly and intensively raises the water level in the riverbed. The pouring precipitation gradually raises water level and can last for days, which is very favorable from the position of the hydrological balance.

Snowfall affects the river regime in two ways. At the time of their excretion during the snowy winter, temperatures are low, so evaporation is reduced as well as inflow due to the general freezing of the basin surface. During this period, low or reduced water levels and flows last on the rivers. During the spring period, the snowfall melts, so the snowfall reaches the rivers and significantly raises their water level. Snow is most often combined with spring rains, which can increase the coefficient of inflow by over 100 %. Water retention in the snow cover in the basin during the winter period is called snow or nival retention. This phenomenon is especially pronounced during the Fen weather, when a warm wind or snowdrift intensively melts snow, especially on windward, northern exposures of mountain slopes. A snowman can melt a snow cover up to 50 cm high in 2 to 3 days. Understanding snow retention is very important for forecasting and planning the spring and summer amount of water in river systems.

In the calculation of the water balance, evaporation is a very important link and represents the difference between precipitation and water outflow from the basin into watercourses (Z0= X0-Y0). In addition to evaporation, ie. physical evaporation of water from the earth's surface and vegetation, there is also biological evaporation in the physiological process of plants and is called transpiration. Very often evaporation and transpiration are combined into evapotranspiration. It represents the loss of water from the basin.

The amount of evaporation depends on several factors, the most important of which are: the humidity of the substrate, ie. height and frequency of precipitation, air temperature, temperature of the substrate from which evaporation is performed, ventilation and air pressure. These categories are in direct reciprocal and consequential connections and relationships. Water loss by evapotranspiration depends on about 60% of air temperature, 30-35% of its humidity and only 5% of wind speed (Spahić, M.2013).

Evaporation enhances plant cover in the process of transpiration. This is confirmed by the transpiration coefficient, which shows that in order to form 1 g of plant material, on average about 300 to 400 g of water should be transpired. Numerous measurements have shown that during a clear day, 47 tons of water vapor are daily released from one hectare of beech forest by transpiration, spruce surface transports 43 tons from one hectare, while one hectare of pine forest loses 23.5 tons of water per day. During the vegetation period, an average of 500 to 700 mm of precipitation evaporates from southern European forests, 370 to 450 mm from Central European forests, and 300 to 400 mm from mixed forests.

Influence of geological structure on the river regime

Geological structure significantly affects the maintenance of rainwater on the surface and on their absorption into the ground. In basins that are built of hydrological insulators such as: eruptions, shale rocks, molasses facies, verfen deposits, flysch, etc. outflow of rainwater from surface predominates and thus, under other favorable conditions, has a positive effect on surface outflow.

In catchment areas constructed of hydrological reservoirs, such as: sands, gravels and karstified carbonates, surface outflow is limited and transferred into underground. This primarily refers to karstified carbonate basins, which affect the disorganization of surface outflow into the underground. Groundwater reduces rainwater loss, especially in the process of evapotranspiration, so groundwater in springs and sources is much more abundant than basins with surface outflows and can provide an average of over 5 m^3/s of water.

Hydrogeological relationships significantly affect the density of the river net. The higher density of the river net faster absorbs rainwater, so water loss in the process of outflow is reduced.

Geological structure affects on depth of the erosion process and the incision of river valleys. The depth of the erosion process, especially in karstified carbonate basins, is determined by aquifers which, in addition to the listed hydrological insulators, can also be represented by bank limestones.

Carbonate geological formations can affect the delay of water inflow into the watercourses. It occurs in those watercourses whose basins are built of carbonate karstified rocks, through whose cracks rainwater seeps into the karst underground to the hydrological insulator. When karst hydrological recipients are filled with precipitation waters, then the ourtflow in the basin is mostly superficial, and karst springs abundantly supply surface flows. Such a delay of precipitation in the amount of outflow and thus a delay in the change of water level and flow is known as karst retention.

Infiltration of precipitation waters also depends on the porosity degree, capillarity and water permeability of the pedological substrate. Soils with limited infiltration capacity, allow rainwater to drain to the surface. Such soils are weakly moisted, which affects on limited evaporation, poor outcrop accumulation of water and slight enrichment of streams with rainwater. Such pedological substrates include podzolic soils, vertisol and reclaimed forest soils. Soils with high infiltration capacity absorb large amounts of precipitation, so the total moisture is equal to the maximum. These include sandy soils.

Influence of relief on the river regime

The relief directly and indirectly affects the river regime. With increasing altitudes, the climatic conditions are modifed in the thermal and isohyetic regime. The consequence is the transformation of precipitation from rainy to snowy, which is maintained on the transformation of the pluvial to the nival river regime.

The relief of the altitude belts changes the thermal gradient, so the temperatures regularly decrease along the wet adiabatic and dry adiabatic gradient. Based on the temperature of the known meteorological station, according to the thermal gradient, the height of the freezing point can be determined, ie. isotherm of 0 °C. According to the zero isotherm, the altitude at which the snowfall melts and affects the level retention is determined.

The influence of the relief on the runoff regime is defined by the hypsographic curve of the basin. It quantitatively determines the surface relations of the basin to altitudes. In addition to this, the hypsographic curve defines the vertical disintegration of the relief, which determines the rate of water outflow.

Influence of vegetation on the outflow regime

Basin areas covered with vegetation significantly affect water outflow. Previous studies shown that forest catchment areas are affected by increased rainfall. Forests raise rising waters close to the topographic surface, thus reducing the infiltration of rainwater. In forest basins, snowfalls dissolve slowly, and affect a longer leveling regime and snow retention of outflow.

Forest catchment areas slow down surface outflow by evaporation, transpiration and infiltration of rainwater into the ground. In addition, tree canopies affect the uniformity of precipitation on the ground, and all together slow down the flow of intense intrusion towards watercourses. The study of the forest impact on outflow is contained in the indicators according to which the total amount of precipitation in beech forest during the vegetation period reduces the amount of precipitation from the upper canopy to the ground by about 50%, flows down the tree 7.6% and evaporates 4% of total precipitation. Evergreen forests have an even greater effect on reducing swelling. Thus, for example, black pine reduces the total amount of precipitation on the substrate by 33.6%, flows down the tree by 1.1%, and evaporates 65.3% of the total amount of precipitation.

Basins covered with woody vegetation retain snowfall longer during the winter period compared to basins without vegetation. Snowfall protects the surface of the basin from freezing at the depth of the root system. Ventilation of forest areas is reduced, so evaporation is weaker, which has a positive effect on the categories of the river regime.

Influence of other factors on the outflow regime

While other things are being equal, the river regime is significantly affected by the density of the river net. The density of the river net, expressed in m/km^2, is an important factor in water inflow. The denser is the river network, the more likely it is that precipitation will swell to some liquid before evaporation. In this way, a higher density of the river net reduces the rainwater loss, which has a positive effect on the outflow regime.

Swelling is significantly affected by wetting. Wetlands lose a significant amount of water on transpiration. In addition to this, wetlands are a very weak regulator of uniform outflow, especially in the warmer period of the year.

In addition to natural-geographical influences that are directly and indirectly manifested on the river regime, anthropogenic factors have a significant effect. By using river water for various needs such as: water supply, industry, agriculture, hydro and thermal power plants, etc., they reduce the flow downstream from the place of water intake.

In recent times, the raids on the construction of SHPPs have been transferred from the riverbed to the pipelines, while the riverbeds remain dry. In this way, a large number of nth-order tributaries disappeared from geographical maps.

ECOLOGICALLY ACCEPTABLE FLOW

From streams to driers

The construction of the SHPP, which has recently gained in importance, is preceded by a project which, in addition to the technical documentation, also contains a part related to the Environmental Impact Study. Based on the Study, water consent is obtained, because its content and proposals should, among other things, define hydroecological conditions during the construction of SHPPs and hydroecological forecasts of future water systems with changed river regime, as defined by legal acts related to water.

Determining the Ecologically Acceptable Flow (EAF) in the Federation of Bosnia and Herzegovina is regulated by the Rulebook which is an integral part of the Law on Waters, adopted by two ministers: the Federal Minister of Agriculture, Water Management and Forestry in agreement with the Federal Minister of Environment and Tourism. The Rulebook deals with the elements of EAF, which is, among other things, the subject of analysis of this paper. Previous experiences and examples from the field have shown that the EAF determined according to the Rulebook is not ecological, and even less acceptable.

The Rulebook in the majority of articles is a general document and does not provide a solid basis for the survival of rivers after usurpation and diversion of river waters into pipelines. The generality, ambiguity and vagueness of the Rulebook is documented by its objectives expressed through the following paragraphs:

“1) preventing the deterioration of the status of surface and groundwater bodies and achieving their least good status;

2) achieving good ecological potential and good chemical status of artificial or heavily modified water bodies;

3) protection, improvement and renewal of surface water bodies and groundwater bodies;

4) maintenance or improvement of water status in protected areas referred to in Article 65, paragraph 2, item 5 of the Law on Waters, which are intended for protection of habitats of plant and animal species or aquatic species, and in which maintenance or improvement of water status is an essential condition for survival; reproduction;

5) maintenance of the highest level of protection of the area of inland water reserves from Article 69 of the Law on Waters, for which the establishment of the protected area determines restrictions and prohibitions on space load and activities that may endanger their qualitative or quantitative state.

The EAF determined for a water body or profile within a water body must be in accordance with the reference conditions, which are adopted for that water body in the water management plan of the river basin district.“ http://www.voda.ba/uimages/zakoni/Pravilnik250713.pdf

The views expressed in the objectives of the Rulebook and in this way serve the Investors so that whatever they do negatively before the law can be defended.

Article 4 of the Rulebook defines the water intake profile for the location of the EAF. The same article does not define the time of determining the EAF. Measured flows from only one season and one year are not representative indicators to be declared average and reference for any water intake. Modern hydrological science envisages the shortest period of hydrological monitoring of at least one decade, at the water meter station, which is not defined in the mentioned Rulebook.

Article 6 of the Rulebook defines new terms that are outside the hydrological and hydroecological science, such as: "maximum ecological potential" which the Rulebook treats as a high ecological condition of heavily modified water bodies. It should be noted that the naming and definition of ecological potentials is incomprehensible and has no complementarity with hydroecological elements.

The second term is "ecologically acceptable flow (EAF)", which is adapted from the ecological flow contained in the European Union Water Directive and means the minimum flow that ensures the preservation of the natural balance and ecosystems related to water.

Defined in this way, ecologically acceptable flow is a very broad concept because the natural balance related to water cannot be established on the basis of the minimum "flow determined according to the components of the ecological regime that initiate ecological and hydromorphological processes necessary for maintenance of structures and functioning of aquatic ecosystems" in paragraph 3 of this article. It is incomprehensible that the author (s) of this Rulebook consider that the functioning of ecological and hydromorphological processes can be initiated and maintained by minimum flows, which are also defined as flash flows based on current measurements, and not from a decade series of minimum flows.

In the same article, "mean minimum flow (minQsr) means the arithmetic mean of the minimum annual values of mean daily flows in the watercourse profile in the considered period and is expressed in m^3". In this definition, the term "period considered" does not have a time determinant, so the definition is not correct, as defined above by the categories of river flow in this paper.

The mentioned article of the Rulebook treats "seasonal variation of flow, which means the time distribution of the minimum flows required to establish the temporal variability of the flow regime, in accordance with the requirements of species of fauna and flora belonging to the water body." The distribution of minimum flows treated in this way is not feasible without long-term research, which would include all existing species of flora and fauna in the basin, and which depend on the given flow.

The eighth and ninth paragraphs of Article 6 of the Rulebook define *"flash flow"*, which means a hydrological event caused by artificial discharge of hydro-accumulation, in order to maintain the floods dynamics of rivers and wetlands, which is necessary for the preservation of coastal ecosystems" and *"maximum hydrological potential"* means the hydrological regime of an artificial or heavily modified water body that meets the conditions of *"maximum ecological potential".* Flash flow in this way of definition has its shortcomings primarily because it has not determined the time of floods to preserve coastal ecosystems, and the maximum hydrological potential is explained with an incomprehensible definition.

The second chapter of the Rulebook regulates the methodology for determining the EAF, where the procedure is divided into two levels. The first level of assessment applies to all watercourses, and the second to flows in protected areas, which is certainly illogical because the hydrometric measurements are identical whether they are unprotected or protected areas.

Article 10 defines the hydrological series for determining the river regime and thus the EAF. Hydrological series are defined with 4 paragraphs, as follows: "1) without errors and missing data; 2) duration of at least 10 years (preferably in order), ie duration of 30 years in continuity (relevant period 1961-1990), whenever possible; 3) time series based on average daily flows, whenever possible; 4) representation of different hydrological conditions, with a balance between rainy and dry years". The written views correspond to the hydrological and hydroecological rules if their conditional rules would be ignored "whenever possible", because the hydrological series are strictly defined and they correspond to the climatically determined weather rules. Further explanations of these views are not acceptable. Thus, the first paragraph gives the possibility that in case ... "data of natural hydrological regime for a longer period of time are not available, they can be determined on the basis of hydrological data from another, neighboring or other appropriate water meter station for which there are hydrological monitoring data (reference stations)" without specifying for which water flow.

The second paragraph deals with the harmonization of non-existent flow data, which can be seen from the statement: ... "EAF and flow in the profile of the reference station, it is necessary to monitor the water level for at least one year, it is necessary to perform simultaneous hydrometric flow measurements in the profile of the water body for which the EAF is determined and in the profile of the reference station". According to the above statements, relevant indicators of the hydrological regime cannot be obtained, because one year is not representative of at least a decade of hydrological monitoring. In addition, it is not possible to construct a flow curve by simulating measurements in one year, regardless of their number. It is not clear what it would be used for if continuous hydrological monitoring was not performed for a period of at least one decade.

The determination of the EAF cannot be tolerated by a general assessment as defined in Article 11 of the Rulebook. Budget is not an estimate! The Rulebook provides for the minimum amount of water that should be discharged into the riverbed only for the dry season. Each season has its own minimum flow, which is obviously higher than the summer. Aquatic and terrestrial fauna and flora have been adapted to the oscillations of seasonal and annual flows. Adaptation, especially of aquatic organisms, is not determined only by the summer minimum, from which an additional 10% of the flow is subtracted from the flash flow, ie the average annual flow, which is regulated by Article 12 of the Rulebook dealing with environmentally acceptable flow.

DISCUSSION

From the moment when humanity realized that the climate fluctuates from one climate period to another increasing the average temperature rise and more than a fluctuating trend, there has been talk of global warming of the entire planet. The main cause of climate change has been attributed to the increase in greenhouse gases, of which the most significant is carbon dioxide, according to which the decades-long story of atmospheric carbonization lasts.

This process is still ongoing, and its solution lies in reducing emissions of harmful products through the use of fossil fuels. The substitution of these energy sources is being solved by the produced energy using renewable resources. Renewable resources, in addition to wind energy, solar, geothermal, marine energy, etc., unjustifiably include hydropower, especially from mini hydro power plants of derivation (pipeline) type where fluids from the natural bed are introduced into pipes of different diameters.

River water in pipelines is domestic water due to the change of natural to pipe environment on a certain longitudinal profile of the river flow where all natural self-regulatory hydrological cycles end. Stream natural water is self-renewable in the processes of: aeration, natural harmonization of longitudinal and transverse riverbeds, adaptation of flora and fauna of both riverbeds and riverbeds to changes in river regime, etc., which cannot be said for the pipeline system. The introduction of fluids in the pipes stops practically all natural processes related to: river natural landscape that practically disappears, elimination of surface drinking water for the population and fauna in the river basin, endangering the groundwater regime, stopping the natural harmonization of the longitudinal river profile, drinking water shortages, etc.

Mankind seems to have encountered great frontal antagonism. On the one hand, its activities disturb the balance of the entire climate system and at the same time humanity destroys those same geosystems and ecosystems that can help us get out of this trouble. In order to stop this irrational trend, it is necessary to protect and restore geosystems wherever possible. In this regard, river geosystems are, from this point of view, and at the same time the most endangered.

Our country has joined the process of solving the substitution of the use of fossil fuels with an irrational approach to the destruction of the highest quality streams from sub-mountain and mountain systems, spending them on electricity production in derivation-type mini hydropower plants. There were no two types of use of renewable energy sources for which Bosnia and Herzegovina has all the predispositions such as solar and wind energy.

Plans envisage the construction of several hundred SHPPs; about 350 of them are most often mentioned, which would mean the destruction of about 3,500 km of rivers, mostly clean and drinkable waters. Previous experiences of SHPP construction are not a reflection of respect for post-pathological postulates and legal legislation, which primarily concerns the ecological flow, which is defined as acceptable in the law in the field of water.

Unlike the previously applied "minimum flow", this new term respects all flows (medium, maximum, minimum, extreme or date) because aquatic and animal and plant organisms that have been adapted to them. Unfortunately, domestic legislation, which is pathologically unacceptable, pays attention only to the minimum residual flow.

Analyzes of some Environmental Impact Studies, which are similar to each other, do not observe hydrological postulates in the use of fluids for SHPPs. The studies do not observe the legal legislation in this area because they are based only on the time of construction of SHPPs, ie. in the phase of program interventions without predicting future prognostic conditions.

Almost all program research on the use of liquefies for SHPPs in the available Environmental Impact Studies is not based on exact indicators of river regime, especially flow and water level, and therefore could not be valid for obtaining water consent and concession for their use.

The analyzed studies do not have data from measuring hydrological stations, which were never established, on water intake profiles from which decades-old categories of flows and water levels could be determined. Without them, it was not possible to define the EAF for any watercourse usurped by so far. All of these EAFs have been assessed and therefore are not valid for any concession actions.

EAFs were to be determined on the basis of comprehensive interdisciplinary research of a given basin. In doing so, some research should have had a longer time distance, hydrological at least a decade, on the basis of which the possible continuation of the existence of the river system in the new technogenic conditions would be defined. Modern hydroecological science defines ecological flow by the minimum amount of flowing water in relation to the known average, from at least a decade series, determined by seasons. This is very important due to the adaptive living conditions in the river water and along the river bed to the oscillations of water levels and flows. In determining the average minimum flows and water levels, the date minimum flows and water levels must also be taken into account, because they can be repeated or be even lower in relation to the previously registered ones. Date water levels and flows can dry up a river provided it is defined by an average minimum water flow. The current method of determining the minimum flow, without previous precise research based on the postulates of hydrological science, has dried up the riverbeds, not only during the summer but also for a longer part of the year. These are actually dry rivers, which only have a smaller amount of water during floods.

The usurped streams for this purpose do not have established hydrological monitoring for control hydrological measurements on the basis of which further hydrological forecasts would be made, which is required by the EU Water Framework Directive. In addition, our water laws and regulations did not provide punitive measures for violators, following the example of the EU, from fines to work bans and revocation of licenses for those who do not comply with the prescribed measures.

CONCLUSION

Following the example of advanced countries in the world, especially the EU, Bosnia and Herzegovina has become involved in the processes of decarbonization of the atmosphere by switching from fossil fuel energy to renewable energy sources. At the same time, it offensively started to use only hydropower, which is also the least renewable because water is consumed in that process, especially in derivation SHPPs, while other types are completely neglected. In such an urgent process of water use in sub-mountain and mountain systems, streams carrying clean, clear and drinking water disappear. The design of these anthropogenic plants is a technogenic aggression on the natural heritage of Bosnia and Herzegovina, which disappears natural landscapes inhabited, still insufficiently explored, endemic species of flora and fauna that could be included in the highest form of natural protection according to the most rigorous criteria.

All this is taking place in front of the eyes of the public, which is trying to stop the further destruction of natural heritage in natural landscapes of the highest level through protests. SHPPs turn the most beautiful streams with plenty of clean and potable water into dryers, rivers that have running water only at the time of floods.

The usurpation of streams, which constitute a common social good, is based on Projects that do not follow the postulates of the hydrological and hydroecological profession and science and the projected EU Water Directive. The environmental impact study treats the permitted actions only during the construction of the SHPP plant and infrastructure, while it does not predict future conditions and ways of monitoring them.

The environmental impact study practically allows the destruction of river systems. This view is confirmed by EAF estimates, without hydrological monitoring data with the shortest period of continuous observation and measurement lasting one decade, which is also provided by the existing Rulebook on the calculation of environmentally acceptable flow. Due to non-compliance with the said Rulebook which regulates this area, practically none of the existing SHPPs is legally valid, nor could it have obtained a use permit.

The minimum average flow cannot be the starting point for maintaining aquatic species in streams. They are adaptive to hydrological oscillations of high, low and average water levels and flows. In addition, very low or date water levels, which can be restored or even lower, must be taken into account when determining average low water levels. If by any chance a very low water level is repeated or lower than it, then a liquid with an average low water level will become a dryer. This practically means that only one dry period interrupts life in streams when they become dead rivers.

All of the above mentioned, indicates the great damage caused by SHPP plants, which cannot compensate for this damage with the planned production of electricity. Today, Bosnia and Herzegovina, without SHPPs and planned wind and solar power plants, produces surplus electricity. If it could resolve the remaining issues related to the unresolved borders with neighboring Serbia and Croatia, where there are three reservoirs, two on the Drina and Buško lake in Livanjsko polje, Bosnia and Herzegovina could provide additional electricity surpluses for export, and close unprofitable thermal power plants.

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