CLEAR

CLimate and **E**nvironment protection progr**A**m in Montenegr**R**o dedicated to the hydrosphere monitoring, pollution control and raising awareness

CZECH REPUBLIC
DEVELOPMENT COOPERATION

FINAL REPORT

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INTRODUCTION

Introduced final report defines objectives, sums the sequence of performed actions and evaluates the outputs of CLEAR project, 1212.004A-08, financed by CEI funds (Central European Initiative, Special Fund for Climate and Environment Protection). The main objective of CLEAR project was the identification of current system of hydrological surface and ground water monitoring in Montenegro as a tool of environmental and climatic assessment and protection of its negative impacts. In the frame of this project there are conditions determined for design and implementation of additional installations concerning monitoring network in terms of organization, technical equipment, data processing and accessing…etc. The area of interest comes within the strategic field of integrated water resources management (IWRM) and is directly related to topic of drink and waste water issue in Montenegro, to pollution assessment and treatment respectively.

The most essential objective is bilateral awareness rising and experience exchange in the form of educational and dissemination activities. There were 2 study tours of experts (and 1workshop) from both Montenegrian and Czech partners organized with participation of following institutions:

- Hydrological and Meteorological Service of Montenegro (HMZCG), Podgorica
- Czech Hydrometeorological Institute (CHMI), department Prague
- Czech Hydrometeorological Institute, department Brno
- **VODNI ZDROJE, a.s.**
- **Czech Ministry of Environment: EU department, Department of Development Aid and Project Co-operation, Unit of Bilateral Co-operation**
- **Czech Development Agency**

Individual project activities were performed in the time period from 1st of March till 31st of December 2009. They were declared by following work packages (WPs):

- WP 1. Analysis of the water management situation in Montenegro
- WP 2. Feasibility study
- WP 3. Study visit – training on the Czech Hydrometeorological Institute
- WP 4. Dissemination
- WP 5. Identification of funding possibilities related to implementation of the climate and environmental protection

PRESENT STATE OF MONITORING OF SURFACE AND GROUND WATER

SURFACE WATER

The Hydrometeorological Institute in Montenegro (henceforth HMZCG) manages the network of gauging stations on surface flows. In the catchment of the Black Sea there are 27 profiles monitored (or are planned to be monitored) and in the catchment of the Adriatic Sea 19 profiles are monitored. Related to the total area of Montenegro, one station serves about 300 km^2. For comparison in the territory of the Czech Republic there is one gauging profile for about 160 km^2.

It is not correct to compare these numbers, because the hydrogeological conditions in both republics are completely different.

According to the information obtained during the visit to HMZCG, about one half of gauging profiles are automated by devices with long-distance data transmission. **With respect to inaccessibility of some profiles given by the mountainous terrain, we can recommend that all gauging stations be gradually equipped with long-distance data transmission. This request is already determined in the current master plan of the surface water observation stations in Montenegro.** At the gauging stations there are the actual water stages and flow velocities measured that are recalculated for discharge with use of stage-discharge relation curves. Besides traditional current meter measurements there are also ADCP devices engaged.

GROUND WATER

In contrast to surface water the state of monitoring of ground water is rather worse. HMZCG pointed out the absence of relevant monitoring stations of ground water. In the past, just occasional measurements of water level and basic quality analyses were carried out, but irregularly and non-systematically. There are too few stations available, while the majority of them are common collecting wells which are technically unsuitable for systematic measurement and sampling. At present, flows are measured in only about 5 used springs. Hydrogeological water balance regions on ground water are not defined in detail for the purpose of building the monitoring network in Montenegro (water bodies, hydrogeological regions), which would enable rational positioning of new monitoring stations. HMZCG has been processing this issue in long term, but regarding extreme geological complexity of the area this goal should be concerned in future consequential projects of CLEAR. Such a project should focus on detailed hydrogeological survey in a big scale.

WATER QUALITY MONITORING

Monitoring of water quality is carried out in range of the basic physic-chemical and microbiological indicators and practically just on surface water. There are following parameters in the laboratory of water quality assessment HMZCG analyzed:
temperature, pH value, electric conductivity, dissolved matter, dust fall, dissolved oxygen, % oxygen saturation, biochemical oxygen demand (BOD), chemical oxygen demand (COD), alkalinity, bicarbonates, hardness dH°, calcium, magnesium, sodium, potassium, iron, ammonium-nitrogen, chlorides, sulphates, phosphates, nitrates, nitrites, phenols, detergents, fecal bacteria, coliform bacteria, aerobic (mesophile) bacteria

LEGAL BACKGROUND OF WATER QUALITY MONITORING

- Water law of Montenegro ("official reports RM" nr. 27/07)
- Statute on classification and division of surface and ground water ("official reports RM" nr. 27/07)
- Program of systematic testing the quantity and quality of surface and ground water (official reports Montenegro nr. 25/09)

STUDY VISIT – WORKSHOP AND BILATERAL MEETING IN CZECH REPUBLIC

During the autumn week 5th-9th of October 2009, there were activities included WP3 „Study visit – workshop on the Czech Hydrometeorological Institute“as one of the most significant activities in the CLEAR project accomplished. The main topic of the study visit was comparison of practical issues in surface and groundwater monitoring systems operated by Czech and Montenegrin hydrometeorological institutes. There were specific problems and measures related to local hydrological conditions discussed. There have been several lectures by experts of Czech hydrometeorological presented on design, history and operation of the recent monitoring system and hydrological forecasting in Czech Republic. The experience exchange (incl. field trip) was focusing especially on karsts areas, which are the major formation of Montenegrin bedrocks.
Both the countries have been dealing significant surface water problems regarding flashfloods, which cause periodically serious damages in the Czech Republic including causalities. On the other hand, similar kind of flashfloods in Montenegro doesn’t mean similar kind of risks because of different watershed shape and outstanding infiltration capacity of the karsts limestone. Typical impacts of the flashfloods (as of the snow melting) are dramatically fluctuating stream discharges between periods, which make the discharge measurements very complicated.
In case of groundwater, there’s a significant assistance for the Montenegrin side needed, both financial and procedural. The lack of monitored groundwater objects in Montenegro makes any research in this field inefficient. In contrary Czech hydrometeorological institute operates a dense monitoring network since early 1960s using numerous capable of providing various time series in quantitative and qualitative indicators. There was a lecture presented on density of monitoring points, range of measured indicators and equipment of measuring station.

As a following part of this study visit there was an excursion of VODNI ZDROJE, a.s. enterprise set to present technical solution and capacities of monitoring wells, which were accomplished by this company for CHMI monitoring purposes. Also various options in future project cooperation were discussed, especially role of VODNI ZDROJE, a.s. in technical assistance for creation of groundwater monitoring wells network. As one of the crucial topics, there were feedbacks on previously presented feasibility study (WP2) collected.
The visit of relevant departments of Czech Ministry of Environment was included into agenda to provide specific information on possibilities of cooperation and co financing in development and EU managed projects.
The delegation of Hydrological and Meteorological Service of Montenegro (HMZCG) consisted of:

Darko Novaković, head of hydrological department HMZCG

Radomir Kandić, expert assistant manager of HMZCG

Ivana Bajković, expert water management planner

Brief agenda overview:

- **CHMI Brno, hydrological department**

Topics: flood forecasting and flood protection in Moravian Karst, surface and ground water monitoring in the karts regions, flash floods and rainfall characteristics, operated models

- **CHMI Prague, hydrological department**

Topics: Czech Hydrometeorological Institute (CHMI) history and structure, surface and ground water monitoring - network density, technical realization, hydrological and meteorological forecasting, monitoring time series, analyses and data accessing, hydrological modeling

- **Czech Ministry of Environment**

Topics: EU department presentation, Department of Development Aid and Project Co-operation presentation, Unit of Bilateral Co-operation: Development Aid project in the scope of Czech Ministry of Environment, priority countries and regions, experiences applicable for EU pre-accessing states

- **VODNI ZDROJE, a.s.**

Topics: company profile, department capacities, role of commercial sector in development aid projects, role of VODNI ZDROJE, a.s. enterprise in creation of CHMI monitoring network, development aid environmental projects in the Balkan region, CLEAR feasibility study discussion and evaluation
Field trip – CHMI monitoring objects in Bohemian Karst

Topics: construction of observation objects in the karts region – deep observation well of ISPA/FS program, crest of weir, surface water flow velocity measurement by ADCP

COMMENTS AND SUGGESTIONS OF THE HZMCG

Despite similarities and overlapping in the basic activities of both Czech and Montenegrin side, there're several specific issues to be included in the feasibility study and taken into account in the CLEAR project in general. These issues regard both environmental and economic point of view and are based on recent experience of data needed to be monitored or estimated. Unlike Czech Republic, the flood forecasting and protection aren't such an important deal for hydrological experts in Montenegro; however the need of data collection isn't lower because of a high demand in the field of land-use planning, environmental protection and commercial activities. The major issues are:

- **Estimating discharge from small watersheds**

For sub basins with missing observation points (which are typically too small to be measured regularly) there's a methodology or modeling needed to be able to provide reliable estimate of discharge or other parameters respectively. Typical need of these data occurs at the designing period of small hydro power plants.

- **Too high flow velocity**

In the upper parts of watersheds, there're frequently flow velocities up to v=5m/s observed, which make an accurate measurements impossible even for ACDP device. A new method of the high flow velocity measurement should be implemented.

- **Groundwater regions**

The system of groundwater regions should be surveyed for more detailed level. The surface watersheds aren't equal to groundwater divide in many cases, determination of groundwater regions is essential for reasonable monitoring network.

PROJECT OF SOLVING THE CONSTRUCTION AND OPERATING THE MONITORING NETWORK

Although it's going on an integrated monitoring system, we have to keep in mind the present situation, when surface streams are monitored, while ground water is not monitored practically at all. This is enhanced by the fact that in the Montenegrin territory no hydrogeological balance wholes are defined on ground water (water bodies, hydrogeological regions), which is one of the basic conditions for reaching the basic goals of water monitoring.

STEPS OF NETWORK CONSTRUCTION

The basic condition for building of monitoring networks is defining the basic hydrogeological balance wholes (hydrogeological regions, water bodies). For the purposes of water supply balance, and other tasks given to the network monitoring, a hydrogeological balance whole cannot be changed or substituted by hydrological catchment. It is defined from the viewpoint of geology, structure geology and hydrogeology as a whole, in which prevails one flow of ground water of a particular type, and at the same time it is the basic unit for ground water sources balance mostly limited by hydrogeological watershed divide, and the place of its drainage.

The procedure of the construction of an integrated system of monitoring ground and surface water should comprise the following steps:

1. Basic definition of hydrogeological balance wholes (hydrogeological regions, water bodies). At the beginning this should be possible, at least roughly, on the basis of present knowledge.
2. Completion of the present hydrological database.
3. Processing of hydrological data.
4. Comparison of the position of present monitoring stations in relation to their position in defined hydrogeological balance wholes, critical evaluation of their positioning by eventual suggestions for their change.
5. Project of completing of the network with monitoring of ground water stations including the choice of appropriate types of stations (bore holes, springs, precipitation gauging stations)
6. Project to equip monitoring stations with measuring and transmission technology in relation to software and the way of data processing
7. Selection of stations serving not only quantitative but also qualitative monitoring, including the choice of the followed quality parameters (basic qualitative indexes corresponding to the requirements of EU directive (WFD) completed with indexes which enable to evaluate influences of water contamination on their quality)
8. Selection of priority regions for the initial stage of completion of a monitoring network
9. Introduction of regular monitoring

SELECTION AND LOCALIZATION OF MONITORING INSTALLATIONS

Regarding the fact that in the Montenegrin territory there are mostly regions with karst permeability, we suppose, that in these regions spring seepages will serve for ground water monitoring. In cases where there is a need to also monitor the sections of hidden drainage of karst water, monitoring bore holes will be used. They will also be used in regions with sedimentary layers (Zetska ravnica - flatland, surrounding of Skadar Lake). The choice of an appropriate type of monitoring station will depend on concrete conditions of individual hydrogeological units (hydrogeological regions, water bodies).

The localization itself of monitoring stations should comply with these conditions:

- to localize monitoring stations primarily at the spot of inlet and outlet of water in hydrogeological wholes
- to localize monitoring stations in such a way that they enable mutual hydrological relation between stations of ground and surface water
- After building stations at inlets to and outlets from hydrogeological units, the network will be gradually completed with stations inside of these units for rendering water routine within hydrogeological unit.

Because precipitation water directly infiltrates into the karst rock (surface drain sometimes does not exist), also precipitation gauge stations have to be incorporated into the monitoring network, mainly in areas where precipitation water directly infiltrates, so that the balance evaluation of data obtained by monitoring could be secured.

Last but not least, is the matter that monitoring stations should be localized inside hydrological units in the direction of the water flow, and below the main sources of contamination, because the quality of water should also be monitored.
The following picture shows an example of a project of monitoring network:

TYPES OF STATIONS

Basic types of installations of the water monitoring network are:

- gauging stations of surface water
- hydrogeological monitoring bore holes
- springs
- precipitation gauging stations

SURFACE WATER GAUGING STATIONS

At present, a part of the gauging stations on surface flows has already been built – in more detail see chapter 3.1. Their technical and device equipment usually correspond to the needs of the monitoring network of surface water. There is a need just to complete or partially adapt the network in relation to hydrogeological wholes so that their localization meet the requirements on an integrated monitoring network.

HYDROGEOLOGICAL MONITORING WELLS

Hydrogeological monitoring bore holes together with sources represent the basic type of station for monitoring of ground water. They have to meet several basic requirements:

- ***Requirement of correct localization***, which would enable the station to characterize the particular hydrogeological unit (above all in the relation to the inlet to and outlet from this unit), so that gathered data would enable a total balance evaluation of specific unit, and at the same time also render eventual changes in qualitative indicators in these units. They also have to be localized in such a way that the relation to surface flows is created.
- ***Requirement of correct technical construction of the station*** – boreholes should be built as fully penetrating wells, i.e. they should go through the whole mass of the monitored collector. Other non monitored collectors should be isolated. The diameter of the well equipment has to be able to provide the well with suitable measuring technology, and has to allow ground water sampling for the purpose of chemical analysis.
- ***Requirement of correct construction of above ground part of the well*** – the above ground construction has to allow placing of technical devices for data transmission. There will be a difference between the construction of wells with positive pressure height of ground water (overflow wells with artesian water table) and wells with free water level. Examples are shown in the pictures.
- ***Requirement of good technical equipment for measuring water level or pressure*** – wells should be equipped with suitable measuring devices for measuring water level or pressure (at wells with positive pressure height). This device equipment should enable the transmission of obtained data to the central database.

SPRINGS

Springs defined for monitoring, together with wells, represent the basic type of installations for monitoring of ground water. As such they have to meet several basic requirements:

- ***Requirement of correct localization***, which would enable to characterize the particular hydrogeological whole (above all in the relation to the inlet to and outlet from this whole), so that gathered data would enable the total balanced evaluation of this unit and at the same time also render eventual changes in qualitative indexes in these units. They also have to be localized in such a way that the mutual relation with other monitoring stations is secured.
- ***Requirement of correct technical construction of the installation*** – wells should be equipped with an overflow, whose choice and construction will correspond to the assumed scope of expected yields. In the water storage before the crest there should be placed a water gauge and a sensor for monitoring the water level before the crest and to transmit the obtained data into the database. For every source a curve has to be worked out enabling the rendering of levels to the respective flow.

PROJECTS OF HIGHER QUALITY OF MONITORING AND BASIC DATA PROCESSING

Individual monitoring installations, both on surface and on ground water, should be placed in such a way so that they enable the evaluation of individual hydrogeological balance units (water bodies, hydrogeological regions). From this ensues that in the initial phase of the construction of the monitoring network they should be placed both at the inlet into the particular balance unit and at the outlet from this unit.

SURFACE WATER

- Eventual completion of monitoring network with new installations

The present locations of gauging stations (with shorter monitoring) should be revaluated with respect to the project of ground water monitoring in such a way that the data from gauging profiles could be used for a complex hydrological or water economic balance (precipitations, drainage, evaporation, extractions or outlet of waste water) in a particular region (catchment). ***With respect to the karst origin of most of the territory the course of the hydrogeological watershed divide is far more important when choosing the location of a gauging station than a standard orographic divide***.

- Completion of hydrological database

From the meetings with the HMZCG representatives of HMZCG ensued that from roughly one decade (the 80s to 90s) part of the gathered data hasn't been processed and made accessible yet. This lack has to be deled with to provide a complete time series of observed period. For further processing of data it is also appropriate that the older monitoring, if available, is processed and in the form of e.g. average daily flows stored in the database. We also have to pay attention to floods and culmination flows of flood waves, which also should be stored in the database. Here it is necessary to pay attention to the extrapolation of stage-discharge relation curves out of the scope of measuring of flows and use a suitable hydraulic model.

- Processing of hydrological data

After the completion of the database, for all the profiles with at least a thirty-year history of monitoring there should be basic statistic analysis performed (average, spread and coefficient of variation) and subsequently M-day flows and N-year culmination flows. M-day flows are important mainly for hygienic needs (e.g. for projecting waste water treatment plants) and supplying inhabitants and industry with water. In Montenegro this kind of data have big importance in hydraulic engineering works, namely hydro power plants. M-day flows are determined and available for all major surface streams, because of observed climatic changes in the last

decade there's a perspective revision being concerned. N-year flows will play their role at projecting flood measures and evaluating projects in inundation areas.
Furthermore, the HMZCG is interested in implementation of hydrological balance methodic for small catchment areas, which don't dispose of stable observation point. An appropriate solution would be for instance a hydrological model (interface of HEC, FMR, CASABLANCA…etc.) calibrated accordingly to local precipitation-runoff conditions. Only input parameters would be of geographical data = easily obtainable. Based on model prediction there could be a map of potentials created having use in designing various hydraulic engineering works.

GROUND WATER

In contrast to surface water the situation of ground water monitoring is significantly worse. Therefore there is the need:

- To complete a preliminary and detailed definition of basic ground water bodies (hydrogeological balance regions)

For the purpose of building the monitoring network in Montenegro, hydrogeological balance units are not defined in detailed scale (water bodies, hydrogeological regions), which would enable rational positioning of new monitoring installations. We recommend:

- To carry out the project of the completion of the network with ground water monitoring installations including the choice of suitable types of installations (wells, springs, precipitation gauging stations) and their construction

The project of completion of the monitoring network should be carried out in relation to defined hydrogeological regions and water bodies together with the relation to surface water monitoring installations so that it is possible to evaluate quantitative water balance in the future.

- The choice of installations for qualitative monitoring

To carry out the choice of qualitative monitoring installations. This choice should be carried out both from the point of view of total qualitative characteristics of the monitored hydrogeological region, and from the point of view of the relation to surface water and eventual sources of contamination.

- Equipment of ground water monitoring installations with measuring and transmission technology

The equipment of monitoring installations will differ in relation to the type of installation:

a) Wells

- shallow wells screened to phreatic aquifers - equipment for measuring water levels

- deep wells – constructed for separated sampling of various water-bearing horizons (there're probably no confined or even artesian aquifers in the area of Montenegro, existence of aquicludes has never been proved)

b) Springs – at their technical adaptation for the need of monitoring we have to take into account the scope of quantity of out-flowing water.

- Setting the interval of measuring

Interval and frequency of measuring should be set in mutual relation to gauging stations on surface flows so that the data can be mutually correlated and evaluated. At the same time we have to set the frequency and intervals of ground water sampling for quality monitoring.

- Setting the parameters for monitoring the quality of ground water

In installations primarily, the basic parameters of ground water qualities should be monitored in the scope carried out on surface water at present – see the table. Installations, whose task will be the monitoring of the relation of ground water to the sources of contamination, should have their scope of monitoring broadened by parameters characterizing the respective source of contamination (e.g. heavy metals, specific organic substances, etc.).

GENERAL SUGGESTION ON COHERENT PROJECTS TO CLEAR

The main practical output of the CLEAR project is the groundwork applicable in future investment projects carried out with intension of meeting the specific needs. The future objective is basically completing of available data and information, but first of all the realization of constructional, operational and methodical improvements of surface and ground water monitoring system (see above) in the meaning of integrated water resource management. The most suitable approach is to start with a carefully chosen pilot site, where could be all the components of final monitoring system tested.
Suggested project schedule:

1. Supplementing unpublished data accessing and processing

The speech is namely about data from detail geological and hydrogeological surveys accomplished yet in competence of federal hydrometeorological institute of Yugoslavia. Unfortunately the division of Yugoslavia predated the data processing and many of those haven't been completed. The data are stored in the former federal hydrometeorological institute in Belgrade therefore there's a need for accession.
Also there's a need of accessing and processing the HMZCG data from all the history of observations to have the complete time series available.

2. Supplementing field survey and detailed ground water regionalization

Monitoring network of surface water operates in sufficient density and it's based on determined catchment areas and well surveyed hydrometric profiles. The improvement is possible in technical installations, data transmission and processing. The distribution of gauging stations may be revised especially with regard to future ground water monitoring network.
In contrary the ground water regions aren't well known in detail and a full-scale hydrogeological survey at least of particular localities should predate to design of ground water monitoring system. That should besides precipitation and discharge measurements also include sample boreholes, geophysical survey and ground water flow tracing tests. The goal is the detection of preference flow paths in karst media, verification of aquiclude existence in Zetska ravnica and specification of ground water regions.

3. Choose of pilot site for initial realization and testing

Despite of assumption Skadarske lake catchment area is the most important hydrogeological region of Montenegro, more suitable for initial locality would probably be some of smaller river catchment areas (Piva, Tara, Ćehotina, Lima or Ibra) because of their possible bigger clarity. Anyway the choice of pilot site is essential to be defined with close cooperation of HMZCG.

3.1. Ground water monitoring network layout

Based on outputs of supplementary survey and completion of map layers

3.2. Construction of ground water monitoring network

Namely observation wells and hydrological weirs for spring discharge measurements

3.3. Operational and maintenance testing

Operational well tests, calibration of gauges, data transmission etc.

4. Implementation for other localities

Application of the know-how step by step for all the hydrogeological regions

5. Training of the technical staff, experience exchange

Based on partner cooperation with the Czech Hydrometeorological Institute

6. Dissemination

ESTIMATED BUDGET

There isn't possible to estimate the total cost of the monitoring network system in the entire republic of Montenegro, because the final number of necessary observation objects isn't known yet. Their determination and division into separate categories will be part of early stage in project designing. This is caused by lack of various significant data that will be necessary to obtain or complete in the 1st stage of implementation. Therefore a reasonable cost estimate will be possible to provide after implementation of 1st four steps of time schedule (see chapter STEPS OF NETWORK CONSTRUCTION). These steps we recommend to process in form of project documentation to define individual tasks for monitoring system implementation. This project includes:

- definition and processing of detailed hydrogeological balance units……..€200,000.-
- completion of missing hydrological databases and their processing……..€250,000,-
- localization, survey and definition of the observation points and objects……..€350,000.-
- design and construction of individual objects incl. the above-ground outfit….€100,000.-
- proposal of measuring installation and data gathering procedure……..€50,000.-

  Because of a big complexity of this procedure a rough estimate of necessary investments is reaching value €950.000,-

Individual chapter concerning the issue of surface and ground water monitoring is the way of data gathering, processing and assessment. Furthermore, there can be cost of individual observation objects estimated however still just in general form because of differences in object category (springs, wells…etc.) and several other criteria (depth in case of wells, discharge in case of springs…etc.). Estimated costs accordingly to object category:

SHALLOW PHREATIC WELLS

- the well with hydrodynamic test for determination of basic hydraulic parameters…..€5,000.-
- construction of well above-ground outfit……€2,500.-
- instrumentation – manual measuring and sampling……€3,000.-
- instrumentation – automatic station……€4,000.-

DEEP WELLS

- the well with hydrodynamic test for determination of basic hydraulic parameters…€65,000-€250,000.-
- construction of well above-ground outfit……..€2,500.-
- instrumentation……..€4,000.-

SPRINGS

- construction of well above-ground outfit……..€6,000.-
- instrumentation……..€4,000.-

POTENTIAL SOURCES OF FINANCING

IPA – EK TOOL FOR PRE-ACCESSION ASSISTANCE

Because Montenegro is recognized in the group of potential EU members, there's a suitable investment tool Council Regulation (EC) No 1085/2006 establishing an instrument for pre-accession assistance (IPA) implemented as EC No 2499/2007.
The IPA tool is designed to provide pre-accession assistance for beneficiaries from EU acceding states. The time frame is of 2007-2013 and the tool is aimed for wide range support of institutional development in the target countries.
The IPA tool should strengthen democratic institutions and the rule of law, reform public administration, carry out economic reforms, respect human and minority rights, encourage gender equality and non-discrimination, promote civil rights and the development of civil society, support advanced regional cooperation and reconciliation and reconstruction, and contribute to sustainable development and poverty reduction, as well as to a *high level of environmental protection in these countries.*

The IPA should also prepare candidate countries for the programming, management and implementation of the European Regional Development Fund, Cohesion Fund, European Social Fund and Rural Development that will be made available to them upon accession.
Because of the content the implementation of CLEAR project comes under following specific thematic spheres of the IPA:

CROSS-BORDER COOPERATION

In the meaning of article nr.86 there's a possible implementation in projects with participation of one or more EU member states and one or more EU candidate states. In the point 86/2/b there is kind of cooperation defined to address common challenges in fields such as environment, natural and cultural heritage…etc. The field is explicitly specified under 86/3/b as "encouraging and improving the joint protection and management of natural and cultural resources as well as the prevention of natural and technological risks. "
Recently the implementation of this cross-border cooperation already exists on the line of Croatia-Montenegro, where on the Montenegrin side there are 7 regions directly participating (Herceg Novi, Kotor, Tivat, Budva, Bar, Ulcinj, Cetinje) and also other 3 regions as neighboring ones (Nikšić, Podgorica, Danilovgrad) in the meaning of implementing regulation IPA (EC No 2499/2007, article 88 and 97).

REGIONAL DEVELOPMENT AND HUMAN RESOURCES

Thematic field defined in the point 147/1/b under applicable topics environment measures related to waste management, water supply, urban waste water and air quality; rehabilitation of contaminated sites and land; areas related to sustainable development which present environmental benefits, namely energy efficiency and renewable energy.
Also, in the meaning of IPA implementing regulation, there could be such measures included, that contribute to increase of regional competitive strength and employment – both especially in the field of supporting the technological development and research including cooperation with tertiary educational sector, research and technological centers.

DEVELOPMENT AID OF CZECH REPUBLIC

Montenegro doesn't actually belong under priority states for Czech assisted development projects; therefore there is no reasonable option to apply for investment projects in the meaning of CLEAR implementation. In contrary, there is a good option to obtain funds for partial objectives in terms of bilateral cooperation – expert consulting, preparing the project application, study visits, internship…etc. This is in competence of Czech Ministry of Environment, Czech development agency…etc.

CONCLUSIONS

The main objective of CLEAR project was the intermediation of expert cooperation to suggest an efficient strategy for building the integrated surface and ground water monitoring system and integrated management tool for operating the water resources in republic of Montenegro. In the feasibility study there are besides detailed state of art analysis also cost estimates included, one chapter of this final report focuses on possibilities of financing the CLEAR project implementations and dissemination.
Partners of the CLEAR project (VODNI ZDROJE, a.s., Hydrological and Meteorological Service of Montenegro, Czech Hydrometeorological Institute) are cooperating on design of the surface and ground water monitoring system with focus on major hydrological and hydrogeological formations in Montenegro:

1. Black Sea infiltration catchment (region of salinization)
2. Skadarske lake catchment area
3. Karst region of western Montenegro
4. Catchment area of Piva and Tara rivers
5. Catchment area of Ćehotina river
6. Catchment area of Lima and Ibra rivers

The system will serve to gather both quantitative and qualitative data on surface and ground water; it will also include observations of potentially contaminated sites. Part of the suggestions is also draft sampling frequency and range of qualitative analysis for appropriate assessments. The issue of surface water, ground water and integrated water resources management requires use of integration methods in technical, economic, environmental, legal and social questions. All should be in terms of efficient development and sustainable water operation. Water management strategy should be coherent with EU environmental regulations and above all to the general directive on water (RSV) and directives on ground water (GWD).
Financing possibilities of CLEAR implementations are most suitable with use of EC tool - Council Regulation (EC) No 1085/2006 establishing an instrument for pre-accession assistance“ or IPA in terms of implementing regulations EC No 2499/2007. Topics of CLEAR project cover in terms of IPA the issues of Cross-border Cooperation, Regional Development and Human resources.
As a next procedure we suggest to process the choice of most suitable area (hydrogeological region) to launch the initial implementation phase – the pilot site. There will be all the suggested activities step by step carried out and gathered experience will be efficient in next enlarging the focus on all regions of Montenegro.