

**ASPECTS ON SUSTAINABLE DEVELOPMENT
OF THE ANINA-BOZOVICI AREA**

Doctoral thesis - Abstract

for obtaining the scientific title of doctor at

Politehnica University of Timisoara

in the doctorate field of Engineering Sciences / Civil Engineering

author, Mariana TĂMAȘ (GÎRU), eng.

scientific leader, Eugen Teodor MAN, PhD distinguished professor

November, 2019

In the perspective of the sustainable development of the Anina - Bozovici area, respectively of *the development of tourism*, the achievement of a modern building infrastructure represents the basis of the economic development, in order to attract profitable investments and to increase the quality of life of the inhabitants.

The purpose of the thesis is to develop proposals and prospective solutions for the sustainable development of the Anina area infrastructure, as well as to highlight the need for measures to protect the quality and quantity of water sources, based on a proper study and a case study for the slope drainage, bordering the tributaries of Buhui Lake, with the help of the Mike 11 program.

The theme was also chosen in the context of the concerns related to the theme of Sustainable Rural and Regional Development of a group of specialists from the Timisoara Faculty of Hydrotechnics and the Timisoara Faculty of Agronomy.

In Chapter 1 of the thesis, a *bibliographic synthesis on sustainable development* was carried out, under all 3 aspects: *environmental, economic and social*.

The concept of sustainable local development is a very current one, *considering the limited natural resources*, as well as the *climatic changes of the last period*.

The extensive process of restructuring and efficiency of the economy, which also included the mining sector, to which the economy of Anina was strongly anchored, had as immediate effects: *the increase of the unemployment rate, the decrease of the standard of living of the population, the decrease of the incomes to the local budgets, the migration a significant part of the population, including the active one, especially young people, to other areas of the region, country or abroad*, etc.

Sustainable development is a new concept, without which no viable development strategy can be elaborated, the use of all local resources' reserves must be made taking into account the needs of future generations, also.

Chapter 2 of the thesis makes a *socio-economic, cultural and infrastructure analysis of the Anina-Bozovici area*. The study area includes *Anina*, located in the Mountaneous Banat, in the central part of Caraș-Severin county, 32 km from Reșița municipality and *Bozovici* commune, framed by Almăjului and Anina Mountains, near *Bigăr waterfall*.

The area of the administrative territory of Anina (14,553.0 hectares) is covered mostly by forests, 83% of the land. Other local natural riches are: coal, building stone, limestone, refractory clay, coking oil and shale clay. *Anina coal* has been in use for over 200 years, with the ***Anina mine being the deepest mine in the country and in Europe***.

The beauty of the landscape and the special scientific value of the protected natural areas that surround the area: Semenik National Park - Caras Gorge (with the *Gârliștei Gorge Mixed Reservation, the Buhui - Mărghitaș Mixed Reservation, the Buhui Cave Speleological Reservation*), Nera's Gorge National Park *give the possibility of using it from a tourist point of view.*

Chapter 2 also presents the main achievements for the ***development/modernization of the hydropower infrastructure:***

1. partially modernized/under modernization *road infrastructure*, rehabilitated/modernized interior streets/pedestrian alleys, arranged parking spaces etc.
2. rehabilitated/upgraded/extended/in progress *water supply and sewage infrastructure*, including wastewater treatment plant in execution, through the project "Modernization of water and wastewater infrastructure in Caraș-Severin county" Phases 1 and 2 financed by Cohesion Funds and POIM - Large Infrastructure Operational Program etc.
3. *waste management and environmental protection*: 100% connection rate to the sanitation service, Anina is assigned to the LUPAC 1 area through the Integrated Waste Management System project, under implementation; natural water sources in good condition, renewable energy resources, etc.

The main deficiencies of the transport and hydropower infrastructure are:

1. *Road and rail transport infrastructure*: lack of bypass road, un-modernized DJ 572 B, non-rehabilitated roads to tourist areas (Maial plateau, Buhui Lake, Marghitaș Resort, Crivaia, Marila, Crivina, etc.), "*Semmeringul Bănățean*" railway, un-modernized bicycle tracks, 41 forest roads in need for rehabilitation, etc.
2. *Water supply system*: insufficient water supply networks, catchment equipment, disinfection station, adduction and distribution pipelines, water tanks, old and damaged pumping stations, outdated treatment technology, raw water from 2 untreated underground sources and so on
3. *Sewerage system*: insufficient domestic and rainwater sewerage network, old network, no pumping station, insufficient treatment, significant pollution of watercourses, etc.
4. *Current waste management system*: selective large-scale waste collection is not practiced, mixed-system collection, from household to household, outdated and insufficient collection equipment, there are no sorting facilities, with small exceptions, there is no waste composting facility and organized biodegradable waste treatment system, etc.

The evolution of the *socio-demographic factors* reveals a constant growth of the population until 1990, due to the development of the mining industry, but the restructuring of the mining activity and the slow development of the business environment from 2000-2015 determined the constant decrease of the population. These factors, as well as the low employment of the active population, led to the *strong migration of the working population, especially of the young, to the urban environment (large cities in the region and to countries of the European Union.* A demographic aging process, due to mainly the decrease in birth rate, is noticed.

The layoffs led to the reduction of more than 1800 jobs in the mining and related services sectors. By establishing the Anina Business Center in 2004, a significant number of people qualified in the field of wood processing and textile clothing.

Subchapter 2.7. *Education. Health. Social assistance* includes data on educational infrastructure, health infrastructure and social assistance infrastructure.

Culture, subchapter 2.8. in Anina bears the imprint of the special conditions of the area, characterized by a great variety of ethnicities: Austrians, Czechs, Slovaks, Hungarians and Romanians from the areas of Oravița and Almăjului Valley, and later Romanians from other areas of the country, due to the development of the mining sector. There are 2 Romanian Orthodox Parishes and 2 Roman Catholic Parishes.

The basic *economic activity* for a long time was mining and related activities, which determined its monoindustrial character. *Timber processing, exploitation and capitalization of timber represent the main opportunity for industrial economic development (about 15 companies).*

The agricultural infrastructure of the Anina-Bozovici area is based on the structure of the administrative area of the area, the plant cultivation is practiced in an individual system especially for self-consumption, however, zootechnics represents an opportunity, due to the large areas of pastures and hay. Also, fruit growing represents an opportunity. The main disadvantages are the lack of the markets and the low prices of the products.

According to the data from at the level of 2016, *drainage works* at county level were made on 28627 hectares, *erosion control and land improvement works* on 49049 hectares, and *drainage works* occupied 831 hectares of the agricultural land.

Tourism is the main opportunity for the development of the area, due to the natural and anthropic objectives. The tourist potential comprises 3 *tourist sub-areas*:

- *Mărghițaș - Buhui sub-area*, around Lake Buhui, with the Buhui cave, which offers favorable conditions for leisure;
- *Valea Minișului sub-area*, includes the Miniș Gorges and numerous trails for hiking and trip making;
- *The sub-area of Carașului Gorges, Carașova and Gârliștei Gorge*, includes the caves: Comarnic, Țolosu, Liliecilor, Peștera cu Apă, objectives of interest: speleological, landscape, botanical, geographical etc.

Tourism in the Anina - Bozovici area, must be developed as a tourism integrated in the tourism of Mountaineous Banat.

Other tourist objectives of the Anina - Bozovici area are: ***the Anina - Oravița railway***, the former mining sites, the industrial objectives, etc.

In Chapter 3, a complete and complex *SWOT analysis* of Anina locality was carried out in the following fields: *civil infrastructure, territory planning and urban development, agriculture and forestry, economic development and tourism, environmental protection.*

Chapter 4 aims to present *Proposals and perspective solutions on the sustainable development of the Anina area infrastructure* starting from the sustainable development strategies at European, national, regional and local level: *Europe 2020 Strategy, National Strategy for Romania's Sustainable Development Horizons 2013- 2020-2030, Strategy for Regional Development of the Western Region 2014-2020, Strategy for sustainable development of Caraș-Severin County 2015-2020, Strategy for sustainable development of Anina city 2014-2020*, etc.

Prospective solutions proposed for the sustainable development of the transport infrastructure and public utility infrastructure of the Anina area include:

- *Transport infrastructure*: construction of a ring road on DN 58, rehabilitation/modernization: DJ 572 B Steierdorf - Marila - Oravița, access roads to neighborhoods and tourist areas: *Maial plateau, Buhui Lake, Marghițaș Resort (DJ 582 C*

and DJ 582 F), the resort of Crivaia, Marila, Brădet, Valea Terezei, Crivina, etc., arrangement: bike paths, paths and routes to tourist areas, repairs of 41 forest roads, modernization of "Semmeringul Bănăţean" Oraviţa - Anina railway, etc.

- *Water supply, sewerage and sewerage treatment systems:* extension/rehabilitation/modernization of distribution and adduction networks, construction of water treatment plant, rehabilitation/extension of sewerage networks, construction of new wastewater treatment plant for Anina agglomeration, restoration/unsilting/completion of pluvial sewerage of the Anina and Steierdorf streams, etc.
- *Waste management and environmental protection:* expansion of selective collection, completion of implementation of integrated waste management project, commissioning of the Integrated Lupac Waste Management Center, to which the Anina area is assigned, consolidation of natural slopes, greening of areas covered with waste dumps, shales, etc.

In order to achieve these objectives, several projects and sources of financing have been identified:

- for the county road infrastructure, the rehabilitation/modernization program carried out at the Caraş-Severin County Council level;
- for forest roads, the investment program of the Resita Forestry Directorate and the FEADR, measure 4.3 Agricultural and forestry infrastructure;
- for the modernization of the water and waste water infrastructure - *Priority investments list*, made through the project **Modernization of the water and waste water infrastructure in Caraş-Severin county (Water - Waste Water Master Plan) Phase 1 and Phase 2, funded by the Cohesion Fund and through the Large Infrastructure Operational Program;**
- for waste management - *the project "Integrated waste management system at the level of Caraş-Severin county" (Waste Master plan at county level)* financed by Cohesion Fund and the Large Infrastructure Operational Program;
- for the rehabilitation of public lighting and the thermal rehabilitation of buildings - **Regional Operational Program 2014-2020** etc.

Proposed measures - own contributions to the development of the Anina locality infrastructure are:

1. Greening/conservation of areas covered with tailings dumps and bituminous shale, by covering with sludge resulting from the Anina and Steierdorf wastewater treatment plants, as well as from the Lupac Integrated Waste Management Center (CMID)

The total area occupied with industrial and household waste at the county level is 459.32 hectares, of which: *5.15 hectares of slag and ash from CET Crivina Anina;*

Although storage on these deposits has ceased, they represent a source of pollution of the soil and adjacent land, atmosphere, groundwater, which also affects the landscape. There is also a potential permanent risk to human settlements, communication paths, etc. The sludge generated by the Water Purification Station is part of the *mineral sludge* category and the sludge from the treatment plant is part of the category of *organic sludge*. Following the investments financed from the Cohesion Funds through the SOP Environment, for the Anina treatment plant, the effluent will be thickened and dehydrated up to 22%. The amount of sludge stabilized anaerobically, thickened, dehydrated 22% dry substance that will be produced annually at the Anina treatment plant **will be 685, 98 tons.**

- The capacity for temporary storage in both Anina and Steierdorf wastewater treatment plants is - 150 cubic meters;
- The area of the temporary storage facilities is 100 sqm (Anina - 60 sqm and Steierdorf - 40 sqm);
- Maximum storage period is - 6 months.

In view of the above, *the sludge from the Anina and Steierdorf wastewater treatment plants*, as well as the *sludge from the perspective of CMID Lupac operation* (located at about 30 km) can be used as *artificial soil* for the *ecological reconstruction of the slag and ash dump produced, mine tailings dump, preparation tailings, bituminous shale* etc, excessively degraded land.

The technology of artificial soil production is simple and the soil can be easily transported. Taking into account the experience of other countries, as well as the areas marked by contaminated sites in the area of Anina, *the artificial soil is a viable solution for the final capitalization of the sludge.*

As a possible source of financing, there is POIM - Large Infrastructure Operational Program, with an allocated budget of EUR 5,716,409, which funds *new investment projects for decontamination and greening of historically polluted sites*, including the restoration of natural ecosystems and quality assurance of the soil.

2. Through the duties of the job description, counselor within the Technical Directorate of Caraş-Severin County Council:

➤ I participated in the period of 2010 – up to present in the development/implementation of the following projects:

- *"Modernization of the water and wastewater infrastructure in Caraş-Severin county" (Master plan for water - wastewater Phase 1, the list of priority investments included the rehabilitation, extension and modernization of the water supply infrastructure and the wastewater treatment in Anina);*
- *"Phasing of the project Modernization of the water and waste water infrastructure in Caraş-Severin county, Romania" Financing contract no. 182/2nd of October, 2017 funded by Large Infrastructure Operational Program (Water-wastewater master plan);*
- *I was part of the group (AQUACARAŞ SA, SC EPTISA SA, SC INTERDEVELOPMENT & FICHER) that evaluated and established on the field the needs and the list of investments proposed for the localities (over 2000 p.e), including Anina and Bozovici;*
- *I participated in the drafting of Decisions of Local Councils for approving the list of priority investments for the proposed localities (including Anina and Bozovici);*
- *I contributed to the finalization and consolidation of the institutional element, namely ADI ACVABANAT;*
- *I provided data from the database of the Caraş-Severin County Council for the consultants of water - wastewater Master Plan;*
- *I participated in the actions taken together with the consulting firm for the elaboration of the supporting report regarding the agglomerations with over 10,000 p.e. (including Anina) for delaying the application of penalties for non-*

compliance according to Directive 98/83/EC and Directive 91/271/EEC, by ABA Banat SA;

➤ I was part of the team elaborating the "**Strategy for sustainable development of Caraș-Severin County for 2015-2020**" (I coordinated the chapter: **Infrastructure**), which included the infrastructure of Anina;

➤ I coordinated the activity of elaborating the "**Strategy for the development of the community services of public utilities of Caraș-Severin county for 2015-2020**", I was part of the team of elaborating the "**Strategy for the development of the community services of public utilities of the county of Caraș-Severin for 2007-2013**";

I was part/coordinated the elaboration/implementation of some financing applications: "**Efficiency of Public Services in Caraș - Severin County**" (PODCA) 2012; "**Sustainable common network for emergency situations in Banat**" (IPA Interreg Ro-Se Program). 2018, under implementation, etc.

In the perspective of **sustainable economic, social and environmental development of the Anina - Bozovici area**, one of the viable opportunities for the economic support of the area is the **development of tourism** with all types: agrotourism, mountain tourism, weekend, industrial, cultural, climbing and adventure, sports fishing, forest tourism, speologic tourism, ecotourism etc

The measures necessary for the development of tourism consist of:

- ✓ Development of accommodation infrastructure and services related to the tourism sector: restaurants, public food services, as well as leisure and recreation services; development of the sector of public food services (restaurants, etc.) with local specificity, based on the multiethnic culinary culture of the area;
- ✓ Arrangement of campsites;
- ✓ Arrangement of routes for adventure tourism, endurotourism, mountain tourism, etc;
- ✓ Arrangement of the **Mining Museum** (project for which there is an external funding source), under implementation;
- ✓ Intense campaign to promote the development opportunities of the area: natural and anthropic tourism potential, through all types of promotion channels (presentation films, clips, mass media, websites, social networks, leaflets, fairs, etc.);
- ✓ Development of the business infrastructure: banking units, consulting firms, design firms etc;
- ✓ Measures for developing and encouraging the entrepreneurial spirit of young people, supporting the local business environment, promoting financing programs, etc.;
- ✓ Appropriate marking and signaling of mountain tourist routes;
- ✓ Measures for forest protection and environmental conservation;
- ✓ Development of zootechnics, for the acquisition of specific local products within the public catering services for tourists;
- ✓ Development of forestry, including the processing industry of forest products (berries, mushrooms, natural plants, etc.) and the production of teas, juices for public catering services for tourists.

Proposed measures - own contributions for tourism development in the Anina - Bozovici area:

1. Inclusion of the Anina – Oravița railway in a tourism project "Coal Road" - Austria - Romania route, which can be financed through the ROP 2014-2020 Program - EU Strategy for the SUERD Danube Region, as well as through other financing programs;

2. Development of *integrated tourism packages* for different types of potential beneficiaries;

Chapter 5 **presents own study** on the protection of water sources, respectively the elaboration of the Lake Buhui protection plan. The study starts from the current situation regarding Lake Buhui, the proposed supply source for the Anina and Steierdorf agglomerations through the Water - Waste Water Master Plan. The Water Framework Directive (Directive 2000/60/EC - DCA) represents the European legal provision for the field of waters, which ensures the sustainable use of long-term water resources for people, the economy and the environment.

In this context, the research aimed to *determine the influence of the uncontrolled and massive forestry cuts on the quality of the raw water*, and the measurements made of the water quality indicators have shown the negative impact of the forest exploitations around the Lake on the quality of the raw water in the area of the overflow (turbidity increases and decreases in CBO5 content).

Another aspect involved the elaboration of a study on the flow from the slopes bordering the 6 tributaries of Lake Buhui with the help of MIKE 11 numerical modeling, which also demonstrated the influence of deforestation on the volumes of water collected from the hydrographic basins of Lake Buhui area. In conclusion, in this context ***it is necessary to carry out a complex research study on the negative effects of the uncontrolled forest exploitations on the quality of the water in the catchment area, on the quantities of water that feed Buhui Lake from the 6 tributaries***, as well as the ***development of the strategic plan for forestry, especially for forest exploitations in the Buhui Lake area in order to prevent their negative impact on the quality of the raw water***.

The special norms of the sanitary and hydrogeological protection areas of the water sources established by the GD 930/2005, do not establish measures to limit the forest exploitation in this area. For the sustainable protection of the water source Buhui Lake, in this context ***it is necessary to develop through the long-term source protection plan some measures to limit forestry cuts and deforestation.***

Assessing the risks in the medium and long term for human health and for ensuring the sustainable exploitation of the Buhui Lake water source, which is currently of good quality, is necessary to stop the cuts of wood in the area, as well as other measures for prevention and reducing the consequences of anthropic activities, in order to maintain this good quality water supply to future generations.

Chapter 6 Conclusions and personal contributions, presents a summary of the previous chapters of the paper.

Own contributions to the development of civil infrastructure in Anina are:

1. Through the duties of the job description, counselor within the Technical Directorate of Caraş-Severin County Council:

- *"Modernization of the water and wastewater infrastructure in Caraş-Severin county" (Master plan for water - wastewater Phase 1, the list of priority investments included the rehabilitation, extension and modernization of the water*

supply infrastructure and the wastewater treatment in Anina) funded by the Cohesion Fund;

- **"Phasing of the project Modernization of the water and waste water infrastructure in Caraş-Severin county, Romania" Financing contract no. 182/2nd of October, 2017 funded by POIM-Large Infrastructure Operational Program;**
- **I was part, as representative of the beneficiary – Caras-Severin County Council of the group (SC AQUACARAŞ SA, consultant: SC EPTISA SA, SC INTERDEVELOPMENT & FICHER) that evaluated and established on the field the needs and the list of investments proposed for the localities over 2000 p.e., including Anina and Bozovici;**
- *I participated in the drafting of Decisions of Local Councils for approving the list of priority investments in the field of water supply, sewerage and wastewater treatment (including Anina and Bozovici) through the project "Modernization of the water and wastewater infrastructure in Caraş-Severin county";*
- *I contributed to the finalization and consolidation of the institutional element, namely ADI ACVABANAT;*
- *I provided data from the database of the Caraş-Severin County Council for the consultants: Louis Berger, SC Eptisa SRL and SC Interdevelopment & Fichtner SA, for the water supply, sewerage and wastewater treatment infrastructure, including for the town of Anina;*
- *I participated in the actions taken together with SC INTERDEVELOPMENT & FICHTNER for the elaboration of the supporting report regarding the agglomerations with over 10,000 p.e. (including Anina) for delaying the application of penalties for non-compliance according to Directive 98/83/EC on the quality of water meant for human consumption and Directive 91/271/EEC on wastewater, by ABA Banat SA;*
- **I was part of the team elaborating the "Strategy for sustainable development of Caraş-Severin County for 2015-2020" and I coordinated the activity of the team elaborating the chapter: **Infrastructure**), which also included the infrastructure of Anina, namely;**
 - *The transport infrastructure*
 - *Public utilities infrastructure (water supply, sewerage and wastewater treatment plants, waste management, urban development and territory planning, etc);*
 - *SWOT analysis on fields: transport infrastructure, utilities infrastructure, urban development and territory planning, tourism environment, agriculture and forestry, etc;*
- **I was part of the team of elaborating the "Strategy for the development of the community services of public utilities of the county of Caraş- Severin for 2007-2013" and I coordinated the team elaborating the "Strategy for the development of the community services of public utilities of Caraş-Severin county for 2015-2020", which included the chapters:**
 - *The transport infrastructure*
 - *Public utilities infrastructure (water supply, sewerage and wastewater treatment plants, waste management, urban development and territory planning, public lighting, centralized system energy, etc);*

- *I was a part/coordinated the elaboration/implementation of some financing applications: "Efficiency of Public Services in Caraş - Severin County" (Development of Administrative Capacity Operational Program) 2012; "Sustainable common network for emergency situations in Banat" (IPA Interreg Ro-Se Program), under evaluation, etc.*

Greening/conservation of areas covered with tailings dumps and bituminous shale, by covering with sludge resulting from the Anina and Steierdorf wastewater treatment plants, as well as from the Lupac Integrated Waste Management Center

The total area occupied with industrial and household waste at the county level is 459.32 hectares, of which:

- *5.15 hectares of slag and ash from CET Crivina Anina;*

Although storage on these deposits has ceased, they represent a source of pollution of the soil and adjacent land, atmosphere, groundwater, which also affects the landscape. There is also a potential permanent risk to human settlements, communication paths, etc. *The area affected by pollution through deposits, dumps, tailings ponds, floating tailings dumps, garbage dumps, etc. in an excessive degree at the county level amounts to 629 hectares.*

The sludge generated by the Water Purification Station is part of the *mineral sludge* category and the sludge from the treatment plant is part of the category of *organic sludge*. Following the investments financed from the Cohesion Funds through the SOP Environment, for the Anina treatment plant, the effluent will meet the provisions of NTPA 001-2005, will be thickened and dehydrated up to 22%. The amount of sludge stabilized anaerobically, thickened, dehydrated 22% dry substance that will be produced annually at the Anina treatment plant ***will be 685, 98 tons.***

- *The capacity for temporary storage in both Anina and Steierdorf wastewater treatment plants is - 150 cubic meters;*
- *The area of the temporary storage facilities is 100 sqm (Anina - 60 sqm and Steierdorf - 40 sqm);*
- *Maximum storage period is - 6 months.*

In view of the above, *the sludge from the Anina and Steierdorf wastewater treatment plants*, as well as the *sludge from the perspective of CMID Lupac operation* (located at about 30 km) can be used as ***artificial soil*** for the ***ecological reconstruction of the slag and ash dump coming from CET Crivina Anina, mine tailings dump, preparation tailings, bituminous shale*** etc, excessively degraded land.

The technology of artificial soil production is simple and the soil can be easily transported. Taking into account the experience of other countries, as well as the areas marked by contaminated sites in the area of Anina, *the artificial soil is a viable solution for the final capitalization of the sludge coming from the wastewater treatment plants and CMID Lupac, as well as the improvement of the large areas of degraded land in the area. Within the 2014-2020 funding programs, there are programs, such as the Large Infrastructure Operational Program (POIM), with an allocated budget of EUR 5,716,409, which funds new investment projects for the decontamination and greening of historically polluted sites, including the restoration of natural ecosystems and insurance the quality of the soil, which can constitute a potential source of funding for the greening works of the contaminated sites in Anina.*

Other proposals for measures - own contributions to tourism development in the Anina - Bozovici area:

1. *Inclusion of the Anina - Oravița railway in a tourism project "Coal Road" - Austria-Romania route, which can be financed through the ROP 2014-2020 Program - EU Strategy for the SUERD Danube Region, as well as through other financing programs;*

2. *Development of **integrated tourism packages** for different types of potential beneficiaries, including the natural and anthropic tourist objectives marked from the 3 tourist sub-areas: Marghitaș - Buhui, Minișului Valley, Carașului Gorges, Carașova and Girliștei Gorges, 2 lakes, caves, 2 natural reserves with protected plant and animal species, Parallel 45, Bigăr Waterfall, Miniș Gorges, various formations: springs, waterfalls, precipices, gorges, caves etc;*

*The own research, **respectively the development of an own Study on the protection of the water sources; Elaboration of the water source protection plan for Buhui Lake** aimed to determine the influence of one of the main factors: *uncontrolled and massive forest cuts on the quality of the raw water of the lake in the area of the overflow and in the area of entry into the lake, on the Buhui stream (the main affluent).* In general, the raw water quality of Lake Buhui is good. However, the results of own research revealed that this disturbing factor, respectively the *massive forest cuts, especially around the lake, influenced the turbidity (own measurements revealed increases of the indicator in the area of the overflow compared to the lake entry area), as well as the content by CBO5 (likewise there were recorded decreases of its content in the area of the overflow compared to the lake entry area).**

Personal contributions on numerical modeling using MIKE11 program:

- To acquire and use slope flow modeling using the MIKE 11 program;
- Conducting a case study for the bordering slopes of the Buhui Lake tributaries using the MIKE 11 calculation program;
- Drawing up the graphs related to the flow rates on the slopes in the hydrographic basins of the study area for 2 study variants: I. 100% forests; II.100% degraded pasture (figures no. 60-68);
- Qualitative and quantitative analysis of the precipitation contribution for the two studied variants (tables no. 65, 66, 67);
- The sanitary protection area for Buhui Lake was established (figure no.75);
- Proposals to revise/supplement the deficient legislation regarding the sanitary protection area.

The theme of own research is of great importance, given the need to maintain quality water reserves for future generations, under the present conditions when the quantity and quality of the water source is a major problem worldwide.

For the sustainable protection of the Buhui Lake water source, in this context ***it is necessary to develop through the long-term source protection plan some measures for limiting forestry cuts and deforestation in this area, as well as other measures to prevent and reduce the consequences of anthropic activities, to maintain this good quality water supply for future generations.***