

Abstracts of the Projects 2015

Branch of Hydraulics, Hydrology and Hydrogeology

Critical source areas of phosphorus in watersheds as the decisive factor of transport – a trial of the expression of the dependence on the source areas of runoff and the way of land management

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Duration: 2012–2015

P-pathways is a project of the American-Czech cooperation on the leaching of phosphorus from agricultural land and/or diffuse pollution leaching from small municipalities and buildings with insufficient removal of sewage.

We work on four agricultural catchments with a different intensity of agricultural production. In 2012 we have constructed a device for artificial rain in order to be able to work with intensities which occur only very rarely; checked the absence of the pesticides with P on 1 catchment; and carried out a preliminary trial with sprinkling on 2 catchments.

In 2013 further experiments with artificial rain and phosphorus leaching have been carried out. Samples have been taken in a number of points in the catchments in order to map the diffused pollution sources.

In 2014–2015 the sampling of diffuse sources continued. An experiment with artificial rainfall has been done in the protection strip near the river.

Uncertainty in Water Footprint and a new way of working with the predictions of climate models

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Duration: 2014

Project is dealing with water footprint in our conditions. In our country the grey water seems to be the most important problem, i.e. water polluted with nutrients.

We are studying the diffuse pollution during various flow events – floods and droughts and compare the agricultural pollution with the pollution from small communities. Also, the efficiency of waste water treatment plants, the various influences on the effluent from the plant and the variability of inflow and outflow play a role in the nutrient pollution of our rivers.

Further we intend to use a new English way of work with the predictions of climate models and use it for the evaluation of dam safety during floods.

Ensuring the quality of drinking water supplied to small municipalities from local sources

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Duration: 2012–2015

The objective of the project was the creation of certified methodology “Comprehensive Management of Small Water Sources for Optimal Securing of Quality of Drinking Water at Usual and Exceptional Situations” that is aimed for administrations of small municipalities (focused at municipalities with up to 1000 inhabitants) with own local water sources and smaller water suppliers. The objective of the certified methodology is to make the ensuring of quality of drinking water in rural areas as good as it is in big cities while respecting the different economic situation of small municipalities and small water suppliers.

In last project year, the monitoring of pilot localities (particularly Omice, Svatoslav, Velký Šenov a Všechnovice) was finished. The obtained data were evaluated and the project outputs were discussed with end users (the representatives of municipalities). The workshop with potential users of results was organized in Brno in March. The methodology was finished, verified and certified by the Department of environmental support to the rural development programme, the Ministry of Agriculture of the Czech Republic. The results of the project were presented in reviewed journal *Vodni hospodarství* (Water Management), at the national conference Groundwater in Water Management Practice, at seminar Current Issues of Hydrogeology, at the 42nd International Congress IAHR and at seminar Groundwater in Water Right Management XII. The economic study of the construction, operation, and recovery of small water resources, including access to the correct determination of the charge for water, is annexed to the final report of the project. The intended results including the intermediate objectives of IV. stage of the project for the year 2015 have been fulfilled. The main result of the project – certified methodology will be introduced in the next years into practice in accordance with the implementation plan and the concluded contract on the use of the results.

Increasing the safety and reliability of culverts with regards to the transfer of flood flows

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Duration: 2014–2016

The aim of proposed project is increasing safety, reliability of culverts and throughput of traffic on roads leading over culverts in terms of passing flood flow through objects using the results of a proper hydraulic design of new structures and reconstruction and maintenance of existing structures throughout their service life. Moreover, the results of the project will also enhance economic aspect of their design, manufacture, installation and maintenance.

The project objective is to improve hydraulic calculations of flow through culverts under different flow conditions and to solve the problems of newly designed culverts. The proposed measures will help to increase the safety and service life of transport infrastructure. The project will also focus on finding simplified procedures for designing culverts that are draining very small watersheds.

TGM WRI in cooperation with Road and Motorway Directorate of the Czech Republic (RSD CR) and the Railway Infrastructure Administration, state organization (SŽDC) focused on

identification of localities potentially at risk in terms of hydraulic characteristics caused by improper design solutions.

In 2015, the efforts of the research team focused on the following work. TGM WRI in cooperation with Road and Motorway Directorate of the Czech Republic (RSD CR) and the Railway Infrastructure Administration, state organization (SŽDC) focused on identification of localities potentially at risk in terms of hydraulic characteristics caused by improper design solutions. The project focused mainly on physical and mathematical models in 2015. The models were focused on determining the value of the coefficient of local losses at the inlet of the culvert.

Compensation of negative climate change impacts on water supply and ecosystems using the localities for potential accumulation of surface water

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Duration: 2014–2017

The main objective of the proposed project is to provide a more accurate data basis for the General Plan of protected localities for surface water accumulation, and for the third round of the River Basin Management Plans update. This refinement will consist of the data replenishment from the non-observed localities and evaluation of storage function security for the individual protected localities (potential reservoirs). In addition the results will be summarized in the form of specialized maps reflecting a vulnerability of the individual catchments and security of the storage function of particular potential reservoirs. The individual procedures will be generalized in the methodology used for the comprehensive assessment of security of the storage function of potential reservoirs with respect to climate change. In addition, the impact of near-natural retention and storage measures will be assessed. The procedures will be encapsulated into a software package.

In 2015, the monitoring continued in the network of gauge stations (built previously). The water management solution of reservoirs at protected localities was carried out. The interactive map showing localizations and the parameters of protected localities was put into operation. The maps shows localizations and the parameters of localities and results of water management solution. Advanced methods of creation of climate change scenarios were tested. The methods were focused on the correct simulation of the long-term variability – in particular for the purpose of modeling the occurrence of dry periods.

Assessing water quality improvement options concerning nutrient and pharmaceutical contaminants in rural watersheds

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Duration: 2014–2017

The project is financed by so called Norway Grants and it is focused of determination of origin of pollution sources in surface water and groundwater (nutrient and pharmaceutical contaminants). Other project objective is to determine the shares of point and non-point sources of pollution in catchments under different hydrological situations. The goal is to evaluate the effectiveness of different approaches to wastewater management including possibilities of using root zone wastewater treatment plants preliminary in small municipalities (up to 500 or 2000 IE). Regarding pharmaceuticals,

the identification of processes during their leaching into water, migration in unsaturated and saturated zone and further "fate" of these substances. The results which will be brought by this project are currently not available in the Czech Republic and partly not available in Norway. These intended results are crucial for fulfillment of mandatory targets of the Water Framework Directive, Nitrates Directive and the Groundwater Directive. They should be taken into account in the preparation of conceptual and technical documents for water management and soil protection management in catchments where the drinking water resources are.

In 2015, the detailed monitoring of behavior of 32 pharmaceuticals was carried out at a pilot locality Horní Beřkovice from source of contamination via waste water treatment plant, infiltration devices to wells cca 1 km away. The results obtained so far allowed to assess the treatment effectiveness and degree of elimination by movement through unsaturated zone including attenuation processes in the collector. Definitive results will be available in 2016.

Review of groundwater resources in the Czech Republic: geological activity for the hydrogeological survey in Area 3

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Duration: 2014–2017

Review of groundwater storages in rayons of northern part of the Bohemian Cretaceous Basin (Area 3) is the main objective of the project. The project is funded by the European Regional Development Fund, from the Operational Programme Environment and by State Environmental Fund of the Czech Republic. It will be possible to determine the quantity of groundwater, the optimal conditions for water withdrawal, and define measures to protect them in evaluated groundwater rayons thanks to obtained data and newly built models. Preparation of the methodological and organizational platform for system review of groundwater resources every six years, so how is it in accordance with the rules of the European Union determined by the Water Act and related legislation. The future regular review of groundwater storage already will require only the minimum financial requirements and will work with the models and results of the current project.

In 2015, the drilling activities were finished, the methodology for determining the nature and exploitable groundwater resources was finished. Nature and exploitable groundwater resources for each hydrogeological region were calculated with varying degree of uncertainty.

Hydrological and hydrogeological research in the wider area of new nuclear source at Dukovany nuclear power plant

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Duration: 2014–2015

The purpose of the project is the hydrological and hydrogeological monitoring in the wider area of the planned new nuclear source.

In 2015, detailed monitoring of surface water flow and water quality was carried out at 3 gauges in monthly time step and at 9 monitoring boreholes. The groundwater levels were

monitored continuously. In the first half of 2015, the existing groundwater monitoring network is extended by the new borehole to a depth of 150 m.

Collaboration on a physical modeling research of the adjustment of the water duct Decin

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Duration: 2014–2016

Research Methodology "Physical model of the adjustment of the water duct beneath the navigation step Děčín" has been prepared within the project "Improvement of navigation conditions on the Labe between Ústí nad Labem – state border CR / FRG – Navigation Level Děčín" (project number 327 520 0007) under contract of the Directorate of waterways of the Czech Republic and the Czech Technical University in Prague, Faculty of Civil Engineering. Research is conducted in cooperation Czech Technical University in Prague, Faculty of Civil Engineering and TGM Water Research Institute, pri.

The aim of the study is to design methodologies and research work program to be implemented to the updated hydraulic model at a scale of 1:70, which is situated in the open within WRI, pri. The model represents the section of Elbe River between 737.5 river km and 730.1 river km with the navigation step Decin at 737.12 river km.

Increasing water resources availability in selected regions of Karlovy Vary district

Project team: TGM WRI: Ing. Adam Beran, doc. Ing. Martin Hanel, Ph.D., Ing. Adam Vizina, Ph.D., Ing. Magdalena Nesládková, Ing. Petr Vyskoč, Ing. Jiří Píček, Ing. Libor Ansorge
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Duration: 2015–2018

The objective of the project is a development of certified methodology for proposal of adaptation measures leading to increasing reliability of water resources in the periods of water stress using existing infrastructures as much as possible.

Project started in April 2015. The members of project team are from TGM WRI and from the Povodi Ohre, state enterprise. In 2015, the available data sources were revised, the missing data were identified and hydrological, meteorological and water management data were collected. The localities for more detailed research were identified in cooperation with employees of the Povodi Ohre, s.e. The potential variants of adaptation measures (to be investigated in the project) will be proposed for these localities. The scheme of water management system from 2010 will be updated by implementation of the measures.

Precipitation extremes and climate change

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Duration: 2015

The aim of the subproject is analysis of observed precipitation extremes and their changes.

The focus is on the relation with the erosivity of the precipitation events and their projections for conditions influenced by climate change. The map R-factor spatial distribution was developed in the project, including its changes according to climate change scenarios. The methodology of generation of design precipitation for climate change scenarios was developed. The analysis of observed precipitation showed the positive trends in many characteristics of erosive precipitation events. However, these trends are insignificant for the most stations. Detectability of trends may increase with the inclusion of the most recent data.

Hydrogeological study of the relationships of selected peat bogs in the Jihlava District

Project team: Mgr. Pavel Eckhardt, Ing. Kateřina Poláková, Ing. Adéla Trávníčková, RNDr. Ladislav Havel, CSc., et al.
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Duration: 2015–2016

The aim of the project is description and analysis of the water regime (the hydrogeological, hydrological and hydrochemical conditions) on the six selected sites of meadow on peat bogs in Jihlava District. The results of the comparative study will provide recommendations for optimization of the management of sites and their revitalization.

The project was launched in late February 2015. In the first step, the sites were inspected and the review of available relevant documents has been carried out. The shallow hydrogeological probes were built for monitoring of the groundwater levels at studied localities. The gauging stations were installed for monitoring of surface water. Probes and selected stations were equipped with devices for continual monitoring. The water was sampled for chemical analysis and selected parameters were monitored monthly. time step. Obtained data were evaluated on an ongoing basis. The selected hydrobiological parameters were monitored. The project will be finished in the first half of 2016. The results will be summarized in the final reports and presented at a scientific conference.

Reference Laboratory of Environment Components and Wastes

New drugs – market analysis, epidemiology of use and identification of preventive and harm minimisation strategies

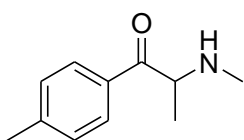
Project manager: MUDr. Tomáš Záborský, Ph.D. (Charles University Prague)

Project team (TGM WRI): Ing. Magdalena Kvíčalová, Ing. Danica Pospíchalová (May 2014), Ing. Alena Svobodová

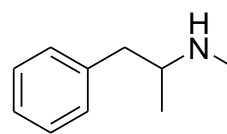
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Duration: May 2013–December 2015

The project is focused on new types of drugs and TGM WRI contributes to it by 1) qualitative analysis of new synthetic drugs that are used in the Czech Republic and 2) dealing with issues of their identification and quantification in waste water and consequent mathematical estimates of amount of consumed drugs. These estimates are based on detected values and knowledge of degradation processes in waste water and metabolic processes in human body. The project is focused mainly on cathinones (e.g. mephedrone). The GS/MS and LC/MS apparatuses will be used for analyses of solid substances and waste water samples.



Mephedrone, 4-MMC, 4- methylmethcathinone
NSD



Methamphetamine, crystal meth
"classic drug"

In the second project year (2013) we focused mainly on development of methodology for determination of 4 selected NSD (New Synthetic Drugs) – mephedrone, 4-methylethcathinone, metylone and pentedrone in waste waters using mass spectrometry with gas or liquid chromatography. After a series of experiments methodology based on LC/MS was found. This methodology was subsequently used for the analysis of real samples, collected in the last year at selected sites in Prague sewerage system. At the end of the year, six NSD were added to original list: ethcathinone, MDPBP (metylenedioxy-pyrrolidinobutyrophenone), PVP (pyrrolidino-valerophenone), flephedrone, MePPP (4- metyl-pyrrolidinopropiophenone) and nor-mephedrone (metabolite of mephedrone).

The last year we also analysed a series of solid samples of narcotics after previous derivatization by GC/MS. We identified mostly MDPBP and mephedrone.

The results of the project were presented on conferencies: Hydrochémia 2014 and 49th Advances in Organic, Bioorganic and Pharmaceutical Chemistry.

In 2015 the methodology of determination of 10 cathinones was optimized. Samples of wastewater (about 80) were taken at selected places in sewerage system and on the inluents of appropriate municipal wastewater treatment plants and were analyzed using this methodology. All selected NSD were detected, most often mephedrone, pentedrone and metylone. The results of the project were presented on the conferencies: Testing the Waters, Ascona, Switzerland and 50th Advances in Organic, Bioorganic and Pharmaceutical Chemistry, Olomouc, CR. The monograph focuses on the "New Psychotropic Substances" from the different perspectives is under preparation.

Determination of the amount of illicit drugs and their metabolites in municipal wastewater – new tool for obtaining of complementary data on illicit drug consumption in the Czech Republic

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Duration: 2012–2015

The objective of the DRAGON project is applying “sewage epidemiology” in the Czech Republic. The project is carried out in the frame of security research (Ministry of Interior of CR). The sewage epidemiology is epidemiology of waste water. The project aims to create methodological approach for estimation of amount of consumed illicit drugs and their metabolites in municipality waste waters. The estimation is then used for calculation of illicit drugs consumption among the population. In comparison with classical methods of research and screening of illicit drugs consumption among the population, the methods of sewage epidemiology are less financially demanding, anonymous and can be performed almost in real time. The sewage epidemiology method has also many general advantages in comparison with conventional methods of research. The method is more universal than conventional and consequently can be used for fast identification of hot-spots (the sites with high consumption of illicit drugs), testing of comparability of different programmes of drugs abuse prevention in specific locality, the validation of results of conventional methods of determination of illicit drugs consumption among the population and estimation of value of financial resources at illicit drugs market at the given locality.

The new approach of the project DRAGON (abbreviated name) is the monitoring of illicit drugs concentration and concentration of their metabolites in raw municipality waste waters not only at the inflow to a waste water treatment plant but also in nodes of the sewage network. It will allow estimate the amount of consumed illicit drugs in individual town districts that are connected to common town waste water treatment plant. The agglomerations selected for the monitoring are Praha, Brno, Ostrava, Plzeň (Pilsen) and Ústí nad Labem. Other monitored localities are Havířov, Český Těšín, Orlová, Frýdek-Místek and Karviná (2013). The following localities were monitored in 2014: Opava, Nový Jičín, Cheb, Aš, Mariánské Lázně, Františkovy Lázně, Karlovy Vary, Liberec, Jablonec, Pardubice, Hradec Králové, Jihlava, Zlín, Olomouc, Bruntál a České Budějovice.

In 2012, the suitable analytical method was implemented and validated. In 2013, four seven-day sampling campaigns were carried out at each of monitored localities. The differences during the week can be detected thanks to the seven-day campaigns.

In 2014, the sampling campaigns continued in similar way. The ACCENDO – Centre for science and research, o.p.s., processed the "Socio- demographic study including analyses of spatial distribution of population and identification of risk groups of users of addictive substances (drugs)" for the DRAGON project. In 2015, the analyses of the waste water samples were finalized and obtained results were processed. The main project output is the “Methodology of the implementation of epidemiology of waste water for determination of the transport of illegal substances in the Czech Republic”. The methodology was certified by the CEMC (<http://www.cemc.cz>).

Research of optimization possibilities of operation and of effectiveness increase of wastewater treatment from small municipalities using non-conventional technologies

Project team: Ing. Eva Mlejnská, Ing. Miloš Rozkošný, Ph.D., Ing. Alžběta Petráňová, et al.

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Duration: 2012–2015

The project is focused on research of possibilities how to increase the effectiveness of waste water treatment from individual buildings or small municipalities in soil filters, root zone waste water treatment plants and biological tanks (so called extensive technologies of waste water treatment). The main goal of the project is to develop the new technology components for increase of effectiveness of the treatment by the extensive technologies. Other goal is the development of suitable bacteria preparations aimed to support the treatment processes of above mentioned technologies and most of all the regeneration of clogged filtration fillings of root zone waste water treatment plants and soil filters.

2015 was the last project year. The activities were focused of finishing of the monitoring of selected waste water treatment plants. The main attention was paid to the effect of installed new technology components on the increase of the effectivity of the treatment. A new variant of the settling tank was proposed in cooperation between ASIO and TGM WRI. New variant of settling tank is the last output planned in the project. Based on the calculations and the design the functional model was manufactured. The functional model was installed in real conditions at the wastewater treatment plant in Dražovice.

In the final phase of the project, the documentations were prepared for all functional samples and pilot objects including documents for registration of utility models that have been processed by the patent agent of the TGM WRI. The implementation plan of the project was processed including the commercial utilization of project results.

The project outputs were presented at conferences (e.g. conference VODA 2015 in Poděbrady) and at workshops for public or professionals. The article for journal VTEI and monograph were prepared. Monograph summarizes the whole issue of extensive waste water treatment methods and their application in the Czech Republic, including the findings of the project to optimize these technologies and increase their efficiency and operation stability.

The project outputs with potential application in practice will be presented on the web pages of all three project participants (the TGM WRI, p.r.i., ASIO, Ltd. and BioEnviro, Ltd.)

The research of detection and determination methods of radioactive contamination

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Duration: 2012–2015

The project objective is the development of fast method for determination of total volume activity Beta and strategy of sampling in case of nuclear accident.

The possibility of fast determination of total volume activity Beta in water samples in case of nuclear accident in the Czech Republic or abroad was verified. The proposed method was verified in cooperation among TGM WRI, p.r.i., water contamination measuring sites and water management and radiological laboratories. Newly, the possibility of calibration with use of standard Strontium 90-yttrium 90 was verified. The results show that values of indicator total volume activity Beta will be higher in the case of this calibration in comparison with use of standard Potassium 40. The evaluated method was processed and published as the CSN 75 7613.

From point of view of samples collecting, the irreplaceable role of water management radiological laboratories of Water administrators (Povodí, s.e.) has been proved. The fast screening measurements for determination of samples contamination with special focus on drinking water resources and water supplied to the public water supply networks proved to be also very important.

Support to activities of the permanent and emergency component of nationwide Radiation Monitoring Network

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Duration: permanent activity

The objective of the project is to monitor the levels of radionuclides in hydrosphere in normal and, where appropriate, in the emergency regime in cooperation with laboratories of the river basin administrations (Povodí, state enterprise).

Respecting the Framework Agreement on the activities of the components of the nationwide radiation monitoring network (RMS) between the Ministry of the Environment and the State Office for the Nuclear Safety, the Reference Laboratory of TGM WRI, p.r.i., guarantees the activities of the permanent and emergency component of nationwide radiation monitoring network in cooperation with water management laboratories of the river basin administrations. In the period of the monitoring in the normal radiological situation (in 2015), the development of the concentrations of radioactive substances in surface and drinking waters, sediments, water sludge and fish biomass was monitored at selected gauging stations. Increased concentrations of tritium in comparison with the background were identified in the Vltava River at Praha-Podolí and at the outlets of the Elbe River and the Morava River. This is a consequence of discharges of waste water from the Temelín Nuclear Power Plant and Dukovany Nuclear Power Plant. The results of the monitoring are continuously transmitted to nationwide radiation monitoring network (RMS) in the scope of the information system of the State Office for the Nuclear Safety.

Monitoring and assessment of surface water and groundwater quality and its changes in relation to the impact of the Temelín Nuclear Power Plant construction and operation on its vicinity

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Duration: 2000–2015

The project objective is given by its name.

The monitoring and evaluation of impacts of the Temelín nuclear power plant on the environment for the need of the CEZ group. The project activities follow on the conclusions of the discussions of the impact of the changes of the structures on the environment (EIA). The project outputs represent the new reference level before the finishing of the new nuclear source at the Temelín power plant locality.

Investigation of impact of the Temelín Power Plant accident on contamination of the Vltava and Elbe Rivers up to the Elbe gauge station at Hřensko (country boundary)

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Duration: 2012–2015

The project objective is to evaluate migration of radioactive substances in the case of accident in Temelín nuclear power plant in water environment.

The migration of tritium along the Vltava and Elbe Rivers was monitored. The tritium discharged during the usual operation of the plant was used for monitoring as a tracer. The time of transfer of the tritium dependent on river flow was evaluated. The proposed method of determination of the distribution coefficients of radionuclides among water and river sediments or soluble substances was approved as a certified methodology of the Ministry of the Environment of the Czech Republic.

The data were prepared for analysis for localization, needs and possibilities of automated monitoring station for continual sampling and radiological analysis.

Content of radioactive substances in the Orlík Reservoir and its tributaries after commissioning of the Temelín Nuclear Power Plant – period 2015

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Duration: 2015

The project objective is to observe and evaluate the content of radioactive substances in the Orlík Reservoir and its tributaries. The client is the watercourse administrator.

The tritium volume activity was monitored in surface water below the discharge of the waste water from the Temelín nuclear power plant. The monitoring included the vertical distribution of tritium in the Orlík Reservoir and at reference sites. Monitoring was carried out for the needs of the Povodí Vltavy, state enterprise, watercourse administrator).

The evaluation of the results of inspection measurements of the changes in gamma radiation dose rate and the content of radioactive compounds in the vicinity of the buildings included in remediation programme of the Nuclear Research Institute Řež – 2015

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Duration: 2015

The project objective is the monitoring and the evaluation of the effects of remediation of impacts of past contaminations at the Nuclear Research Institute Řež, a. s., on the environment.

In the framework of the project, the effects of remediation of impacts of past contaminations at the Nuclear Research Institute Řež, a. s., on the hydrosphere and other

components of the environment were monitored. These are part of the bases for the assessment of the effectiveness of remedial measures taken in the framework of the Implementation project of the remediation activities.

Determination of pesticides in crops hop (commercial contract)

Project manager: Ing. Věra Očenášková

Research team: Mgr. Petra Kolářová, Ing. Danica Pospíchalová, Ing. Alena Svobodová

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Duration: 2014–2015

The aim of the commercial contract for company PP servis, a. s., was to develop the methodical approach for analysis of pesticides in hop cones, pellets and other parts of plants and to use the proposed procedures for analysis of supplied samples.

Hop is one the most complex matrices to analyze. The new procedures for determination of requested pesticides were developed in hydrochemical laboratory of the branch 220. The procedures include the very complicated preparation of samples prior to analysis. In total 40 pesticides are examined by three analytical methods (LC-ESI⁺-MS, LC-ESI-MS and GC-NCI-MS). LODs for individual pesticides are at very low levels (hundredths mg/kg) to be able to determine whether the amount of given pesticides does not exceed the maximum permissible level in the analyzed matrix. The developed methods were validated and accredited.

Development of methodological, planning and monitoring measures for solving fragmentation of the river continuity in the Czech Republic

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Duration: 2014–2016

The project objective is to develop innovative approach for the solution of fragmentation of the rivers, to obtain and verify relevant data and to build one central database cumulating all relevant data. The aim is to built central data storage and to propose the structure of the outputs that would be effectively used by professionals, scientists, civil service and general public. There will be also designed and tested system of monitoring of the realized fish-passes. The standardized methodology of functionality evaluation and long-term monitoring of fish-passes will be created. The project started in July 2014.

For the database functionality, it is necessary to define the competence of management and the flow of data to suggest its structure and outputs to be usable for professionals, including reporting to the EU. This comprehensive approach is completely innovative in the Czech Republic, and probably in the EU. The data will be collected on migration barriers in rivers, small hydro-electric power plants, status of ichthyofauna, status of existing and prepared fish passes (Fps). The different methods of FPs monitoring will be compared regarding effectivity and economy. The system of on-line monitoring of FPs will be developed. The system will use special probes. The result will be standardized methodological approach for evaluation of the functionality and monitoring of FPs. The system will be used in the preparation of future programs to support the construction of FPs. The project will include an analysis of the relevant legislation and proposals for amendments with respect to supporting the construction of FPs. The outcome will contribute to solving the problems of unblocking the river network to aquatic organisms, and thus improve the status of the environment in the Czech Republic.

Water Recreation – Bathing in Bathing Sites and Other Freshwater Bodies

Project team: Ing. Tomáš Fojtík, Ing. Arnošt Kult, RNDr. Dana Baudišová
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Duration: 2014–2015

The project objective is to reevaluate the current status of the list of natural bathing places and bathing surface waters. The reevaluation will be carried out via Methodological Guidance of Chief Hygienist for Identification of New Bathing Waters. The second output will be the set of specialized maps, which would be useable as supporting document of the Methodological Guidance.

In 2015, the questionnaires survey continued and selected localities were explored. The aim was to find out the behavior of bathing persons. The conclusions were formulated from obtained data and then transformed in project outputs. The project output “The set of maps of bathing sites” contains the map viewer and a set of thematic maps. The maps serve as a support to methodical guidance of main hygienist for decision making on publication or cancellation of bathing waters.

Introduction of new market-based tools to increase the efficiency of the surface water allocation

Project team: doc. Ing. Lenka Slavíková, Ph.D., prof. Ing. Jiřina Jílková, CSc., Ing. Ondřej Vojáček, Ph.D., Ing. Jan Slavík, Ph.D. (IREAS, p.s.c.), Ing. Lubomír Petružela, CSc., Ing. Jiří Dlabal, Ing. Arnošt Kult (TGM WRI, p.r.i.)

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Duration: 2014–2015

Project aimed to issue that the permission to withdraw surface water that is currently free of charge (and therefore overused) causes increasing ineffectiveness in water allocation. The emission of new permissions might be threatened; public water management is burdened with extra costs for the supply of water that is not used at the end. Project proposes introduction the payment for permitted amount of water - to increase the efficiency of allocation and to open the door for possible future permission transfers among water users.

In 2015 the project entered the final phase of solutions aimed at creating economic analytical motivational tool. They were created and forwarded the results set: Methodology for analyzing modifications payments for watercourse management and basin management in order to achieve greater efficiency in the allocation of surface water. (Number Certificate: 68156/2015-MZE-15121) and microsimulation model, software tool in the MS Excel, parameterized separately for each administrative basin (scope River Basin state enterprise). The model allows the design of the above two part payments consisting of charging permitted amount of and payment for actually withdrawn surface water, and is an integral part of the methodology.

The results are summarized in the material: Slavíková, L., et al. The methodology for analyzing modifications payments for watercourse management and basin management in order to achieve greater efficiency in the allocation of surface water, IREAS, p.s.c., TGM WRI, p.r.i., Prague, November 2015, 36 pp. (+ SW)."

Based on partial outputs created during the project: "Pilot testing and results interpretation methodology: Vltava River Basin, IREAS p.s.c., TGM WRI, p.r.i., Prague, 2015, 10 pp.", and "The analysis of the institutional framework and institutional barriers to change a system of licensing and charging for water consumption, TGM WRI, p.r.i., Prague, 2015" and have been continuously presented as articles in peer-reviewed journal.

In accordance with the requirements of the project results have passed opponency, was prepared Implementation Plan and the Agreement on the application of the results with a major user in the state administration (Ministry of Agriculture).

The Methodology and the Software are designed for actors in the field of water policy of the Czech Republic to assess ex-ante impact of changes in fee policies. The software is also publicly available on the project website: <http://www.ireas.cz/cz/zamereni/33-zivotni-prostredi/projekty/131-vek>

Regulation of public services in water management with emphasis on drinking water supply and sewerage sector

Project team: doc. Ing. Miroslav Hájek, Ph.D., Ing. Roman Sloup, Ph.D., prof. Ing. Luděk Šišák, CSc., Ing. Vilém Jarský, Ph.D. (CULS), Ing. Lubomír Petružela, CSc., Ing. Václav Šťastný, Ing. Arnošt Kult, Ing. Jiří Dlabal (TGM WRI, p.r.i.)

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Duration: 2014–2015

The two-year project monitors the area of regulation of services of general interest: public drinking water supply and sewerage. It is incoming from an EU approach based on the specifics of water management and regulation in member countries. It focuses on the sub-regulatory principles, their interactions and comprehensive action in relation to economic and social efficiency of the public services and the innovation potential. The results are targeted to indicate the risk of pricing and its control in this area. Their summary is "Methodology indication of risk pricing and sustainability of prices for water and sewage" (certified), including software. The target user is the Ministry of Finance.

In 2015, the project was focused on the synthesis and processing of the intermediate results into the final output: "Methodology indication of risk pricing and sustainability of prices for water and sewage." CULS, Prague, TGM WRI, p.r.i., Prague, 2015, 33 pp. (Certification number MF-55849/2015 / 1601-1) and Customer Billing Software © v.01.02 j. The software is designed to use data from the general water and sewage bill led within the government Department of agriculture. The methodology and the software is focused on the indication of risk in the process of pricing in the area (water and sewage) in the current legislative framework for regulation and control competencies of the Ministry of Finance. It synthesizes evaluating of several methodological blocks: data integrity, risk pricing, price sustainability, sustainability of assets and operational sustainability and is intended as indicative (rather than punitive) tool of price control.

The result was created on the basis of documents and international consultations (Research of documents in 2014, consultations with the Ministry of the Environment of the Slovak Republic, Federal Ministry of Environment and the Federal Ministry of Economy in Switzerland, universities and representatives of the World Council for Sustainable Development).

Partial results were regularly presented at the international conferences (Rotterdam, Tabor, Prague, Lausanne, San Sebastian) and fundamental result accepted for publication in an impact journal ("Scientia Agriculturae Bohemica").

In accordance with the requirements of the project results have undergone opponency, the Implementation Plan was prepared and an Agreement on the application of the results of a major user in government (Ministry of Finance).

The methodology and software are designed primarily for components of government acting in the regulation and control of pricing in the field of public water supply and sewerage systems in the Czech Republic.

Analysis of water balance data of amount of surface water in the Vltava River catchment

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Duration: 2015

The project objective was the extension of functionality of a simulation model on storage function of water management system. The model is used at processing of water balance of current and forecast status of amount of surface water in subcatchments of Upper Vltava, Lower Vltava plus other Danube tributaries.

The project outputs were: (a) the extension of simulation model by possibility to perform the calculation above the river network model according the "Central registry of watercourses" and (b) the extension of the simulation model by function of automatic calculation of preliminary hydrological analogy with subsequent creation of discharge series for any discharge gauge station of the investigated water management system based on hydrological data from the adjacent stations. The project continued on the previous processing of water balance of current and forecast status of amount of surface water using the simulation model of storage function of water management system in 2006–2014.

Final treatment pools used with low intensity

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Duration: 2012–2015

The project is focused on potential of final treatment of wastewater from activating wastewater treatment plants (WWTP) in final treatment pools that are newly designed. The project is based on prototype WWTP Zbytiny for 500 Hab. Eq. The objective of the project is a quantification of processes that take place in final treatment pools under various conditions and optimization of the processes. Concurrently, the attention is focused also on potential of pools while the domestic WWTPs are used.

The retention experiment of the accumulation of waste water was finished and evaluated on the overall treatment efficiency in 2015. The monitoring of the effect of final treatment plants on the overall treatment efficiency was finished. The monitoring of the biological final treatment ponds in Mysletice, Malovice and Mikulůvka was finished in the project last year. The waste water is pretreated in WWTP at these localities. At the Mysletice locality, the retention experiment with accumulation of waste water was carried out. The pool experiments continued in TGM WRI. Many modifications and sizes of tanks and their effect on the overall treatment efficiency were tested. The two overload experiments were carried out. The aim was to determine the impact of a possible leak of the sludge from the domestic WWTP on the treatment efficiency. Output of the project is the utility model and the prototype. The prototype has been included in the production and product range of the cooperating company.

Activity of the Testing laboratory for water management facilities in 2015

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Duration: unlimited (according to contract)

The Testing laboratory for water management facilities is a part of the Testing laboratory of Technologies and Environmental Components in WRI TGM, p.r.i., which is accredited by the Czech Accreditation Institute under the number 1492. The Testing laboratory for water management facilities tests mainly treatment efficiency of domestic waste water treatment plants (WWTP) according to the ČSN EN 12566-3. Since 2014 it has been possible to test treatment efficiency of domestic waste water treatment plants behind septic tank according to the ČSN EN 12566-6. The Testing laboratory also does accredited tests of separators for light liquids (according to the ČSN EN 858-1.) and grease separators (according to the ČSN EN 1825-1). It is also possible to test different water management installations according to customer's requirements in a non-accredited way.

In 2015 two domestic WWTPs were tested by an accredited test procedure in the Testing laboratory. One of them was tested according to the standard ČSN EN 12566-3, the other one (septic tank and ground filter) was tested according to the standard ČSN EN 12566-6. Septic tank from the WWTP was tested in a non-accredited way in the same time. One tested WWTP which is used for waste water treatment on the ship was tested according to the standard MEPC.227(64).

Five WWTPs in the Testing laboratory are in the testing procedure in different phases of accredited testing. One waste water treatment plant, which was already tested in the laboratory according to the standard, was additionally tested according to customer's requirements.

Courses of sampling for personnel of laboratories in water management and technology

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Duration: unlimited, standard frequency 2 terms per year

The principle of courses is the interpretation of sampling of water and water environment (incl. drinking and waste water), according to international standards of series CSN EN and CSN EN ISO 25667 and linked supplementary documents.

Above all the following aspects are included:
Strategy of sampling, selection of sampling sites, frequency and types of sampling;
Techniques and technology of taking samples of various systems: running, stagnant, ground and waste water and of utility systems, incl. safety rules;
Treatment of samples and transport to the laboratory;
Management and quality assurance of the sampling processes;
Integration of sampling activities into the Systems of Quality of laboratories, according to the standard ČSN EN ISO/IEC 17 025.

Courses are closed by a written rest of knowledge and certificates are issued to the participants. In 2015 two courses were arranged for total number of 36 successful participants.

Branch 240 orders – joint contract

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Duration: 2015

Four expert opinions in the field of water supply and sewerage systems were processed in branch 240 in the frame of this joint contract. Three expert opinions were for courts and one was for the Czech Environmental Inspectorate. In addition, many different contracts was carried out: detailed sampling of operation of several urban wastewater treatment plants (WWTPs) for the needs of research, selection of an appropriate solution to the reconstruction of the industrial WWTP, the propose of the measures to reduce foaming wastewater discharges from industrial plant, laboratory verification of the biodegradability of the wastewater from industrial production, the assessment of the suitability of the design of the reconstruction of the structure in the water treatment plant, assessments of the causes of the excessive precipitation of iron in the bathing water or assess the impact of add-ins in domestic sewage treatment plants.

The comments have been processed to the legislative proposals of the government regulation and of the water law.

Strategy for protection against negative impacts of floods and erosion phenomena by nature-friendly measures in the Czech Republic

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Duration: 2014–2015

The comprehensive project of infrastructural nature for universal long-term use will provide an evaluation of the entire territory of the Czech Republic regarding the society-wide benefits of financial and material parameters of the projects submitted by applicants for grant programs. Outcomes of the project will create a comprehensive strategy of the Ministry of the Environment addressing flood protection, diffuse pollution, water erosion and restoration of the water regime.

Proposals of the systems of nature-friendly flood and erosion control in basins with the most urgently needed solutions to these issues are the project objectives. The project results are available on the map portal to target groups of users (<http://vodavkrajine.cz>). The systems of flood protection were supplemented by elements of local protection and effective measures to protect the soil against erosion in order to adapt to the potential impacts of climate change. Documentation was created to complement existing planning agendas in rural areas especially for sub-basin plans, projects of landscaping modifications, territorial systems of ecological stability, and regional plans of forest development and registration of agricultural land use.

Implementation of the project is the major contribution towards achieving the objectives of the Water Framework Directive and fulfillment of tasks of relevant resolutions of the government of the Czech Republic.

Analysis and evaluation of socio-economic impact on the development of society in areas protected for surface water accumulation

Project team: Ing. Milena Forejtníková, Mgr. Jana Ošlejšková, Ing. Alžběta Petránová, Mgr. Jiří Kroča

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Collaborating organization: Masaryk University Brno, Faculty of Social Studies

Duration: 2014–2015

The project objective is to create suitable tools that will provide the expert and objective basis for land use decisions. It will highlight various aspects, positive and negative impacts of further protection of area or construction of planned structures. The project will take into account the variability of a solution in a specific location by variability of requirements, including the possible utilization for energy production.

The list of localities that are suitable for accumulation of surface water (regarding morphology, geology and hydrology) is a part of the document "The general plan of protected areas for surface water storage". Detailed assessment of the socio-economic and societal impacts of the current limitations associated with such protection will be an important basis for decision-making at all levels of management.

The detailed analysis and impact assessment is carried out on existing reservoirs. The localities of various types (regarding the difficulty of solving social and economic relations associated with the construction and land use change) have been selected for this evaluation.

Specific impacts on the lives of citizens emerged from the results of the questionnaires. Another part of the project focused on the analysis and evaluation of the impacts of current constraints and planned measures in the areas under consideration for future surface water accumulation. A detailed analysis of social, economic and environmental impacts on the environment and residents took place in selected locations. Specialists from the Faculty of Social Studies of the Masaryk University in Brno participate in the project to guarantee expertise in this respect.

Results of the analysis and relevant data of the evaluated areas as well as other findings which can be generalized were processed to the "Methodology for preparing documents for spatial planning and land use in areas protected for surface water accumulation". Simultaneously, the document "Structure of territorial study of area protected for surface water accumulation" was prepared. The document contains instructions which essential items should be included in the assignment of a territorial study in case that a part of given territory is an area protected for future surface water accumulation.

Another planned output is a set of maps "Evaluation of changes in selected areas protected for surface water accumulation."

The project outcomes will be used mainly for spatial planning at various levels. To facilitate their implementation in practice implementation plan for the next three years has been adopted. All relevant outcomes of the project are available on the website of the project at the TGM WRI server.

Identification of significant areas with cultural and historical values threatened by natural and anthropogenic stresses

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Collaborating organization: National Heritage Institute, Prague

Duration: 2012–2015

The objective is to evaluate the size of threat for selected categories of historical objects (Cultural Heritage Objects and UNESCO objects) and protected areas (urban monuments preservation areas, village heritage sites, archeological heritage sites and other heritage sites) by important natural, industrial and agriculture hazards in the Czech Republic using unified procedure.

The categorization of historical objects is carried out according to the size of potential threat individually for each hazard. Consequently, the synthesis of all threats and comprehensive evaluation of objects and sites listed above will be processed. Special attention is paid to the Cultural Heritage Objects of global importance. The evaluation is processed based on spatial map analyses using the available databases, field surveys and process modeling. The results have been verified by comparison with findings of regional offices of the National Heritage Institute.

The project outputs will extend the integrated information system of National Heritage Institute by systematic findings in form of thematic databases. The set of specialized maps has been generated from these databases. The maps will show the size of potential threat to all observed historical objects by evaluated hazards: river floods, torrential rains, water and wind erosion, landslides, atmospheric deposition, industrial activity and also threats to the objects

bound to the water including changes of their diversity. Additional outcome is web map application that will present the results to the public interactively.

The methodology describing how to evaluate the selected potential threat to the other historical objects is an independent project output. The methodology also describes which documentation should be used preferentially and which procedures should be chosen. It is possible to use the methodology at the repeated (updated) evaluation of historical objects and its use will allow compare the size of threat in time and space.

All the planned project outputs were finished in project last year. The international seminar was organized in town Telč. The Czech-English collection of contributions from the seminar is available in electronic version. A set of maps was accepted by Ministry of Culture with recommendation for listed users. The methodology is the same in the certification procedure of the same ministry. The most of the project outputs is publicly available in different level of detail at web pages of TGM WRI. In future, they will available at web pages of the National Heritage Institute and the Ministry of Culture. The adoption of the implementation plan was a part of the project. The implementation plan will help to inform about the project and to implement the obtained results in practice.

Technical tools to identify pollution

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Duration: 2014–2015

The project objective is creation of maps usable for decision-making of public and state administration in the field of corrective measures in reducing of the nutrients contamination of water in the catchment of the Mostišť water reservoir. The results provided an overview of the size of load from point and non-point sources of pollution in the catchment and the possibilities of pollution reduction to reach of good status of waters.

In 2015, the monitoring of quality of treated and untreated water, the water washed from the urban areas and of groundwater was carried out in five subcatchments of the given water reservoir catchment.

Building on the activities carried out in the previous year, the nutrient emission load was evaluated in surface water. Seven sources paths are evaluated including point and diffusive pollution sources. The value of reduced load was evaluated in parameters characteristic for nutrients in evaluated catchment. Such evaluation allows to assess the effectiveness of measures to reduce the pollution (and reduction of emissions from pollution sources that are introduced to watercourses) to the level of good status of surface water. In total 12 specialized maps of nutrient emission load in surface water were created. The project was supported by the Technology Agency of the Czech Republic.

Monitoring of the impact of the Dukovany Nuclear Power Plant on the quality of water in the Jihlava River

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Duration: 2012–2014

The programme of monitoring of the impact of the Dukovany Nuclear Power Plant (NPP) on water quality is focused on implementation of the inspecting long-term monitoring in the Jihlava River and in the Dalešice-Mohelno reservoir system in order to assess the impact of discharge of waste water from the Dukovany NPP on surface water quality. The monitoring is based on the contract with CEZ. The monitoring in 2015 followed up the previous observations since 2002.

The monitoring was focused on the physico-chemical, chemical, biological and radioactive water indicators at representative monitoring sites. In 2015, significant variations from the long-term status were not observed. The steady state followed from the results, i.e. the quality of water in the area was affected by the supply of organic fecal pollution from the upper catchment of the river Jihlava, which was largely eliminated in the Dalešice Reservoir and in the Mohelno Reservoir. The wastewater from the Dukovany NPP increased concentrations of inorganic salts and tritium in the Jihlava River and in both reservoirs. The increased concentrations of nitrates were found at all monitoring sites: the water quality was classified according to ČSN 75 7221 to IIIrd class at all monitoring sites affected by waste water. Nitrate pollution was the cause of failure to comply with the values of permissible pollution Government Regulation 401/15. Biological monitoring has demonstrated high trophic potential of water in the monitored system: A high content of chlorophyll-a was detected at the inflow to the Dalešice Reservoir and the increased trophic potential was observed at the other monitoring sites. Index of saprobity confirmed the steadily favorable status of organic pollution of water. Long-term systematic monitoring of water quality, monitoring of trends and on the links between pollution and the quality of the water in a major water management system is used for an objective and comprehensive assessment of the qualitative status and influence of the environment at the observed localities.

Inundated cultural and natural heritage of Southern Moravia

Project manager: RNDr. Hana Mlejnková, Ph.D.
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Duration: 2013–2016

The project is focused on changes induced by construction of big water reservoirs: it evaluates the changes in settlement, culture, land use, water structures and the natural environment. The project deals with the most important localities of river engineering in Southern Moravia: the Nové Mlýny water reservoirs system, the Vranov and Brno water reservoirs. Collected documents from all available sources will be processed and presented in the form of exhibition, which will be held from May to June 2016 in the Moravian archives in Brno and in the form of popular-scientific publication with the name of "Inundated Cultural and Natural Heritage of Southern Moravia".

The third year of the project was focused on the processing of materials and documents collected in the first two project stages. The results have been processed into the map outputs by individual researchers. The maps were accompanied by explanatory texts. All the outputs were

prepared for further processing. An important step was the assembly of partial results in presentations and articles in proceedings in 2014 and 2015. Prepared supporting documents will be adjusted for presentation in the main outputs of the project – the exhibition and the book, which will be implemented in 2016. In 2015, the updating of the database continued, the field surveys were carried out, the photographic documents were collected and the search for new sources of information continued. All the relevant documents have been digitized. The recent information on the project is available at the web page of the project: zatopene-dedictvi.eu.

Drying out of streams during climate change: prediction of risk and biological indication of drought periods as new methods for water resources and landscape management

Project team from TGM WRI: RNDr. Petr Pařil, Ph.D., doc. RNDr. Světlana Zahrádková, Ph.D., RNDr. Denisa Němejcová, Mgr. Vít Syrovátka, Ph.D., RNDr. Jiří Kokeš, Mgr. Pavel Tremml, Mgr. Marek Polášek, Mgr. Libuše Opatřilová, RNDr. Yvonne Puchýřová
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Duration: 2012–2015

The objective of the project was to create “The map of watercourses complete dry-out risk. The map is based on the model of abiotic data. The model is verified by the biotic data. The second major output of the project is the certified “Methodology of retrospective bioindication of dry-out based on macrozoobenthos analysis”. The analysis includes metrics quantifying the frequency and extent of dry-out. The project outputs will allow identification of areas that are at most under risk and they will allow to effectively focusing the protection measures. The effectivity of the measures can be assessed by the methodology. The two main objectives of the project were completed in 2015 and will be subsequently implemented into practice.

In 2015, the project activities were focused on finishing two main project outputs (abiotic metrics describing the areas under risk of dry-out of small watercourses and biotic metrics reflecting in macrozoobenthos community the previous episodes of dry-out. The set of the most suitable descriptors was selected based on statistical analysis. The set was used in the final version of the maps published in GIS layers at heis.vuv.cz. Each catchment of 4th order is classified with this methodology into the one of three categories of dry-out (permanent, vulnerable, drying out). Similarly, the most suitable metrics describing with the given reliability the previous episode of drying-out were selected based on the analysis of macrozoobenthos. Then, the watercourse can be classified as a permanent, vulnerable to drought or drying out. The main project outputs will be gradually implemented into practise based on their publishment on web, creating the software tools and contracts with their potential users (individual river basin administrators, Czech Hydrometeorological Institute, the Ministry of the Environment etc.)

Development of technologies for road and other paved areas storm water runoff cleaning

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Duration: 2013–2015

The project objective is to design, build and verify on 3-stage pilot plant the complex technology of treatment of storm water from the transport infrastructure and paved areas in industrial parks and add missing data for a design of a type of equipment. The partial project objective is to develop

the halophilic biopreparation for microbial degradation of the petroleum products and fuel residues. The preparation will be focused on elimination of the contamination of storm waters in wetland wastewater treatment system. Other project objective is the design and realization of percolation device including the dimensional parameters. The novelty of the projects is in the variability of the final solution that will reflect the specific situation or requests of the user. Innovative is the definition of the scale of the intensification of treatment processes while maintaining the minimum cost of operation and maintenance.

The 2015 year was the last project year. The testing of developed units was finished. The testing was focused on hydraulics and treatment effectivity. The software models of units with modeled overload states were finished. The models are prepared to further using at designing of constructions. The experiments with vegetation regarding the elimination of monitored pollutants (particularly metals) were finished. The experiments to develop the biological preparation for elimination of oil and PAHs were also finished. The documentation to all functional samples and pilot plants was prepared. The implementation plan of the project was processed. The public and professionals could acquaint with the project results at national and international conferences and in scientific papers (journals Odpadové fórum and Water Science and Technology).

Complex planning, monitoring, information and educational tools for adaptation to the impacts of climate change, with the main emphasis on agriculture and forestry management in the landscape

Principal research worker: Ing. Karel Drbal, Ph.D.
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Duration: 2015–2016

Comprehensive multidisciplinary project aimed at eliminating the negative impacts of climate change in the South Moravian Region (SMR). Based on historical climate data and expected climate scenarios it can be considered as the most affected region (particularly due to drought) in the whole country.

The project leader is the Brno University of Technology (the Faculty of Civil Engineering, the Institute of Landscape Water Management). The project involves 5 top Brno specialist departments in the fields of hydrology, soil science, agriculture, forestry, climatology, landscaping, space planning, geoinformatics and the Norwegian partner.

The main focus of the project is directed to the agriculture and forestry sector, which covers 90% of SMR and where climate change is expected to cause reduction in the natural production capacity of the soil and consequently reduction of crop yields or increment of forest trees. On the contrary, successful implementation of adaptation can help agriculture and forestry sector to achieve the best effects.

As part of the solution there will be a model interconnection of different spatial planning agendas i.e. landscaping, zoning, planning documents, river basin management plans, regional plans of forest development, etc.

The project will also be based on the integrated approach to obtain the effective adaptation to climate change. In terms of spatial extent the project is divided into the following tasks:

- a) Monitoring, evaluation, analysis, calculations, proposed measures and strategies implemented across the board for the entire region.
- b) Demonstration projects, measurement and type of measures implemented only in selected locations where there will be developed and partially implemented model draft measures for selected sites in the South Moravia Region to serve as a practical guide to dealing with the impact of agricultural and forestry management modes.

All project outputs will be linked to different types of system tools (planning, monitoring, information and education) in order to develop strategies and comprehensive facilities for implementing effective adaptation measures to eliminate or reduce the negative impacts of climate change.

New approaches to optimization of integrated protection systems in the context of their economic sustainability

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Duration: 2015–2018

The aim of the project is especially verified procedures of proposals of integrated protection of the territory against the effects of the local floods and erosion phenomena. The procedures have to be effective, enforceable and sustainable. The project is financed by the Ministry of Agriculture.

T. G. Masaryk Water Research Institute, p.r.i., is the project leader. Other project investigator is the Brno University of Technology. Project partners are Povodi Moravy, s.e., Zemědělské družstvo Vrchovina and the town of Fulnek.

In 2015, the project focused on collection of supporting documents a survey of the selected areas: catchment of the Husí potok stream (a left tributary of the Oder River) and catchment of the Litava River (a right tributary of the Svratka River). Simultaneously, the first proposals of components of integrated flood protection in selected catchments were prepared based on the assessment of runoff and erosion conditions. The proposals of integrated protection are processed in desired level of detail in such way to be usable for project partners in next steps of implementation of the project. The proposals follow on the measures in the areas with important flood risk, on the network of country roads and on the territorial system of ecological stability. Supplementing the local alarm subsystem (LAS) was proposed in the catchment of the Husí potok stream. The measuring devices have been purchased to supplement the network of precipitation stations and for measuring the water levels at selected monitoring sites. Supplemented LAS will be functional after end of the project and it will be operated by the town of Fulnek.

System of water management infrastructure monitoring and maintenance

Project team: Mgr. Pavla Štěpánková, Ph.D., Mgr. Martin Caletka, et al.
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Duration: 2015–2018

The aim of the project is to implement a system which will allow effective control of monitoring and maintenance of water structures and watercourses in order to ensure the fulfillment of their basic purposes in a sustainable manner. The project leader is the firm VARS, a.s. (Ing. Robert Knap, et al.), the project partners are TGM WRI, p.r.i., Brno university of technology (Faculty of civil engineering (doc. Ing. Aleš Dráb, Ph.D., et al.). The project is financed by the KUS programme of the Ministry of Agriculture.

The system of water management infrastructure monitoring and maintenance will be based on the central register of the main asset of the water reservoirs and modifications of watercourses. The water administrations maintains such registers. The reference status of a given water reservoir will be determined based on available data (longitudinal and transverse cross

sections and other in detail described technical components of a structure). These components will be converted to a digital terrain model. The digital terrain will be a reference model of water reservoir structure (summary of data describing the design/projected parameters).

The current (new) status of water reservoir will be determined using sonar devices (multi-ray sonar for continuous measurements of bottom, sub-bottom profiler and sidescan). The procedure for import of the current digital terrain model and sediment layers (measured by modern technologies and combined approaches) will be implemented in the system. The differential comparison of given states and the change of bottom will be determined (localization of sedimentation zones and potential erosion. The morphological changes will be evaluated together with mathematical modeling with regard to the process dynamics and their influence on the fulfillment of the water reservoirs purposes. Based on that information, the effectiveness of maintenance and recommended solutions will be determined (the intervention prediction alternatively). The system will be equipped with a web interface so that it will be accessible to the person acquiring monitoring data, as well as to the administrators of monitored water bodies and other authorized users. The system and partial methodologies will be developed and verified on the data obtained at three pilot reservoirs with different type of using (drinking water reservoir, production of energy power, flood protection) and at three watercourses sections with different types of treatments and flow characteristics (weir reservoir, regulated flow without the influence of baffle device with earth dikes and regulated flow without the influence of baffle device in urbanized area).

Monitoring of long-term changes in biological diversity of running waters during climate change: design, realisation, and implementation in the ARROW public information system

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Duration: 2015–2016

The objective of the project is to expand the current system of surface waters monitoring and the related public information system IS ARROW with a module for monitoring long-term changes in diversity of significant components of the biota of surface running waters (phytobenthos, macrophytes, macrozoobenthos, fish) in conditions of climate change.

The above biota components are monitored for the purposes of assessment of ecological status of surface waters pursuant to Directive 2000/60/EC. The importance of monitoring of long-term changes and biodiversity research is emphasized in Articles 7 and 12 of the Convention on Biological Diversity (CBD). In order to detect changes in biodiversity in the conditions of a climate change, it is vital to separate anthropogenic impacts as much as possible and to evaluate longer periods of time.

Therefore, monitoring of long-term changes is proposed to be carried out in a network of segments of watercourses showing minimum anthropogenic impact, while using data obtained in "reference locations" monitored in past periods (since 1996) with the aim to set reference, i.e. background conditions for evaluating the ecological status within the intentions of the Directive 2000/60 EC. Research carried out in the reference locations will be used, on the one hand, in evaluation of stability of the said reference conditions, and, on the other hand, as a baseline for evaluation of the scope of anticipated changes in biological diversity and their possible causes.

The main project activities include:

- establishing of a network for monitoring of long-term changes in biological diversity in watercourses in the Czech Republic;
- taking of biota and surface water samples in network profiles using standard procedures and in usual periods including analysis and evaluation of results;
- hydromorphological assessment of network profiles;
- design and implementation of an innovative method of evaluation, interpretation and presentation of newly obtained data in the context of historical data;
- implementation of these procedures in the form of an extension module of the current IS ARROW system to be used both by the expert and general public;
- designing of a system of future monitoring with ten-year periodicity.

Data processing for Innovation voucher JIC

Project manager: Ing. Miloš Rozkošný, Ph.D.

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Duration: 2015–2016

The contract is the processing and delivery of documents for the Innovation voucher JIC for company Geosan, spol s.r.o., in area of water and sewerage systems, with a focus on medium and small settlements.

In 2015, the activities on contract started. The processing of documents for the Innovation voucher JIC for company Geosan spol s.r.o. was initiated.

The data were collected on the status of water resources management of medium and small settlements in selected regions (Southmoravia Region, Vysočina Region, Zlín Region and Olomouc Region). The focus was on the settlements that are not integrated into the bigger water management units. The aim was to define the opportunities to construct partial or complete water resources management system or the proposal of services in the field of water supply and sewerage.

Documentation, passportization, archiving and conversion proposals of chimney reservoirs as an endangered group of industrial heritage sites in the Czech Republic

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Duration: 2013–2015

The main objective of the project is to get sources for protection, identification and presentation of one of the most endangered and very rare and unique monuments of industrial heritage – smokestacks with water reservoirs. The main outcome of the project is a technical book.

In 2015, locations of existing and already non-existing smokestacks with water reservoirs in the Czech Republic were finalized, in some cases additional structural and historical survey on the spot was held (Přelouč, Kolín). Ongoing research was conducted in archival and library funds. A specialized map of 60 smokestacks with water reservoirs was realized, a workshop focusing on new use of existing buildings was organized. An exhibition where all the existing chimneys with water reservoirs were presented was organized, possibilities of their new utilization were presented and a critical exhibition catalogue was issued. At the end of the project a book describing the historical development of the smokestacks with reservoirs was published.

Discover the secrets of science

Project managers: Ing. Robert Kořínek, Ph.D., Ing. Petr Tušil, Ph.D., MBA, et al.
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Duration: 2014–2015

The aim of the project is to strengthen the competitiveness of the territory through development of human capital in science and research. Key activities include implementation of popularization activities in the field of science and technology, education of researchers in this field and implementation of science and research into teaching. To these activities the Regional Centre of Science and Technology was established, which serves as a communication platform between scientists from institutions in the Moravian-Silesian Region and regional schools. The aim is cooperation of three generations in science: senior experts, junior experts and young people interested in science and research.

In 2015 seven special educational teaching modules were created. The modules were then tested in practice in primary and secondary schools. The quality of the modules was evaluated by students and teachers alike, the possibility of usage in teaching was also evaluated. The modules were shipped both in print and in electronic form. At the end of the project a conference was held with participation of all the authors – researchers and teachers, and also with the participation of experts.

Erosion washout: increased possibility of danger for population and water quality in connection with expected climate change

Project managers: Mgr. Pavel Rosendorf, doc. Ing. Martin Hanel, Ph.D., Ing. Jiří Pícek, doc. Dr. Ing. Tomáš Dostál (Czech Technical University in Prague)
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Duration: 2012–2015

Torrential precipitation accompanied by soil washout is a risk factor that threatens population, municipal infrastructure, even surface water resources and important recreation areas. The amount of torrential precipitation increases with climate change.

Future risks connected with these extreme events might influence important parts of the territory of the Czech Republic. The main objective of the project is to propose conceptual approaches for area assessment with regard to risks of erosion washout connected to expected climate change.

The 2015 year was the last project year: the final version of the Methodology for determining the area potentially threatened by the impacts of heavy rainfall associated with soil erosion, taking into account expected climate changes was prepared. The interactive software tool for presentation of the research results was finished. The tool also delimits the critical points and their contributing areas for territory of the Czech Republic. In total, more than 150,000 critical points are defined in the Czech Republic. There is potential of conflict between the concentrated runoff from agricultural and forest soils accompanied by erosion and sediment transport, and various types of vulnerable objects and specific types of land use (buildings and facilities in urban areas and important water bodies used for water supply purposes and bathing) at these points. These points were classified regarding the overall risk. Four different scenarios of measures on agricultural and forest land were simulated for these points. The project results were taken into account in Update of the Concept of Environmental Security for the 2016-2020 and view to 2030. The Update was approved by National Security Council in January 2016. The project results were also presented at several conferences and an information seminar to present the results to the user and the wider professional community is in preparation.

Optimization of large wood structures for stream restoration and semi-natural stream regulation

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Duration: 2012–2015

The aim of the project is to develop new technical solutions and methods for safe and effective application of large wood structures in stream restoration and semi-natural stream regulation. The project also deals with the management of woody debris in streams and its influence on water animals. TGM WRI collaborates with project company Šindlar, s.r.o., on this project. The project is supported by Technology Agency of the Czech Republic.

The 2015 year was the last project year. All project activities were gradually completed: the results of the hydraulic modeling were processed, field monitoring of wood inserted into the selected watercourses sections and monitoring of natural river wood. The most attention was paid to the completion of the main project results: technical design of wooden structures and proposal of the methodology for using these structures in semi-natural modifications of watercourses and revitalization of watercourses. They were filed four applications for utility models. The solutions described in patent applications was based on the hydraulic tests of different variants of wooden structures enhanced by the knowledge acquired in the field. The Methodology of using the wooden structures at revitalizations and semi-natural modifications of watercourses was compiled in such way that it provides briefly motivations and general recommendations for safe and effective using of wooden structures. The main part of the methodology is the Catalog of basic types of wooden structures suitable for insertion in watercourses. It Includes also examples of the practical use of wood in watercourses in the Czech Republic.

Preparation of a Strategy to Mitigate the Effects of Fragmentation of River Networks in the Czech Republic

Project team: Ing. Jiří Musil, Ph.D., Mgr. Aleš Zbořil, Ing. Tereza Barteková, Ing. Miroslav Barankiewicz
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Duration: 2015–2017

The project objective is to contribute to protection of watercourses with focus on the two-way migration permeability of water flows with the primary interest in the conservation of nature, both on the international and national level. The fish migration is monitored in the project by racking the fish migration in selected already implemented measures – fish ladders.

An important part of the project is the implementation of the pilot monitoring of the migration of two flagship fish species Pilot projects will be processed as feasibility studies for a specific solution of selected major obstacles in the Czech Republic. Project promoter is Nature Conservation Agency of the Czech Republic. Project partners are Norwegian Institute for Nature Research (NINA), TGM Water Research Institute, p.r.i., and Beleco, z.s.

Monitoring and nationwide mapping the species of European importance as a basis for finalizing the draft of Natura 2000 network in the Czech Republic

Project team: Ing. Věra Kladivová, Mgr. Ondřej Simon, Bc. Miriam Jandáková, Ing. Jiří Musil, Ph.D., Ing. Miroslav Barankiewicz, et al.
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Duration: 2012–2015

The project objective is monitoring and mapping of selected species of European importance on the specified territory for Natura 2000 in the Czech Republic according to the methodology by the Nature Conservation Agency of the Czech Republic for each species.

Three species of water molluscs are monitored: Thick shelled river mussel (*Unio crassus*), Narrow-mouthed whorl snail (*Vertigo angustior*) and Ramshorn snail (*Anisus vorticulus*). The objective has been to search for new localities of their occurrence in Central Bohemia, South

Bohemia, Hradec Králové Region, Pardubice Region and Vysočina Region. Species *Rhodeus sericeus amarus* and European weatherfish (*Misgurnus fossilis*) have been monitored in the whole territory of the Czech Republic. Monitoring is carried out as an annual in-depth ichthyological survey at selected localities with the occurrence of the species.

The workflow for designing revitalization measures on waterways

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Duration: 2015

The aim of the study is to assess the ecological role of the shoots, which are among the most commonly used revitalization structures in relation to the inland navigation.

The building of shoots increases the shelter capacity of a watercourse. The areas with current shadow and areas with a faster flow are created. It has positive impact on reconstruction of natural heterogeneous hydraulic regime.

The 0+ fish community was sampled using PASE method to assess the effectiveness of the shoots in relation on the biological component fish.

The methods of optimization of the proposed measures in watersheds of reservoirs leading to effective decrease of their eutrophication

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Duration: 2012–2015

One of important problems of status of water bodies according to Water Framework Directive (2000/60/EC) is nutrients loading in water reservoirs as it followed from approved District Water Management Plans for period 2010–2015. The most important nutrients are phosphorus and nitrogen. The issue expresses by eutrophication which is caused by increased nutrients loads in watercourses. In the end, the eutrophication may cause the changes of status of many water reservoirs. The project objective is to propose methodology and suitable technical tools for identification of such pollution sources that have the most negative impact on eutrophication of water reservoirs with regard to technical-economical possibilities and impacts of individual solutions.

The 2015 year was the last project year. The certification of the Methodology for evaluation of the influence of the pollution sources on the eutrophication in water reservoirs was successfully finished at the beginning of the year. The testing of methodologies continued in pilot catchments and software tool for decision support was finalized. The tool supports the decisions on selection of suitable measures for decreasing the phosphorus inputs from different anthropogenic sources. The software tool VSTOOLS.EUTRO was finished and published (with other project results) at the project web pages. The procedure for selection and evaluation of effective measures leading to overall reduction of phosphorus load in catchments of water reservoirs was prepared. It may be used with the simulation results to select the suitable measures in the frame of approved river basins management plans and also for 3rd planning cycle. The project results were presented at national and international conferences focused on water reservoirs and sources of water pollution.

Software tools for evaluating the hydromorphology of aquatic ecosystems and proposed measures in relation to biological components

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Duration: 2014–2017

The project objective is to provide a software tool for comprehensive evaluation of environmental damage in technical and economic activities on rivers and floodplains and evaluate the benefits of implemented or planned revitalization of watercourses. Software will allow geomorphological analysis of a watercourse, the evaluation of hydromorphological parameters of channel of a watercourse and evaluation of the relation between these parameters and biological recovery of watercourses. TGM WRI collaborates with project company Šindlar, s.r.o. (project leader), on this project. The project is supported by Technology Agency of the Czech Republic.

In 2015, the TGM WRI team sampled macrozoobenthos and fish communities at several dozens of localities on semi-natural watercourses. The objective was to complete the database of biological communities at different geomorphological types of watercourses. Samples were determined to the level of species. A preliminary assessment shows the dependence of increasing species diversity with an increasing number of river "phenomena" (morphological formations bottom and banks) that have been detected at the localities. Results of analyzes will be subsequently transferred to a database module of the software and tested at the model locations.

The evaluation of municipal sources of pollution in the catchments of Lomnice, Skalice and Loděnice

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Duration: 2015

Many water bodies in the catchment of the Vltava River cannot reach the good ecological status because of the phosphorus loads emitted from different sources. The analysis of significant point sources of urban waste water in the heavily loaded catchment of Lomnice, Skalice and Loděnice would bring an answer to the question of which types of pollution sources are significant for water pollution and which types of waste water management are riskiest regarding phosphorus load. The aim of this study was to conduct a complete inventory of the treatment of municipal wastewater in the selected high-risk catchments (Lomnice, Skalice and Loděnice) and to identify locations where wastewater treatment is problematic and may worsen the state of water bodies.

The detailed survey of all municipalities in selected catchments was carried out. The wastewater treatment plants including their discharges were inventoried. The outlets of public sewerage systems, outlets of storm sewers and selected individual systems of wastewater treatment were inventoried. Waste water was sampled during the inventory for determination of total and phosphate phosphorus. All survey results were processed in detailed report. The outlets of wastewater into the recipient or on the surface were processed into the individual GIS layers. The transformation of phosphorus pollution from wastewater treatment plant in New Strašecí in stream was monitored in order to get information on velocity of degradation between the outlet and the confluence with the Loděnice. The study results will be used by the Povodí Vltavy, s.e. (river

basin administrator) for the water management planning and agenda related to the management of river basins.