

Abstracts of the Projects 2016

Branch of Hydraulics, Hydrology and Hydrogeology

Increasing the Safety and Reliability of Culverts with Regards to the Transfer of Flood Flows

Project manager: Ing. Pavel Balvín
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Duration: 2014–2016

The aim of the 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 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 main project objective was to improve hydraulic calculations of flow through culverts under different flow conditions. The project deals in detail with solving the problems of newly designed culverts (improperly designed shapes of flow profiles, the issues of a culvert capacity, inappropriately selected vertical alignment, inlets hydraulically poorly designed, inadequate or dysfunctional energy dissipation, inappropriate placement of structures, inappropriate fortification or foundation supports, the issues of capturing the floating material during a flood etc.). The proposed measures will help to increase the safety and service life of transport infrastructure. The project was also focus on finding simplified procedures for designing culverts that are draining very small watersheds.

Revision of Vulnerable Zones for Nitrate Directive

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Duration: 2016

To meet the requirements of the nitrate directive, vulnerable zones have been defined within the meaning of this directive. The water from these zones is polluted or threatened by nitrate pollution from agriculture sources. The measures will be implemented in these zones to reduce nitrate concentration in water. In 2016, the project objective was to fulfill the reporting according the article 10 of Nitrate Directive 91/676/EEC.

All activities in 2016 were aimed at fulfillment of reporting duty of the Czech Republic on vulnerable areas for 2012–2015. It was necessary to process all available data on quality of surface and groundwater for given time period (parameters nitrates and phosphorus). The data were then inserted into the data model in the prescribed format and sent to the European Commission. The main output of the project in 2016 was the Report of the Czech Republic on Status and Directions of Progress of Aquatic Environment and Agriculture Procedures according the Article 10 and Appendix 13 of the Nitrate Directive 91/676/EEC. At the same time, the expert support on the national and international levels was carried out continuously including active participation in the meeting of the Nitrate Committee in Brussels.

Support of Activities in the Process of the River Basin Management Planning

Project manager: RNDr. Hana Prchalová
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Duration: 2016

The project aim is the support of expert and conceptual activities during preparation of third round of the River Basin Management Plans Update.

In 2016, the project was focused on follow-up activities associated with reporting to the European Commission and on the preparation of the next planning cycle. The analysis of identified shortcomings was carried out continuously in input data, methodical support and coordination of activities in order to secure optimal starting point for the process of the River Basin Management Planning in next period. Main project activities were:

- The issue of the application of the exceptions under Art. 4.7 WFD;
- Delimitation of heavily modified water bodies (HMWB) and determination of good and maximum ecological potential;
- Analysis of the timetable and program of activities for the preparation of the second planning period;
- The issue of measures to achieve environmental objectives under the WFD;
- Analysis, suggestions and proposals for the processing/updating of the methodologies for the preparation of the third programming period.

Activities to Support the State Administration Regarding the Issues of Drought in 2016

Project manager: RNDr. Josef V. Datel, Ph.D.
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Duration: 2016

The objective of the project was to support the state administration, the Department of the Water Protection of the Ministry of the Environment of the Czech Republic (DWP ME) in particular, regarding the impact of the drought, following up the implementation of the Government Resolution No. 620/2015.

These 5 given partial projects were solved within the task sheet 31:

- The completion of the summary of the assessment criteria of the intensity of hydrological drought and more detailed assessment of the quantitative status of water and water bodies in accordance with Directive 2000/60/EC (cooperation with CHMI), project manager Ing. R. Vlnas;
- The regionalization of the Czech Republic according to the risk of the occurrence of drought (frequency, duration), project manager Ing. A. Vizina, Ph.D.;
- The assessment of potential of catchments affected by drought and lack of water for the use of artificial infiltration systems (e.g. filling/recharge of intake area in the period of water excess) in order to support water supply systems in the dry period, project manager doc. RNDr. Z. Hrkal, CSc.;
- Proposals for the modernization of wastewater treatment infrastructure in selected catchments affected by drought because of increased demands on the quality of discharged waste water in the dry period, project manager RNDr. J. Fuksa, CSc.;

- Proposal for a solution involving the issue of drought regarding the restrictive and protective measures in the protection of water resources and possible methods how to refund the restriction of the use of land and buildings, project manager RNDr. J. V. Datel, Ph.D.

Three other assigned projects were not carried out because of the decision of the client. The outputs are reports and maps with proposals of the measures for the purposes of DWP ME. On the basis of some project conclusions, some of the activities continued in the end of 2016 as the contract Activities to support the State administration regarding Drought.

Processing of Methodologies Related to Minimum Residual Flows

Research team: Ing. Pavel Balvín, Ing. Adam Vizina, Ph.D.
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Duration: 2016

The project aim was to process the methodology of minimum residual flows and their measurement as a supporting document for governmental regulation.

The project was focused on processing the methodology of minimum residual flows and their measurement as a supporting document for governmental regulation.

Controlled Artificial Infiltration

Project manager: doc. RNDr. Zbyněk Hrkal, CSc.
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Duration: 2016

The project objective was to provide the administrative support for the localities selected for the artificial infiltration and first phase of survey activities.

The next phase was realized in second half of 2016 based on regional assessment of territory of the Czech Republic from point of view of suitability of different artificial infiltration methods. The list of pilot localities was updated based on detailed administrative and field investigation in frame of the task Support for the State Administration. Eventually, six localities were selected. The detailed research of natural conditions (including existing boreholes); the permission of the landowner with subsequent technical activities was secured:

- The concepts of climatic scenarios were built for each locality based on observed data.
- The base of hydrological balance model (based on archive data) was built for each locality.
- The detailed geophysical survey was carried out at each locality. The objective was to get maximum information on geometry and properties (thickness and grain size) of Quaternary sediments, of a weathered layer and on potential tectonic influence on basement rocks.
- The used methods were: vertical electrical sounding, resistance profiling, resistivity tomography, dipole electromagnetic profiling and seismic.

Activities to Support State Administration Related to Drought

Research team: RNDr. Josef V. Datel, Ph.D., Ing. Adam Vizina, Ph.D., et al.
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Duration: 2016

Aim of the study is to prepare supporting documents (including general evaluation of processed analyses and recommendations) to fulfill the chapters of outline of draft of Conception of Protection against the Drought Impacts in Territory of the Czech Republic (Conception) within competencies of the Ministry of the Environment of the Czech Republic (ME) based on division of competencies according the Resolution of the Government No. 620/2015 to drought and subsequent meetings of the Executive Committee of the Commission WATER-DROUGHT (the Commission) to form the outline of the draft of the Conception and responsibilities of the resorts for given chapters.

In 2016, the partial projects (PP) were carried out. List of partial projects is in the table including the name of project manager. PPs carried out the analysis of fresh scientific results, analytical analyses, creation of a map etc. Result of a PP is a technical report. All reports are available at web portal of the project <http://www.suchovkrajine.cz>.

Names of the PPs and project managers of project

Number	Partial project	Project Manager
PP 1	Administration	A. Vizina
PP 2	An analysis of Past Experience of the Dry Season	M. Forejtníková
PP 3	Hydrological Balance of Water Quantity during a Drought Period in the Czech Republic	A. Vizina
PP 4	An Analysis of Shortage Volumes in Surface and Groundwater Bodies	M. Hanel
PP 5	Assessing the Impact of Drought on Water Use	P. Vyskoč
PP 6	An Analysis of Status of Protection of Surface and Groundwater Bodies, Specifics for drought Periods	P. Rosendorf
PP 7	Evaluation of the Impacts of Drought in Bodies of Surface Water to Water and Water-bound Organisms	P. Tušil
PP 8	Drought Impacts on Water Quality, Analysis of Current situation and Its Causes	J. V. Datel
PP 9	Potential of Application of Nature-friendly Measures for Water Retention in the Landscape and Improvement of Ecological Status of Water Bodies	M. Dzuráková
PP 10	The Methodology of Processing of Operation Plans for Drought Control	R. Vlnas
PP 11	Comparison of the Effects and Impacts of the Construction of New Water Reservoirs and the Spectrum of Semi-technical Measures	R. Kožín

PP 12	Hydrological and Water Management Aspects of Water Transfers and of Interference with the Hydrographic Network during Drought	M. Mrkvičková
PP 13	Evaluation of the Analyses and Elaboration of the Concept of Protection against the Effects of Drought for the territory of the Czech Republic Using Implemented Measures	T. Hrdinka

Increasing Water Resources Availability in Selected Areas of Karlovy Vary Region

Project manager: Ing. Adam Beran
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Duration: 4/2015–12/2018

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. The methodology will be validated at pilot catchments in Karlovy Vary Region. The proposed methodology will be useful for water administrators (Povodí, s. e.), water companies or other important water users or water authorities and regional authorities. It will support the sustainable development of water resources under conditions of climate change in water management planning. The methodology will be accompanied by the appropriate software to facilitate its application, in particular with regard to the classification of the measures proposed in the river basin district plans. Construction and validation the methodology will be based on a pilot application for the territory of the Karlovy Vary Region.

In 2016 the activities on construction of updated scheme of water management system (WMS) in cooperation of whole research team (TGM WRI and Povodí Ohře, s. e.). The scheme contains localities for potential accumulation of surface water, prospective additional water reservoirs, updated manipulation protocols of current reservoirs, values of updated minimal residual flows and planned water transfers within hydrological catchments. Based on these data, the options of water management system of Karlovy Vary Region will be modeled in 2017 including the uncertainties of time variability and detected differences among actual and authorized water abstractions. The modeling should contribute to the improvement of the situation concerning the supply of water in the problem areas identified by the project in 2015).

It was very beneficial for the project that the database was built on equity and operational records of water supply and sewerage, based on the documents received from the Ministry of Agriculture. The database will help to identify the structure of owners of the water and wastewater companies and their operations in the region, at the same time it can reveal possible reserves in the water supply.

Five gauge stations were installed to increase density balance monitoring network to evaluate the influence of water supply on flow regime in localities with long-term issues of securing the minimum flows.

Headwaters Retention Potential with Respect to Hydrological Extremes: the Verification of Hypotheses on Outflow Formation by Model MIPs in Comparison with the Other Models

Research team: prof. RNDr. Bohumír Janský, CSc. – Charles University in Prague (principal investigator), Ing. Šárka Blažková, DrSc., Ing. Alena Kulasová – TGM WRI, p. r. i.
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Duration: 2013–2017

The project aims to evaluate the retention ability of watercourses in different mountainous catchments with vegetation cover using modern methodologies.

Experiments continued on the slope in village Lučany in April and in July 2016 to determine the runoff paths. The level of subsurface water was measured in piezometer that was installed below the experimental slope. The water conductivity was measured in five points and water samples were collected from watercourse and from water in drilled probes. Experiments were carried out in the dry season, and therefore failed to completely saturate the soil profile and even after water pouring there has been no runoff of water into the gutters. Poured water emerged only in drilled probes. The results of the experiments from 2014, 2015 and 2016 were orally presented at the Conference ERB in Bucharest in September 2016. Currently, the scientific paper *The Influence of Extreme Rainfall on Flow, Soil Moisture, Nutrients and Tracer Pathways* is in print.

The subsurface water was measured in the catchment of stream Černý potok in Šumava in four transections and saturated localities were mapped using boot method. New tensiometers by company Fiedler-Mager were installed in transections in May to monitor continuously. The precipitation sums were higher than in previous year, however according the obtained parameters the drought dominated in the catchment.

ResiBil – The Balance of Water Resources in Eastern Part of Czech-Saxony Border Region and Review of Potential of Their Long-term Use

Project manager: doc. RNDr. Zbyněk Hrkal, CSc.
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Duration: 2016–2019

The aim of the project is to create a joint Czech-German strategy of use of groundwater resources in cross-border areas.

The Czech Republic and the Free State of Saxony cooperate on the project ResiBil. The project is funded by the European regional development fund. The aim of the project is to create a joint Czech-German strategy of use of groundwater resources in cross-border areas. The modeling of groundwater flow is a methodical tool to achieve this goal. The modeling will result in creation of joint water resources management decision-making tool. Unified conception of geological structure of the joint water management unit will be used as a basis for the tool along with new hydrogeological conceptual model and field data including a number of boreholes on both sides of the border.

Assessing Water Quality Improvement Options Concerning Nutrient and Pharmaceutical Contaminants in Rural Watersheds

Project manager: doc. RNDr. Zbyněk Hrkal, CSc.
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Duration: 2014–2017

The project objective is to determine the origin of pollution sources in surface water and groundwater (nutrient and pharmaceutical contaminants).

Project AQUARIUS is financed by so called Norway Grants 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. Regarding pharmaceuticals, the identification of processes during their leaching into water, migration in unsaturated and saturated zone and further "fate" of these substances. Part of this project is an extensive socio-economic study in the Czech Republic and Norway, focusing on the social acceptability of the proposed treatment and monitoring technologies.

Protection of our Most Vulnerable Biotopes – Wetlands and Steppes – via the Land Associations

Project manager: Mgr. Pavel Eckhardt
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Duration: 2015–2016

The project objective is to process hydrogeology and hydrology study of selected sites of meadow on peat bogs in Jihlava District.

The hydrogeological and hydrological regime was monitored during one year in selected six small peat bogs in Jihlava District. Selected peat bogs are small protected areas. The drainage using melioration was used here in past and intensive agriculture in surroundings resulted in contamination of environment with nitrogen compounds. Currently, the effort to revitalize these areas takes place. The recommendations how to revitalize followed up from hydrogeological, hydrological, hydrochemical and partially hydrobiological monitoring.

Hydrological and Hydrogeological Survey in the Wider Area of New Nuclear Facility at Dukovany Nuclear Power Plant

Project manager: doc. RNDr. Zbyněk Hrkal, CSc.
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Duration: 2014–now

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

The purpose of the project is the hydrological and hydrogeological monitoring in the wider area of the planned new nuclear source at Dukovany. The objective is to assess possible qualitative and quantitative impacts on hydrological and hydrogeological conditions in area within approximately 3–5 km from future construction site. In 2016 TGM WRI operated basic network of monitoring system for surface water at five gauges of shallow circulation and eleven boreholes of deep circulation of groundwater. The monitoring was qualitative and quantitative.

China – Safety of Wasteponds for the Extraction and Treatment of Uranium

Project manager: RNDr. Josef V. Datel, Ph.D.
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Duration: 2014–2017

The aim of the project is to provide expert support to the Chinese state institutions of the nuclear industry in the field of environmental safety of mining wasteponds and processing of uranium ore. The official name of the project funded by the European Union under EuropeAid is "INSC project CH3.01/10 Enhancing the capabilities of national nuclear institutions to ensure safe nuclear power programmes", subtask 3.3 Capacity building to assess the safety and environmental protection of uranium mining and milling facilities. The project leader is Nuclear Research Institute Řež. TGM WRI was responsible for subtask 3.3.

In 2016, two major outputs of the project were achieved: the methodical material and the organization of a week workshop in China to Chinese experts with 21 contributions, culminating in Proceedings.

The project outputs cover 6 main defined problem areas:

- A. Geotechnical Assessment of Uranium Tailings Ponds and Spoil Dumps,
- B. Dam Breach, Accidental Leakage of Contaminants From Tailing Ponds,
- C. Investigation of Groundwater Contamination, Water Sampling,
- D. Removing the Effects of Environmental Accidents, Tailing Ponds Closing,
- E. Numerical Models of Groundwater Flow and Contaminant Transport,
- F. Evaluation of Radiation Situation, Risk Analysis and Radiological Monitoring.

In 2017, the project will be completed by the final documentation.

Support at Fulfillment of Conditions to Placement for the New Nuclear Facility at Nuclear Power Plant Temelín

Project manager: RNDr. Josef V. Datel, Ph.D.
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Duration: 2015–2017

The project objective is the supplement of expert data that are necessary for processes related to decision making on placement of a new nuclear facility at Temelín.

In 2016 the field survey at Temelín continued. The laboratory work continued. The automatic flow measurement took place at local watercourses. Second stage of soil infiltration measurement took place at eight sites around the nuclear power plant. The determination and assessment of migration characteristics of soils was completed (adsorption experiments an ion exchange processes on selected list of radionuclides. The most important output of 2016 is the conceptual

model of subsurface transport of pollutants potentially released at territory of Nuclear Power Plant Temelín.

In 2017 the hydrological measurement will continue and hydrological balance will be processed for the area.

Collaboration on a Physical Modeling Research of the Adjustment of the Water Duct below the Navigation Step Děčín

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Duration: 2015–2016

The project objective is the assessment of proposals in water duct of navigation step Děčín based on physical research.

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, p. r. i.

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 TGM WRI, p. r. i. The model represents the section of Elbe River between 737.5 river km and 730.1 river km with the navigation step Děčín at 737.12 river km.

Detailed Mathematical Model of Groundwater Flow and of Substances Transport in Dukovany

Project manager: RNDr. Josef V. Datel, Ph.D.
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Duration: 2015–2016

The aim of the project was to elaborate a detailed mathematical model of groundwater flow and transport of substances as a basis for the safety report of the new nuclear source for the evaluation of the criteria of Decree No. 215/1997 Coll., and the related IAEA Safety Standard NS-R-3 requirements and also for updating the safety report for the existing Dukovany nuclear power plant.

The activities continued from 2015, when two partial tasks were finished (DP 1 borehole network of deep circulation groundwater and DP 2 Installation of water gauge stations). In 2016 these three partial tasks were completed:

- DP 3 Hydrological balance of narrower area (based on currently obtained field data – 5 hydrologic gauges at local watercourses);
- DP 4 Detailed hydrogeological conditions of narrower area (including conceptual model of groundwater flow), zonal and isotopes analyses, hydrogeological map outputs and assessment of radiological properties of groundwater;

- DP 5 Mathematical model of groundwater flow and of substances transport (hydraulic and transport model, update of risk analysis, determination and assessment of migration characteristics of soils and rocks for selected radionuclides: adsorption tests, grain-size curves, content of organic carbon etc.) and settlement of requirements and criteria set by applicable regulations.

Analysis of Potential Impacts of the Project of Water Duct Děčín on German Territory

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Duration: 2016

The project aim is the analysis of potential impacts of the project of Water Duct Děčín on German territory.

The analysis followed up on expert opinion to potential impacts of the project of Water Duct Děčín on German territory by prof. Ing. Pavel Gabriel, DrSc., from 2006. It took into account mainly the outputs of proposal of manipulation protocol, physical and mathematical models. The analysis evaluated also the influence of realization and operation of the intended project on hydrological, hydraulic and alluvial regime, water quality and runoff condition on German territory.

Physical Hydraulic Modeling Research of Construction Progress of a Water Structure – Improvement of Navigation on Elbe River in Section Ústí nad Labem – International Border Czechia/Germany – Navigation Step Děčín

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Duration: 2016

The aim of the research is to validate the newly proposed procedure of construction of Navigation Step Děčín.

The research validated of the newly proposed procedure of construction of Navigation Step Děčín on navigation, flow under normal and increased flow rates, including the security of constructions and hight of reservoirs. Model had a moving bottom: it was possible to rebuild the model according to given stages of its construction. The activities were carried out against the timeline by sequential demolition of existing model. The research was realized on current model in scale 1 : 70 with a moving bottom that was constructed in big water management hall of TGM WRI, p. r. i.

Water Work Hněvkovice – the Validation of Consumption Curves on Physical Model

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Duration: 2016

The aim of the project was in accordance with current applicable regulations, to assess the effectiveness of the proposed construction measures for improving the passage of a flood (return period 10 000 years) through the water work.

The proposed construction has been tested on the effectiveness of the measures for improving the passage of a flood through the water work. The main question was to which extent the decreasing of the lock sill would have influence on increasing the flow through the lock. The research was carried out for given flows up to $Q_{10\,000}$. It was carried out on existing model of the water work in small hydraulic laboratory of TGM WRI, p. r. i.

Total Reconstruction and Extension of Central Waste Water Treatment Plant on Císařský Ostrov

Research team: Ing. Pavel Balvín, Ing. Miroslava Benešová, Ing. Zdeněk Bagal
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Duration: 2016–2017

The aim of the research is to verify the flood flows on the physical hydraulic models in the newly built central waste water treatment plant (CWWTP).

The subject of the research is to determine the hydraulic variables and proposal of measures in the area of the Troja wally. The results obtained on each of the physical models in a suitably chosen scales, whose proposal is part of this methodology, will be used as the basis for the mathematical modeling of flood protection of the city of Prague. The flow conditions are so complex in urban area of Prague that it is not possible to examine them with sufficient accuracy using any known calculation method; even the methods of mathematical modeling of spatial flow are not usable here. This concerns in particular flow in inundated territory with housing and a variety of other obstacles to the flow. Flow around objects is complex to be described by mathematical models precisely, and therefore, it is beneficial to combine both modeling approaches. In 2016 the project focused on the research methodology and the construction of hydraulic models in 1 : 70 scale and 1 : 75.

Supplement of the Monitoring Network of Deep Circulation Groundwater in Surroundings of New Nuclear Facility of Nuclear Power Plant Dukovany with One Monitoring Hydrogeological Borehole (maximum depth 250 m)

Project manager: doc. RNDr. Zbyněk Hrkal, CSc.
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Duration: 2016

The project objective was to supplement the monitoring network with new borehole.

The current monitoring network had to be supplement with new borehole to 250 m depth.

II. Phase of the General Plan of Water Management of the Landscape of the Czech Republic

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Duration: 2016

Farming is one of the key factors that can mitigate the effects of climate change. Those are manifested mainly in the form of more frequent occurrence of meteorological, hydrological and socio-economic, agronomic drought and floods from torrential rainfall. The traditional agricultural areas faced with frequent occurrences of droughts, or with the appearance of the flood from torrential rainfall, often several times in one year. The territory affected by such extreme events will be fairly early and significantly expanded in the Czech Republic based on climate change scenarios. The response to these factors is General Plan of Water Management of the Landscape of the Czech Republic, which is focused on agricultural practice that aims to define effective farming methods acceptable for agricultural entities (friendly programs), including the related necessary legislative changes. Then, it is necessary to obtain the financial backing for the implementation of adaptation measures with an emphasis on the primary role of farmers as an active entity (e.g. a system of tax concessions and technical support vs. subsidies). Its II. phase applied these measures to the of the selected agricultural entities.

General Plan of Water Management of the Landscape of the Czech Republic is focused on conceptual adjustments to management in the landscape with regard to the impacts related to climate change. General Plan of Water Management of the Landscape of the Czech Republic is a project of the State Land Office with support of many research institutions and universities (MENDELU, VUT in Brno, Research Institute for Soil and Water Conservation, p. r. i., TGM WRI, p. r. i., Czech Globe, p. r. i.). This is a project with a focus to agricultural practice, the objective of which is to define the most vulnerable territories in the Czech Republic and to develop proposal of protective measures to mitigate negative effects in particular of floods and droughts that would be acceptable for agricultural entities. In 2016, detailed hydrological models were created for the areas of interest and they were evaluated for hydrological balance and water availability for present and future conditions. For the areas of interest, the current water use was assessed, both according to actual values as well as according to permitted values.

Supporting Hydrological Data for New Nuclear Facility of Nuclear Power Plant Dukovany

Research team: Ing. Adam Vizina, Ph.D., et al.
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Duration: 2016

The project objective is to set the water management balance on Jihlava River. The hydrological data are needed for such assessment. This partial project focuses on preparation of these data. The study follows up the previous studies.

In 2016 the hydrological modeling data series were extended to 2015, i.e. for 2012–2015 (flows, climatological data: air temperature and precipitation sums in daily time step). The evaluation was carried out for catchments with following gauges at outlets: DBCN (id) 469500 Mohelno pod nádržemi, 478000 Ivančice, 477000 Moravský Krumlov-Rokytná and 474000 Oslavany-Oslava. The model Bilan was used for hydrological modeling. The hydrological balance was evaluated for current conditions and for scenario of 2 °C increase in air temperature and variable precipitation

during a year. The derivation of the scenario was also carried out in this project. Minimum residual flows were also evaluated.

The Assessment of Minimum Total Outflows and Baseflows Regarding Water Use and Other Factors

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Duration: 5/2016–11/2017

The project aim is to propose a method for eliminating the effect of water use on estimation of baseflow using the separation methods (separation from series of mean daily flow).

The proposed approach will be validated at selected localities in the Vltava River Catchment with different type of water use. Then, the approach will be used on data from gauge stations that are used for determination of baseflow. It will be evaluated how much the new approach improves the determination of baseflow in comparison with the calculation without elimination of water use influence. Further, the localities, where the baseflow is influenced the most by the combination of natural conditions and water use, will be determined especially under conditions of hydrological drought.

Evaluation of the Effects of Discharges of Radioactive Substances on Surface and Drinking Water at Dukovany and Possible Effects on Public Health

Project manager: Ing. Anna Hrabánková
tel.: +420 220 197 437, e-mail: anna.hrabankova@vuv.cz

Duration: 2016

The aim of the project was to evaluate the impact of discharges of radioactive substances on surface and drinking water at Dukovany, the maximum amount of tritium, which can be under different flow conditions drained to recipient Jihlava River from nuclear sources in Dukovany and the possible effects on public health, which will be an integral annex of documentation EIA New Nuclear Facility at Dukovany Nuclear Power Plant according to Act No. 100/2001 Coll., on environmental impact assessment, so that it will acceptable seamlessly by relevant authorization, supervising and other authorities, offices and institutions.

The project was divided into three parts (DP1–DP3). In the Valley of the river Jihlava in the area of interest bellow the Mohelno Reservoir, there are three water intake areas intended for the abstraction of drinking water: intake area of Nová Ves (Hrubšice), intake area Ivančice and intake area Moravské Bránice. DP1 examined these areas throughly from point of running monitoring of surface and groundwater by CHMI, CEZ Group, Povodí Moravy, s. e., TGM WRI and precipitation monitoring. Groundwater was analyzed in individual wells used for drinking purposes and evaluated on the option of transfer of tritium from Jihlava River into groundwater. On the basis of these data, relationships were established of the transfer of tritium into groundwater sources of drinking water.

Within the DP2 and DP3, the evaluation of the effects of discharges of radioactive substances in surface and drinking water at the site was performed. Additionally, the maximum amount of tritium and other radioactive substances, which can be discharged to Jihlava River un-

der various flow conditions Jihlava from nuclear sources in Dukovany, was determined. The calculation was carried out of allowable tritium volume activity along the Jihlava River below the Mohelno Reservoir. The conditions were evaluated under which the tritium volume activity would not be above 100 Bq/l in wells used for water supply (in drinking water).

Expert Opinion on Action "Remedial Measures – Ostramo Lagoons"

Project manager: Mgr. Pavel Eckhardt
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Duration: 2016

The project objective was processing of expert opinion on remediation of saturated zones in locality Ostramo Lagoons.

The remediation at locality Ostramo Lagoons is long-term activity. The remediation is processed by DIAMO, s. e. The aim was to elaborate expert opinion (to assess the activities carried out so far) on remediation of saturated zone that took place in 2004–2015. The completeness of the project was evaluated in relation to the terms of this public contract. It was evaluated whether the funded activities related to the saturated zone lead to the intended target.

Reducing the Grade Level Karlín: Validation of Transformation Effects of Flood Flows in Planned Polder Maniny

Project manager: RNDr. Tomáš Hrdinka, Ph.D.
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Duration: 8/2016–9/2016

The aim of the project was expert assessment of the impact of construction of polder Maniny (phases 0001 and 0002) on transformation of flood flows/flood wave in Vltava River (for Q_{20} , Q_{50} , Q_{100} and Q_{2002}) with regard to the purpose of the polder construction as a component of flood protection of Prague.

The purpose of the project was to assess the transformation of flood flow (flood waves) in the intended polder Maniny (realized by reducing the grade level Karlín) to verify its real effects in the flood protection of affected and subsequent territory down to the Vltava River. Verification of the effects of transformation was carried out on the model (a typical N-year flood) and the real flood waves that hit the territory of Prague in 2002 and in 2013. Results of the study were subsequently confronted with the intended way of financing the investment as a measure primarily intended to flood protection (flood risk management). The results show that decreasing the return period and therefore the size of a flood, the flood transformation is expressed more distinctively, however, the realistic effects on reducing the flow rate or time of culminating flow are completely negligible in the given scale. Based on the results, it can be concluded that the proposed implementation of a polder Maniny (specifically, the stage 0001 and 0002) has absolutely no practical flood control effect. For this reason, the processor strictly did not recommend to finance the proposed investment from the program intended for flood control.

The Vltava Water Management System – Data for Medium-term Planning of Operation under Low Flow Conditions

Research team: Ing. Magdalena Nesládková, Ing. Radek Vlnas, Ing. Ladislav Kašpárek, CSc.
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Duration: 2016

The project objective was to find suitable simplifying relations for estimation of outflow during low flow periods. It was based on detailed analysis of hydrological drought events in historic time series of flows in Vltava River including the analysis of precipitation development before a hydrological drought event.

The operational management of the Vltava Water Management System (VWMS) requires complex decision making under uncertain future hydrological conditions. The analysis of hydrological drought events was carried out in a historic series of flow in the Vltava (to gauge Kamýk). Relations were sought that would be usable to estimate the development of the hydrological situation based on precipitation forecasts for hydrological drought conditions for decision support in the medium-term plan of operation of VWMS. The important episodes of hydrological drought were identified using shortage volume method. The statistical characteristics of precipitation and flows were elaborated for these episodes to be compared with average values. Approaches were described for the determination of the outflow from the catchment that is usable for planning the operation of the VWMS. The results of the study show that the mere knowledge of the deficit of precipitation is not enough for credible estimation of runoff from the catchment or directly the expected shortage volume on inflow. As the most robust solution that would lead to a reduction of uncertainties in the process of decision making, was identified the model of the hydrological balance in monthly step in the operational mode.

Update of Groundwater Bodies Information Sheets

Project manager: RNDr. Hana Prchalová
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Duration: 2016–2017

The project aims to complement and update the information sheets of groundwater bodies and work units.

The project follow up the activities of 2013: the information sheets of groundwater bodies were created then in connection with processing of balance of water quality and quantity. The results of balance were saved in these information sheets. The results were stored in a communications environment that consequently automatically generated worksheets in the environment pdf. In 2016, it was agreed to continue in this project. The project was divided in the two parts: to collect and sort all the available data and data on groundwater and working units (stage 1) and the draft of updated version forms and information sheets of groundwater work units and the design of the content of the communication environment (stage 2).

Balance Assessment of Water Resources and Water Need with regard to the Irrigation Systems

Research team: Ing. Adam Vizina, Ph.D., et al.
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Duration: 2016

Currently, the lack of water and drought occurrence increase worldwide in increasing number of areas. The drought occurrence reaches in some cases the level of a natural disaster with massive impacts. The drought occurrence increase in some territories including the Central Europe. The phenomenon is connected to the process of global climate change. The issue of ensuring of water supply starts to express in territories, where the population has not been aware of the issue, however the drought issues are increasingly more significant experience in these territories. In territory of the Czech Republic so far, this is not about massive strikes in water supply for the population and for industry, but for agriculture and for forestry, where the impact of this phenomenon usually first manifest themselves. There was an increase in the number of days with a lack of moisture in the crucial period for the production of most crops between 1961–1990 and 1991–2014. These trends are independently identified in a number of other studies. This situation is also reflected in the Central Europe and adaptation measures for its solution must, among other things, must be aimed not only for irrigation of gardens, greenhouses and grassy pitches; but the availability of irrigation must be reflected to stabilize agricultural production (especially special cultures) and for selected purposes (plant nurseries) and in forestry. The study represents the first attempt to comprehensively map available water resources for irrigation, for use on the territory of the Czech Republic and is designed for framework evaluation in this field.

The team of experts from different research institutions and universities collaborated on balance evaluation (MENDELU, VUT in Brno, Research Institute for Soil and Water Conservation, p. r. i., TGM WRI, p. r. i., Czech Globe, p. r. i., CHMI). TGM WRI collaborated on evaluation of water balance for the territory of the Czech Republic. The evaluation was carried out using the model Bilan. A simplified water management model was created for the territory of the Czech Republic. The water availability was quantified for given catchments under current and potential future conditions.

Czech Calibration Station for Current Meters

Project manager: Ing. Adéla Trávníčková
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Duration: permanent activity

The project objective is to provide services in calibration of hydrometric gauges and compliance with accreditation requirements according to ČSN EN ISO/IEC 17025:2005 arising from Accreditation Certificate No. 535/2015.

Czech Calibration Station for Current Meters (accredited laboratory) provides the calibration of water current meters of propeller or cup type. Moreover, the calibrations of electromagnetic and ultrasound devices for measuring the flow velocity of liquid. Calibration is possible to carry out in a range of velocities 0.02–7 m/s at a nominal temperature of water (1–26 °C). Devices can be mounted on a rod or rope with weights 10, 25, 50 and 100 kg.

In 2016 almost 80 calibrations were carried out. The two-year contract with the Czech Hydrometeorological Institute was finished. The other contracts were carried out (Ohře River Board,

s. e., Nature Conservation Agency of the Czech Republic, ČEVAK a. s., Aquatest a. s., Progeo, s. r. o., Enviform a. s., Pars aqua, s. r. o., Elzaco s. r. o., and Ekora s. r. o.). The hydrometric sets of TGM WRI Hydrology and Hydraulics Departments were also calibrated.

The most of the contracts were calibrations of the classical propeller current meter by OTT, other 7 calibrated devices were electromagnetic and 2 were of ultrasound type (one of the types was calibrated in our laboratory for the first time (Flow Tracker)).

Calibration laboratory successfully underwent regular surveillance visit of accreditation body.

Compensation of Negative Climate Change Impacts on Water Supply and Ecosystems Using the Localities for Potential Accumulation of Surface Water

Research team: Ing. Roman Kožín, doc. Ing. Martin Hanel, Ph.D., Ing. Petr Máca, Ph.D., et al.
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Duration: 2014–2017

The main objective of the 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 2016 the monitoring continued in the network of gauge stations. The observed time series were extended to 2015. The synthetic time series 1000 years long were created using three weather generators for selected catchments. The weather generators were tested on representation of occurrence of drought periods. The suitable methods for creation of climate change scenarios based on new simulations from CORDEX project were tested. Finally, the water management solution was evaluated. The methods for estimation of retention change based on proposed semi-natural measures were developed in cooperation with the Czech University of Life Sciences. The web application for interactive displaying of project results was put into the operation. The development of software for calculation of water management solution continued.

Reference Laboratory of Environment Components and Wastes

Conditions for the Successful Transposition and Implementation of the Risk Analysis System for Drinking Water Supply in the Czech Republic

Project manager: RNDr. Dana Baudišová, Ph.D.
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Duration: 2016–2017

The main objective of the project is to help public authorities in public health (Ministry of Health) to implement an optimal transposition of the amendment to the EU Drinking Water Directive. This directive introduces a risk analysis into the water sector. However, it provides only a framework support and leaves a specific form of achievement to the member states (implementation of the RA). The project ensures that Czech legislation is professionally sound and based on the needs of water producers in the Czech Republic. Introducing RA into practice will lead to increased drinking water safety. Currently, risk analysis is the best tool to ensure security of supply and it has been extensively promoted by the WHO for more than 10 years and recently also by the European Commission: in 2015 it was also incorporated into EU legislation (the amendment to Directive 98/83/EC).

The project was supported by TA CR, in 3rd public call of programme OMEGA supporting applied socio-scientific research and experimental development. The project is solved in cooperation with The National Institute of Public Health (NIPH). The principal investigator of the project is MUDr. František Kožíšek, CSc. (NIPH).

Specific objectives of the project by the end of 2017 are: to map out the current way of risk assessment and the related preparedness of Czech drinking water producers to adopt and incorporate the new RA requirement into practice, including their requirements and needs, and to prepare a proposal for the optimal incorporation of this new instrument into Czech legislation.

Quality and Assessment of Surface Water

Project manager: RNDr. Dana Baudišová, Ph.D.
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Duration: 2016–2017

The main objective of the project is to update the water quality indicators and their evaluation. This will lead to the elaboration of updated standard ČSN 75 7221 Water Quality – Classification of Surface Water Quality. Another objective of the project is to evaluate the societal need for the use of this standard and the interest of the public in the quality of surface water.

The project was supported by TA CR, in 3rd public call of programme OMEGA supporting applied socio-scientific research and experimental development.

An expert analysis is carried out as part of the project, taking into account the relevant implementing legislation and the requirements of the Water Framework Directive 2000/60 / EC. In particular, it is important to first establish the boundary between II. class and III. class of quality. The boundary should be in relation to the surface water quality objectives. Calculation methods will include calculations of conversion factors between individual concentration characteristics from water quality monitoring data. All-society needs are verified by questionnaires on individual river basin administrators and environmental departments of municipal authorities. The revised standard will be used to assess the quality of surface waters not only by river basin administrators but also by other relevant bodies of state administration, local administrations and professional bodies.

Criteria and Requirements for the Competence of Persons Authorized to Sample Water

Project manager: Ing. Alžběta Petránová
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Duration: 2016–2017

The aim of the project is to unify the criteria and qualification requirements for the competence of the persons authorized to sample for the purpose of conducting water analyzes by authorized laboratories in accordance with Section 92 of the Water Act and other regulations. This sampling is a part of the water quality monitoring process and is subject to high quality assurance requirements according to the international standard according to EN ISO/IEC 17025.

The sampling of drinking or wastewater is a relatively frequent profession in water management. According to the National Qualifications Framework (NQF), each who wants to do the sampling professionally has to prove his/her professional competence by a certificate of successful passing of the exam, in order to prove his/her competence in the field of water sampling in front of the commission. The competences can be acquired in different ways, most often by attending various courses and training. However, their concepts and scope differ, as NQF only provides the recommended qualifying standards. Presently, in the preparation of samplers, priority is given to issues of sampling quality at these courses.

However, the no less important area – health and safety at work – is often mentioned only marginally or in insufficient scope. New persons competent to sample come into practice only with limited theoretical knowledge and skills, which is negatively reflected primarily in work-related injuries. According to statistics compiled by the State Labor Inspectorate, almost 1000 work injuries with incapacity for work occur annually in the sector of Water Supply and Waste Management, of which 3 on average are fatal.

The purpose of the project is to develop standards that, to the extent required, include both the requirements for obtaining reproducible results of water sampling and the conditions for proper protection of the life and health of the persons who carry out the sampling while they are working in the field. The main result of the project will be the Certified Methodology of Criteria and Requirements for the Persons Authorized to Sample Water, which will unify the criteria and qualification requirements for the competence of the persons authorized to sample for the purpose of carrying out water analyzes by authorized laboratories in accordance with Section 92 of

the Water Act and other regulations. In accordance with the approved project plan, the methodology will be based on an analysis of valid legislation and normative documents, verification of standard operating procedures used, study of the latest knowledge and recommendations of good practice, analysis of relevant operational accidents and measures to eliminate the risks to life and health risks at work.

Support to Activities of the Permanent and Emergency Component of Nationwide Radiation Monitoring Network

Research team: Ing. Eduard Hanslík, CSc., Ing. Barbora Sedlářová
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Duration: permanent activity

The project objective the monitoring of radionuclides levels in hydrosphere in normal and emergency conditions, in cooperation with laboratories of water administrators (Povodí, s. e.).

Following the Framework Agreement on the activities of the components of nationwide Radiation Monitoring Network (RMN) between the Ministry of the Environment and State Office for Nuclear Safety (SONS), the Test laboratory for components of the environment and water technology of TGM WRI, p. r. i., carries out the activities of permanent and emergency component of RMN in cooperation with laboratories of water administrators (Povodí, s. e.). In 2016, the development of radioactive substances was monitored in surface and drinking water, sediments, water slurries and biomass of fish at selected gauges in the monitoring period under the usual radiation situation. The increased occurrence of tritium in comparison with the background was found in the Vltava profile of Prague-Podolí and in the outlets of the Elbe River basin and Morava River basin as a result of the discharge of waste water from NPP Temelín and NPP Dukovany. The monitoring results are continuously transmitted to the RMS Information System under the jurisdiction of the SONS.

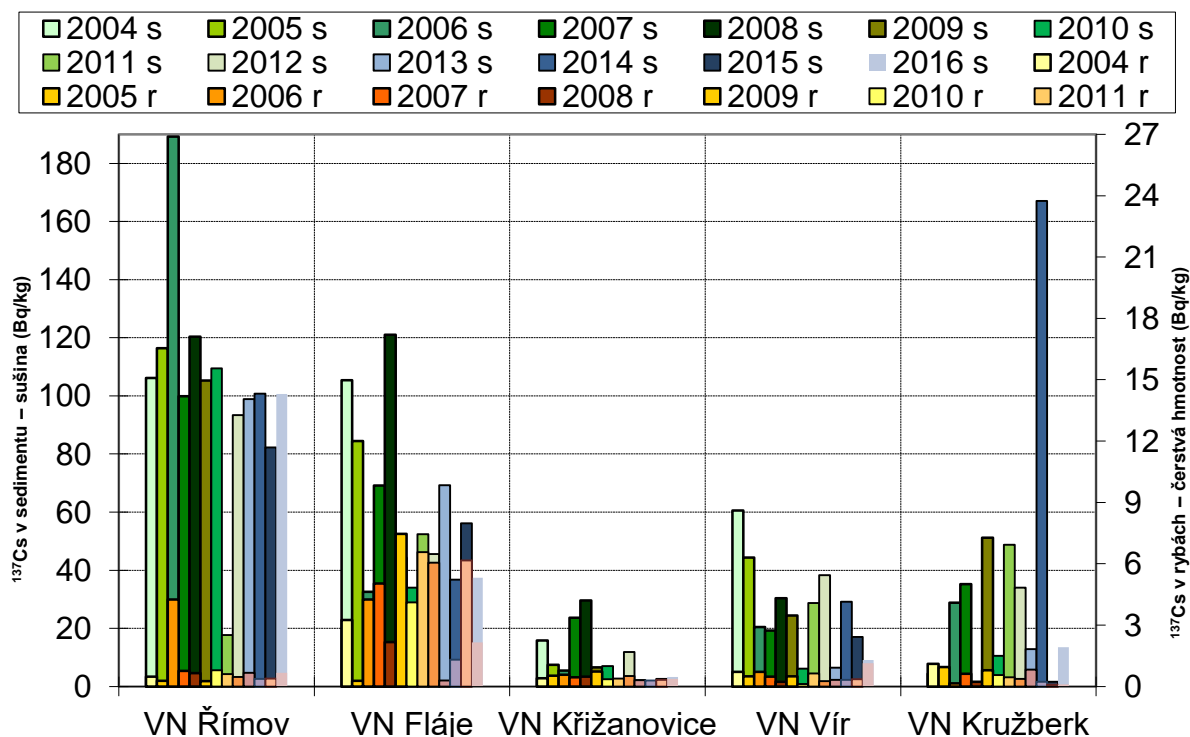


Fig. 1. The development of mass activity ^{137}Cs in sediments and fish at gauges of Radiation Monitoring Network of the Czech Republic

Legend: s – sediment, r – fish; left y axis: ^{137}Cs in sediment – dry mass (Bq/kg), right y axis: ^{137}Cs in fish – fresh mass (Bq/kg), x axis: VN to reservoir e.g. Římov Reservoir

Monitoring and Assessment of Quality of Surface and Groundwater and Their Changes in Connection with Influence of Operation of Temelín Nuclear Power Plant on Its Surroundings

Project manager: Ing. Eduard Hanslík, CSc.
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Duration: 2000–2016

The project objective is the monitoring and assessment of quality of surface and groundwater and their changes in connection with influence of operation of Temelín Nuclear Power Plant (NPP Temelín) on its surroundings.

In the frame of this contract, the monitoring and assessment of impacts of NPP Temelín on environment was carried out. The client was CEZ Group; the project activities followed the conclusions of discussions on impacts of changes in buildings on the environment (EIA). Outputs represent a new reference level before the completion of a new nuclear power facility at NPP Temelín.

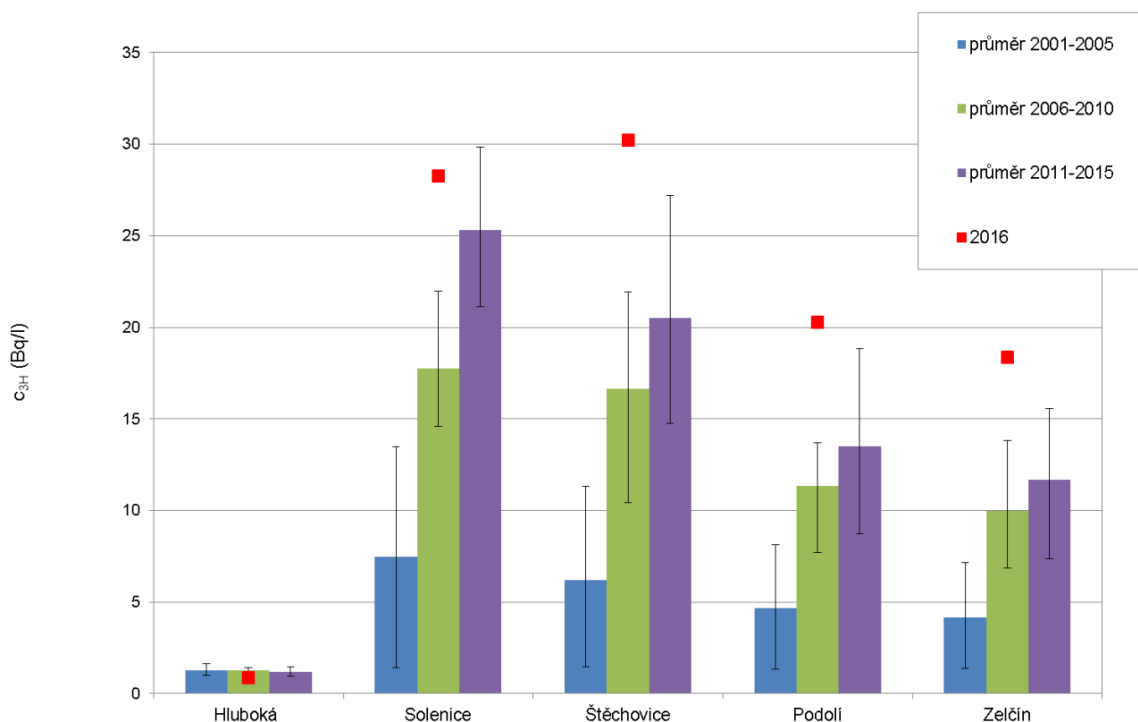


Fig. 1. Annual mean tritium volume activities along the Vltava River (at sites affected and unaffected by NPP Temelín in 2016 compared to mean values for 2001–2005, 2006–2010 and 2011–2015 with min-max range in given periods

Legend: průměr – mean

Determination of Pesticides in Hop Crops, Heads and Granules

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Duration: 2016–2017

The aim of this commercial contract for company PP servis a. s. was to supplement the methodology developed in previous years. The methodology is focused on analysis of pesticides in hop heads, pellets and other parts of plants; it was supplemented here with new determined substances and it was used for analyses of provided samples.

Hop is one of the most complex matrices from an analytical point of view. Procedures have been developed for the determination of required pesticides in hydrochemical laboratory of Department 220 including complex pretreatment of samples. More than 60 pesticides is monitored in samples of hop with seven analytical procedures that use liquid and gas chromatography coupled with mass spectroscopy.

Limits of determination for given pesticides are at very low levels (up to hundredth of mg/kg), so that samples can be analyzed to determine whether the quantities of each pesticide does not exceed international maximum levels (IML) of these substances in the analyzed matrix. The developed procedures are validated and for most of pesticides also accredited.

Determination of Tritium Volume Activity in Samples of Surface Water Affected and Unaffected by Tritiated Wastewater Discharged from NPP Temelín

Project manager: Ing. Barbora Sedlářová
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Duration: since 2015

The project objective is the monitoring of tritium volume activity at selected gauges on the Vltava River.

The contract owner is Povodí Vltavy, s. e. Subject of the contract is to determine the activity concentration in samples of surface water affected and not affected by discharges of tritiated waste water from NPP Temelín. Samples are taken at selected gauges once a month. The tritium volume activity with lowest detectable activity at the level of 1.0–1.2 Bq/l is determined for samples affected by discharges of tritiated waste water from the NPP. The tritium volume activity with lowest detectable activity at the level of 0.05–0.1 Bq/l is determined for samples unaffected by discharges of tritiated waste water from the NPP; prior to that, the samples are pretreated by electrolytic tritium enrichment.

The Content of Radioactive Substances in the Orlík Reservoir and Its Tributaries after the Start of Operation of the NPP Temelín – 2016

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Duration: 2016

The project objective is the monitoring and assessment of selected radioactive substances in the Orlík reservoir and its tributaries for purposes of the watercourse administrator.

Tritium volume activity was monitored in surface water below the outlet of wastewater from NPP Temelín, including the vertical distribution of tritium in Orlík Reservoir, and at reference (unaffected) gauges. The monitoring was carried out for purposes of Povodí Vltavy, s. e.

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 – 2014

Research team: Michal Novák, Ing. Eduard Hanslík, CSc.
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Duration: 2016

The project objective is the monitoring and the evaluation of the effects of remediation of impacts of past contaminations on the environment.

The effects of remediation of impacts of past contaminations at the ÚJV 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.

Expert Opinions of Hydrochemistry Department

Project manager: Ing. Alžběta Petráňová
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Duration: continuous activity

The orders for analyses from external clients are brought together in the first part of the contract. In 2016, it was focused mainly on the analysis of drinking water from wells in the scope of the annex No. 5 of Decree No. 252/2004 Coll., laying down public health requirements for potable and hot water, and the frequency and scope of the monitoring of drinking water; additionally, the analysis of selected drugs in surface and waste waters, etc.

In the second part of the contract, samples for proficiency in the basic chemical analysis are prepared in cooperation with the Department of 240 for the ASLAB (Centre for the assessment of the competence of laboratories) regularly in spring and autumn.

Expert Opinions of Department of Water Microbiology

Project manager: RNDr. Dana Baudišová, Ph.D.
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Duration: continuous activity

The orders for analyses from external clients are brought together in the first part of the contract. In 2016, mainly following activities were carried out: microbiology analyses of groundwater samples, determination of assimilable organic carbon, courses, seminars etc.

In the second part of the contract, samples for proficiency testing in the microbiology analysis are prepared for the ASLAB (Centre for the assessment of the competence of laboratories) including evaluation regularly in spring and autumn.

Expert Opinions of Hydrobiology Department

Project manager: RNDr. Blanka Desortová, CSc.
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Duration: permanent activity

The orders for analyses from external clients are brought together in the first part of the contract. The activities are mainly analyses of water hydrobiology characteristics. Based on customer requirements, the evaluation is carried out either according to the applicable legislative provisions in the field, or in terms of time-spatial evolution and relationship of hydrobiology characteristics to chemical and hydrological indicators of water quality.

In the second part of the contract, the activities for proficiency in the hydrobiology analysis are proposed. Subsequently, the appropriate natural samples are prepared and distributed to the participants of proficiency testing. Other parts of contract are: implementation of the review analyses of samples by selected methods, evaluation of the results obtained by participants of competence testing and the preparation of the final report.

Expert Opinions of Radioecology Department

Project manager: Ing. Barbora Sedlářová
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Duration: permanent activity

Following activities are carried out in the first part of the contract: determination of radiological indicators of surface, ground and waste waters and solid matrices – sediments, soils, sediments and aquatic biota. Concerning the Atomic Act 263/2016 Coll., and related Decree No. 422/2016 Coll., on radiation protection, the measurement and evaluation of radioactive substances are carried out in drinking water and in solid matrices (filter fillings of drinking water plants and sludge from waste water treatment plants). Furthermore, methodical and consulting activities are carried out for radiological laboratory practice.

In the second part of the contract, samples for proficiency testing in the radiology analysis (water and solid matrices) are prepared for the ASLAB (Centre for the assessment of the competence of laboratories).

Development of Methodological, Planning and Monitoring Measures for Solving of the Fragmentation of the River Continuity in the Czech Republic

Research team: Mgr. Aleš Zbořil, Ing. Jiří Musil, Ph.D., et al.

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Duration: 2014–2016

The project objective was to implement innovative approach for the solution of fragmentation of the rivers, to obtain and verify relevant data and particularly to build new and unique central database cumulating all relevant data. The aim was to build central data storage and to propose the structure of the outputs that would be effectively used by professionals, scientists, civil service and general public. The next project objective was the development of technical solution and proposal of standardized methodology to assess the functionalities of the database and long-term monitoring of the fish-passes.

For the database functionality, the competence of management and the flow of data to suggest its structure and outputs were defined. This comprehensive approach is completely innovative in the Czech Republic, and probably in the EU. The collected data are: migration barriers in rivers, small hydroelectric power plants, status of ichthyofauna, status of existing and prepared fish passes (FPs). The different methods of FPs monitoring were compared regarding effectivity and economy. The system of on-line monitoring of FPs was developed. The system uses special probes. The result is 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 includes an analysis of the relevant legislation and proposals for amendments with respect to supporting the construction of FPs. The outcome contributes to solving the problems of unblocking the river network to aquatic organisms, and thus improves the status of the environment in the Czech Republic.

The Development of a Methodology for Evaluation of State Certified Infrastructure for Spatial Information in the Czech Republic

Project manager: RNDr. Eva Sovjáčková

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Duration: 2016

The project objective was to create a comprehensive proposal for the project TA CR TB0500MV004 "The development of a methodology for evaluation of state certified infrastructure for spatial information in the Czech Republic". The project for which this proposal was processed, was focused on the design standard of the structured procedure, which would suitable for publication as certified methodology for repeated evaluation of the state of the infrastructure for spatial data in the Czech Republic. The output passed to the customer was designed as a propositional methodology based on the identification and description of the supporting factors for the development of interoperability in the Czech Republic.

Interoperability of spatial data was shown as a custom representation of spatial data infrastructure. A total of 160 supporting factors have been processed in the form of statements, focusing on the priority status of the management of the national infrastructure for spatial data to the State step in 2015–2016. Statements were organized into a structure that generally corresponds to the reference model for open distributed processing (RM-ODP) at European and

national level is a respected part of the European interoperability framework (EIF) data. The project fulfilled the condition to base on and to use as a starting point all parts of the report CEN/TC 15449 Infrastructure of spatial information.

An important characteristic of description of the supporting factors of national infrastructure for spatial data processed was the possibility of their aggregation or specialization in partial steps, selecting and assessing the factors of the development of interoperability on a national level. Each statement was documented in the form of scoreboard, which was prepared on the basis of the essential factors in the form of a standardised documentation templates for example of use (Use case). Thanks to that, the link to documents approved by government of the Czech Republic was maintained (Development Strategy of Spatial Information in the Czech Republic by 2020). The form of the statements fulfilled the condition of the project to guarantee the repeatability of the structure of the assessment. The formal language of the statements was chosen with a regard to use in the top management of state administration bodies and in the processing of monitoring reports for the Government of the Czech Republic.

The project showed a particular option of using the evaluation processed in this way: interoperability of spatial data in the Czech Republic can be used for an aggregated and sophisticated evaluation of the status of the organization and management of the infrastructure for spatial information at the national level or at a lower hierarchical level, the readiness of departmental systems and geoinformation management on the producer's willingness to spatial data sets of mutually link and take advantage of the benefits that interoperability brings. The project demonstrated in this part the possibility of implementation tools reviews infrastructure for spatial information developed at European level.

Updating of Water Resource Protection Zones

Project manager: Ing. Hana Nováková, Ph.D.
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Duration: 2015–2017

The project objective is to update the spatial data of water resource protection zones (WRPZ) and the protective zones of the water reservoirs (PZWR) in such way that the resulted layer would contain only zones their validity and accuracy was verified by the water authority (regional authority (RA) or the municipality with extended competence (MEC)). A scan of the relevant water decision (measures of a general nature) will be attached to each zone.

In 2016, the communication with water authorities continued to obtain the data for update of WRPZ. Data of the Pardubice and Hradec Králové regions were imported into the database. The data of the Zlín Region was re-imported. The database of the Plzeň Region was updated on a regular basis and it was repaired and supplemented several times in cooperation with the RA. The data of the Olomouc Region was partially imported, of which 212 of the 1070 polygons will have to be consulted with the WA MECs and will be corrected. A total of 4 597 WRPZ polygons were updated from data of RAs.

Data from MECs water authorities (covering regions that do not have comprehensive datasets of WRPZ) is updated very slowly. The zones are solved individually and it is necessary to open and study every water decision. During 2016, a total of 22 MECs were updated in this way. It was 1 884 WRPZ polygons. Another 20 MECs are currently in processing, thirteen documents have already been incorporated and municipalities have been re-addressed with a request for their replenishment.

In autumn 2016, the update of the PZWR layer began. A drawing of the Švihov Reservoir protective zones was obtained and attributes were added to several other zones from the older

materials. 435 polygons of PZWRs were updated in total. In spring 2017, the project will focus on PZWRs.

Bathing Waters Reporting: Update of the List of Identified Bathing Waters

Project manager: Ing. Tomáš Fojtík
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Duration: 2016

The project objective was to collect verified supporting data for reporting of bathing waters and to prepare the supporting documents for the collection of programmes of measures and to carry out their subsequent compilation.

It is necessary to collect the data on new bathing sites and update of the List of identified bathing waters before new bathing season. Verification of coordinates and construction of point data layer are carried out. The layer represents the aforementioned list. A variety of spatial analysis is carried out on the created data set. The aim is to complete attributes required by template for reporting according the Directive 2006/7/ES.

Another project activity is the preparation of documents for establishing programmes of measures for the bathing water. Lists of bathing waters are prepared for individual businesses, river basin administrators (Povodí, s. e.) and regional authorities.

Then, collection of such information is carried out. The measure programme is compiled in the summary tables. Attributes are checked in the list reported after the end of season.

The Support of the Representation of the Czech Republic in Activities of the International Commission for the Protection of the Elbe River (ICPER)

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Duration: permanent activity

The aim of the project is to provide expert support for ICPER activities in certain fields, the preparation of documents and participation of the TGM WRI employees at the activities of the ICPER expert groups.

In 2016, the TGM WRI participated at the activities of expert group Surface Water, expert group Nutrients and expert group Groundwater. The employees of the other organizations (Povodí, s. e., CHMI etc.) participate also in activities of expert groups.

Main task of the expert groups was in 2016 the processing of experience from preparation of the International Elbe River Basin Management Plan for 2016–2021 period and initialization of preparation Strategy for nutrient management in international river basin district. The International Programme of the Elbe River monitoring was updated, the information's were exchanged on methodologies of evaluation of surface water ecological status and status of groundwater and on current specific load in the Elbe River.

The Support of the Participation of the Czech Republic in Activities of Permanent Committee Saxony and Permanent Committee Bavaria of the Czech-German Commission for Cross-Border Water

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Duration: permanent activity

The objective of the project is a long term provision of expert materials to Ministry of the Environment for cooperation on cross-border water and a support of activity of both the Permanent Committees.

The issues are solved in Czech-German expert groups, alternatively in direct collaboration of Czech and German experts. Employees of TGM WRI, p. r. i., participate on preparation of expert materials for meetings of expert groups and superior bodies of this cooperation. The project activities are diverse: from conceptual and methodological documents to solving of specific problems of individual localities, e.g. protection of *Margaritifera margaritifera* and *Unio crassus*. The procedures of the Water Framework Directive are implemented on border waters. Employees of other organizations (Povodí, s. e., CHMI etc.) also participate in this activity.

In 2016, the experts from TGM WRI participated in direct collaboration of Czech and German expert institutions on solution of the problems of cross-border water bodies, the quality of surface water and groundwater protection. Comparing the methodologies for assessing the status of common bodies of surface water should lead to convergence of methodologies, especially when applying environmental quality standards.

Water Balance, Audit and Evaluation in the Field of Water Quantity and Quality

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Duration: permanent activity

The objective is to process the Summaries of water balance of main basins of the Czech Republic according to paragraph 1 article 2 of the Decree of the Ministry of Agriculture No. 431/2001 Coll., on the content of water balance, the methodology of its creation and data for water balance.

Following outputs were prepared in 2016 during analysis of using the water resources and water demands regarding water quantity and quality:

- record of data on realized water abstractions and discharges submitted to Povodí, state enterprises according to Decree No. 431/2001 Coll. (updated data sets on abstractions and discharges for 2014 and data transformed for calculations in the form of database files etc.),
- the checking balance calculations after the previous water balance or Methodological instruction of Ministry of Agriculture for processing the water balances of river basin districts,
- the summarized hydrological balance,
- the recorded abstractions and discharges are publicly available on Internet via HEIS VÚV,
- the summarized water management balance (the amount of surface and groundwater).

Data Support to State Administration in Water Management and Preparation of Cartographic Outputs

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Duration: 2016

The project objective was operation of selected registers ISVS-VODA and their publishing via web services. Data support to the Ministry of the Environment of the Czech Republic (ME) covers also long-term collaboration with Geodetic Office (GO) and CHMI on update of watercourses and catchments layer. Participation at meetings of the Ministry of the Environment and the Ministry of Agriculture (MA) was carried out. These meetings were initiated by the Ministry of Agriculture, the topic was building of "new" ISVS-VODA. The project members familiarized with the needs of directive INSPIRE.

Register ISVS-VODA

The project objective was to run and to publish the data of selected registers on state of surface and groundwater in information system of public administration (ISVS-VODA) for ME, which are operated by TGM WRI, p. r. i. The manner and extent of keeping records is stipulated by Decree No. 252/2013 Coll., on the extent of data in the records of surface and groundwater status and on the way of processing, storing and forwarding of such data to public administration information systems. The project covered the processing (management, updating, publication) of a total of ten registers, the activities involved both the accessibility of data in the form of online services (online viewing within the heis.vuv.cz portal, linking the data to the water.goc.cz portal and the geoportal national geoportal.gov.cz, availability via wms services), as well as the provision of downloadable data sets, all including the relevant metadata.

Update of watercourses and catchments in cooperation with CHMI and GO

In the first quarter of 2016, the processing of uncertainties in the watercourse layer took place (for GO). As a necessary follow-up step, the structure of the DIBAVOD watercourses was checked. This activity is the basis for a good description of the river network. Simultaneously, the development of other automated tools for numbering the river network structure took place. The numbering should be based on correct watercourse information. The performance optimization of automated tools took place in second half of 2016. These tools allow carrying out additional analysis of river network spatial data for the purpose of migrating these data into a new data model.

Activities to develop the ISVS-VODA in cooperation with MA

The main activity was a participation in working groups of the project update and development ISVS-VODA and fulfillment of related activities. Four working groups were formed, to which the relevant TGM WRI staff were appointed, who participated in the work meetings and fulfilled the agreed tasks during the year. In the second half of the year, a pilot catchments were selected to test the differences in the watercourse datasets of the ME and MA resorts towards the national guarantor of watercourse layer ZABAGED®.

Activities related to requirements of INSPIRE on water management data for ME

Several meetings were held with CENIA representatives, documents were commented, and errors were removed in metadata and browsing services.

The Data Support to the State Administration at Water Management and Preparation of Cartographic Outputs in Relation to the Operational Programme Environment (OPE)

Project manager: Ing. Tomáš Fojtík
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Duration: 2016

The project objective was the conversion of designs of seminatural flood protection measures from project documentations into vectorized GIS data and to publish them in the form of map compositions at portal Voda v krajině (www.vodavkrajine.cz) including relevant information and documents.

Following activities were carried out:

- digitalization of project outputs supported by OPE 2007–2013 into vector GIS data including proposal of suitable data model,
- publication of map compositions containing digitalized data of proposed measures at portal Voda v krajině (<http://www.vodavkrajine.cz/mapove-kompozice>),
- creation of section of portal Voda v krajině, which will be dedicated to publication of relevant information and supporting documents (see <http://www.vodavkrajine.cz/podklady>).

Creation of the Report for the European Commission on Changes in General and Water Management Characteristics of Basins

Research team: Ing. Petr Vyskoč, RNDr. Hana Prchalová, Ing. Tomáš Fojtík, Mgr. Silvie Semerádová
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Duration: 2014–2016

The project objective is to provide the expert support to the Ministry of the Environment of the Czech Republic in the exercise of state administration at on implementation of river basin plans in the Czech Republic including electronic sending of required data in 2016. Activities are based on recommendations of EC on processing of plans in the Czech Republic, on requirements specified in relevant direction documents and on requirements of Commission for Planning in Water Resource Management in the Czech Republic.

In 2016, the project was focused on completion of data needed for the reporting on river basin management plans, their conversion in the geodatabase and consequent checking of their quality (completeness, logical consistency). Then, the records were processed in the required structure and formats. After approval of the content of reporting by the Ministry of the Environment and the Ministry of Agriculture, the records were sent in electronic form to the European Commission.

Report on Water Management in the Czech Republic – Comprehensive Preparation of Documents in the Field by the Ministry of Environment

Project manager: Mgr. Hana Černá
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Duration: permanent activity

The project objective is to collect, to analyze and publish the summary information on water in the Czech Republic based on projects of TGM WRI. Additional objective is to collect the summary information on water from other organizations in the Czech Republic, in different forms according the requirements of the Ministry of the Environment of the Czech Republic. The main activity is the processing of comprehensive supporting documents for Report on status of water in the Czech Republic.

In 2016, the relevant supporting documents for the Report on status of water in the Czech Republic were processed. The data were related to water management, the progress of produced and discharged pollution from point sources, the progress of pollution from non-point sources, the accidental pollution, the surface water quality and its development from 1990, the constructions for protection of water (overview of constructed and reconstructed communal/industrial waste water treatment plants in 2015) etc.

In the end of 2016, the additional data for chapter "Water" in Statistical Yearbook of Environment in the Czech Republic in 2015 have been sent to CENIA agency.

Reporting of Emissions into the Aquatic Environment

Research team: Ing. Petr Vyskoč, Mgr. Silvie Semerádová
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Duration: 2008–2016

The objective of the multi-year project is to provide expert support to the Ministry of Environment of the Czech Republic in exercising of state administration regarding the reporting to the EEA on emissions in water environment "Water emissions quality, WISE-1" that is a part of annual reporting on status of the environment (SoE). The objective of the report is the data on emission of substances into the water environment from point and non-point sources of pollution. The data are reported to EEA trough Central Data Repository EIONET.

The data were evaluated on emissions from point sources for 2015 and data on emissions from municipalities not connected to public sewerage networks. Data on emissions from point sources were implemented according the data registered in the list of discharged water sources for requirements of water balance according the Decree No. 431/2001 Col., and data of ownership and operation of water networks and sewage systems in register led by the Ministry of Agriculture according the Decree No. 428/2001 Coll., and data in the Integrated Register of Pollution. The data on emissions were reported aggregated to so-called sub-units (10 partial catchments in the Czech Republic) classified according the category of pollution.

Assessing the Impact of Drought on Water Use

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Duration: 2016

The project objective was to provide expert support to the Ministry of the Environment of the Czech Republic in evaluation of drought impact on water use. Current tools and available data were described including identification of their disadvantages. At the same time, risk areas in the Czech Republic were identified.

The project aim was a critical analysis of the existing instruments for assessing the impacts of drought on water use (in particular the water balance), including proposals for their amendment or addition. Based on the analysis, suitable indicators were set for identifying the risk areas in the Czech Republic regarding drought impact on the use of water. The risk areas were identified in the Czech Republic (hydrological catchments, hydrogeological regions and water reservoirs). Identification contains also specification of information gaps and uncertainties of current status of solution.

The Assessment of Possibilities of Water Abstractions for New Nuclear Facility at Nuclear Power Plant Dukovany and Assessment of Wastewater Discharged from Nuclear Power Plant Dukovany on Surface Water – Partial Project “Water Management Balance”

Project manager: Ing. Jiří Píček
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Duration: 5/2016–10/2016

The objective of “water management balance” was processing and assessment of balance water management calculations, both in the form of separate outputs and evaluation required by the contracting authority, as well as the basis for the other parts of the contract.

“Water management balance” determined expected securities of raw water abstraction for the needs of a new nuclear facility at Nuclear Power Plant Dukovany (NNF NPPD) in the form of elaboration and evaluation of the balance water management solution. The method of simulation modeling was used. The influenced flow time series were created as a basis for solution of influences of wastewater discharges from NNF alongside with current discharges from NPPD on quality of surface water. The solution was varied for the specified power alternatives of NNF, both for the current climatic conditions and in the variants considering the assumed climate change.

Water Management Balance of Surface Water Quantity in Subbasins Upper Vltava, Berounka and Lower Vltava

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Duration: 2016–2017

The project objective is to process the water management balance for current and projected state of surface water quantity in subbasins upper Vltava, Berounka and lower Vltava. Contracting authority is the state enterprise Povodí Vltavy. The principles, procedures and tools developed in TGM WRI, p. r. i., are implemented in project (processing of water balance in accordance with Water Framework Directive, using the outputs of water balance in water management planning and implementation of simulation modeling of storage function of water management systems. The project follows up the similar projects in TGM WRI, p. r. i., since 2006.

In 2016, the current state of surface water quantity was evaluated. The evaluation was based on water supply demands (abstractions and discharges) registered in 2015. The balance states in monitoring gauges (balance gauges and gauges of important water reservoirs) were evaluated using simulation of storage function of water management systems.

Cooperation with Austria on Transboundary Waters

Project manager: RNDr. Hana Mlejnková, Ph.D.
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Duration: 2016 (long-term activity)

The project is a part of the activities carried out within the framework of the long-term state administration support for the Ministry of the Environment. In 2016, the activities are set at meetings of the Czech-Austria Commission for transboundary waters. Specifically, the activities were given by the Protocols from the 22nd meeting and from the 23rd meeting of the Czech-Austria Commission for transboundary waters. The Commission was established based on the Treaty between the Czechoslovak Socialist Republic and Austria on Water Management Issues on Transboundary Waters.

Activities carried out in 2016 were focused on securing long-term activities and addressing topical issues at border watercourses with Austria.

The activities in 2016 were: active participation of water quality expert at meetings of the Czech-Austria Commission for transboundary waters, coordination of monitoring of boundary waters on all important watercourses (Dyje, Malše, Lužnice etc.) in cooperation with the water administrators Povodí, s. e., according to updated Programme of Monitoring of Quality of Czech-Austria Transboundary waters for 2016, summarization, processing, and assessment of analytical results; processing of Report on Monitoring Results of Quality of Czech-Austria Transboundary Waters for 2016; organization of Czech-Austria inter-laboratory exams of validity of analytical methods in 2016 and update of Programme of monitoring of Quality of Czech-Austria Transboundary Waters for 2017.

In 2016, activities continued in relation to the issue of the production and discharge of wastewater from the Austrian chemical plant Jungbunzlauer in Pernhofen into the Dyje River in September 2016, despite the dissenting opinion of Czech partner. The Czech partner enforced an increased range of monitoring in the area in order to objectively assess the impact on the Dyje River in the Czech territory. The other issues were dealt with: drainage of rainwater from the Czech highway D52 and Austrian highway A5 to watercourses, the drainage of wastewater from wastewater treatment plant near the border and issues of pollution transport from the former mining area in Austria to Czech territory. The project activities continue in 2017.

Monitoring of the Impact of the Dukovany Nuclear Power Plant on the Quality of Water in the Jihlava River in 2016

Project manager: RNDr. Hana Mlejnková, Ph.D.
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Duration: 2015–2018

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. Long-term monitoring ensures the continuity of measured data and the possibility of evaluating the trends of water quality development in the long-term. The monitoring in 2016 followed up the previous observations since 2002.

The monitoring was focused on the physic-chemical, chemical, biological and radioactive water indicators at representative monitoring sites. The localization of these sites allows to compare the water quality above the outlet of wastewater from NPP Dukovany (inlet of Jihlava River to Dalešice Reservoir, in Mohelno Reservoir below the dam of Dalešice Reservoir, in the stream Skryjský potok, its channel is used for wastewater from NPP Dukovany to get into the Mohelno Reservoir and in Jihlava River below the Mohelno Reservoir.

In 2016, the monitoring did not detect a significant problem threatening the surface water quality and critical deterioration of its state by wastewater discharge from NPP Dukovany.

However, it was confirmed that the quality of water in the area is affected by the supply of organic fecal pollution from the upper catchment of the river Jihlava and the influence of wastewater discharge from NPP Dukovany that increase concentrations of inorganic salts and tritium in the Jihlava River and in both reservoirs. The increased concentration of nitrates is the most important problem in whole monitored area. Biological monitoring has not proved the direct impact of wastewater on surface water quality. Index of saprobity confirmed the steadily status of organic pollution on level of slightly polluted 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 will continue in 2017.

Inundated Cultural and Natural Heritage of Southern Moravia

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

Project Inundated Cultural and Natural Heritage of Southern Moravia were initiated in Programme Applied Research and Development of National and Cultural Identity (INC) of the Ministry of Culture of the Czech Republic (DF13P01OVV012) in 2013–2016. The project objective was to collect and process the information on territories inundated by the water reservoirs in Southern Moravia, specifically the Vranov and Brno water reservoirs the Nové Mlýny water reservoirs system. The various experts participated in the project: so the broad extend of phenomena (that is changed by the construction of a reservoir) was covered.

The year 2016 was last project year: the final outputs of the project were processed (maps, scientific papers, exhibition, monograph, educative programmes). In total, 36 outputs were created during the project, 24 was not planned. The declared benefits and the mission of the project were fulfilled, i.e. contributing to the fulfillment of the inter-ministerial concept of applied research and the development of national and cultural identity through the proposed research and development activities.

The project contributed to identifying and documenting the heritage of intangible cultural heritage and making knowledge of national identity and cultural heritage available to all users and interested parties.

A very successful outcome of the project was the organization of the exhibition "Inundated Cultural and Natural Heritage of South Moravia", which took place in May and June 2016 in the Moravian Regional Archive in Brno and subsequently at the Ministry of the Environment in Prague.

Exhibition panels will be permanently installed in the TGM WRI, Praha. The model of the Roman river port in Mušov, which was part of the exhibition, is located in the TGM WRI, Brno.

The original design of the space arrangement presented the idea of the project very well and it was able to aesthetically combine very different topics that were included in the project.

The exhibition was commented on in the exhibition catalog, which was prepared in two versions. The printed (black and white) version was available to exhibitors, a color version of the

catalog, in the 200 copies, was included in the printed catalog in electronic format and will be permanently accessible in public on the project website in pdf format. The results of the 4 years project were summarized in the book "Inundated Cultural and Natural Heritage of Southern Moravia". The book is currently distributed to experts and public, especially in Southern Moravia. The creation of the book consisted of patient search, finding and collecting a large set of diverse materials, which have been studied in detail and expertly processed.

The materials found, including their current location, were recorded in a common "project database", creating a unique and very extensive set of records that will enable future generations to readily look into the history hidden beneath the levels of the studied locations. The selected source and the processed materials will be stored after completion of the project in a separate archive of the Moravian archives in Brno.

Other outputs of the project, which made available the results to the experts and to the public, are specialized maps: Land use change connected to the Brno Reservoir; Landscape changes connected to Nové Mlýny Reservoirs System; Landscape changes connected to Vranov Reservoir; The influence of changes of landscape use on the vulnerability of the soil to water erosion connected to Nové Mlýny Reservoirs System and archaeological sites beneath the surface of Nové Mlýny Reservoirs System; audiovisual: materials database to the project (with 859 records); educational programs "Walk through Old Bítov" and "How was life in the Bítov and Kníničky, before they disappeared under layers of dams and reservoirs?"; 5 articles in peer-reviewed journals, 18 articles in Conference proceedings and 2 informative popular scientific articles.

The outputs of the project (book, exhibition catalog, database, etc.) will be permanently accessible in pdf format at the project web page: <http://heis.vuv.cz/projekty/zatopene-dedictvi>.

Contracts of Department 232

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

Task 9531 includes the execution of commercial activities, carried out by the staff of the Department 232, on the basis of contracts and orders.

In 2016, water quality analyzes for the Austrian firm Jungbunzlauer were included in the commercial activities of Unit 232. Jungbunzlauer operates in Pernhofen. The order follows the agreements of the Dyje Working Group, following the activities of the Czech-Austria Commission for transboundary waters. The Order included sampling and analyzes of water from the Dyje River above and below the Jungbunzlauer wastewater outflow within the scope of the special monitoring of transboundary waters quality. The special monitoring corresponds to the requirement of the Czech partner for the financial participation of the Austrian partner to provide the basis for an objective assessment of the impact of the discharge of wastewater directly into the Dyje River, which the Austrian partner implements despite the Czech side's dissenting opinion. Other activities addressed in the commercial way were contracts for cooperation and promotion of Aquatis, j. s. c., and Povodí Moravy, s. e., during the exhibition "Inundated Cultural and Natural Heritage of South Moravia" (project NAKI 2991).

Reporting to Articles 15 and 17 of Council Directive No. 91/271/EEC in 2016

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Duration: ongoing activity

The project aims to create a complete documentation for checking the status of compliance with article No. 15 of Council Directive No. 91/271 / EEC on the territory of the Czech Republic.

The scope of a project of 2016 was the processing and verified data on local sources of waste water pollution. The collected data are used to inform European commission about the status of urban waste water treatment from agglomerations above 2000 PE in accordance with articles 15 and 17 of Council Directive No. 91/271/EEC concerning urban waste water treatment. The final version of the data was exported in due course.

Decree Documents Preparation According to Prepared Amendment to the Water Act for Construction and Operating Conditions of Combined Sewer Overflows in Combined Systems

Research team: Ing. Jiří Kučera, Ing. Miroslav Váňa
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Duration: 2016

Within this contract the legal situation of wastewater discharges from single sewer systems using relief chambers was analyzed.

During the project solving it was found that part of the amendment to the Water Act is not the intended mandate. The matter will be solved by amendments Decree implementing the Water Supply and Sewage Act, which belongs to the Ministry of Agriculture. Within the contract we also prepared comments to the draft of the Standard CSN 75 6262 Rain Separators, resp. Combined Sewer Overflows.

Experts and Technical Documents Elaboration for the Preparation of Draft Implementing Regulations to the New Waste Act

Project manager: Ing. Dagmar Vološínová
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Duration: 2016

The main objective was to create documents for three implementing regulations to the new Waste Act regarding selected types of waste – plastic, paper, gypsum, waste for energy recovery and construction/demolition waste.

Works were focused on drawing up experts and technical documents for proposal preparation of three implementing provisions to the new Waste Act. By using the implementing regulations it shall be met one of the main objectives of the new Waste Act – restrictions on landfill waste and increase of waste recycling to the level of successful western states of the European Union. The first implementing regulation concerns the setting of criteria and conditions under which some selected types of waste (plastic, paper and gypsum) ceases to be a waste and can be treated as a raw material or commodity. The aim of the second regulation is to define the criteria and conditions in order to refuse derived fuel was taken as a product, i.e. lost its status of being a waste. The last implementing regulation sets out the criteria specifying when it is possible the excavated soil and asphalt slabs (incurred by construction activities) consider as a by-product.

Harmonization of the Legislation with the EU Directive for Waste Water Management

Research team: Ing. Jiří Kučera, Mgr. Josef Fuksa, Ph.D., Mgr. Daniel Fiala, Ing. Hana Nováková, Ph.D.
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Duration: 2016–2018

This project is carried out for the CzechAid (Česká rozvojová agentura) and deals with some aspects of the implementation of Directive No. 91/271/EEC concerning urban waste water treatment, in the conditions of Moldova. The project aims to assist in defining the urban and sensitive areas in Moldova (according to the directive) and to assist with training to enhance expertise on the directives issue and wastewater treatment in general.

In 2016, the works began by study visit in the Czech Republic of Moldovan experts from the Ministry of Environment and the State Ecological Inspectorate. The study visit was followed by data collection in Moldova. The final proposals defining the urban and sensitive areas in Moldova are to be processed in 2018.

Activity of the Testing Laboratory for Water Management Facilities in 2016

Research team: Ing. Jana Čapková, Ing. Věra Jelínková, Ing. Martina Beránková, Vojtěch Mrázek, Ing. Martin Novák
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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 TGM WRI, 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 2016 three domestic WWTPs were tested by an accredited test procedure in the Testing laboratory. On one waste water treatment plant is carried out by accredited testing. In one WWTP (septic tank and ground filter) was launched in testing mode non-accredited way. Other waste water treatment plant was brought in late 2016 for testing according to customer's requirements.

Department 240 Orders – Collection Contract

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Duration: 2016

During the year of 2016, there were series of expert opinions elaborated in the department of 240 under this contract. Of those, one expert opinion was for the Czech Police and one for the commercial sphere. Further, there were solved numerous other works for different clients, for instance: i) sample analyses, ii) assessing the capacity of the wastewater treatment plant Dobřichovice, iii) assessing the function of domestic treatment plant, iv) assessing the causes of water seepage on the land or v) impact assessment of domestic WWTP accessories.

Finally, there were also prepared the comments to the draft legislation for Government Regulation and Water Act.

Courses of Sampling for Personnel of Laboratories in Water Management and Technology

Research team: RNDr. Josef Fuksa, CSc., Ing. Václav Šťastný, Ing. Jiří Kučera
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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 according to international standards of series ČSN EN and ČSN EN ISO 25667 and linked supplementary documents. Topics of the course include all types of waters – surface (running and stagnant), ground water, waste waters and also sediments and sludge. 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 their 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 2016 one course was arranged for total number of 20 successful participants.

New Approaches to Optimization of Integrated Protection Systems in the Context of Their Economic Sustainability

Research team: Ing. Karel Drbal, Ph.D., Ing. Jana Uhrová, Ph.D.
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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 Fulnek.

In 2016, 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 river Litava (a right tributary of the Svatka River).

Several field surveys took place at both selected areas; the objective was to localize problematic sites within the catchment and to get the detailed data for the project. The proposal of for procedure of analysis of the costs and benefits for biotechnical erosion control measures, such as retaining ditches. Other types of anti-erosive or flood control measures are analyzed in similar way.

The creation of implementation project of the water reservoir in the catchment of Stříbrný potok stream was one of the main activities in 2016. The project was based on results of analysis of hydrological conditions, altimetry measurements and hydrogeological assessment. The proposals of water retention spaces and other protective measures on agricultural land in the catchment of the Husí potok stream were processed by relevant experts (designing according the procedures and rules of plan components of common facilities in a process of reparcelling).

Approaches and pitfalls of multiobjective optimization have been assessed. The objective of multiobjective optimization is to find optimum which represents solution for set of simultaneously applied criteria. The issues of solutions of complicated systems follow mainly from application of contradictory and thus conflicting purposes. The entire process of optimization of the system of protection against the impacts of the floods was designed as a definition of its target behavior. Here, the attention was paid to supplement the experience with a creation of criteria depending on the application of numerical methods.

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

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Duration: 2015–2016

Comprehensive multidisciplinary project aimed at eliminating the negative impacts of climate change (drought and local torrential rains) 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 was 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.

The key component of the project was to assess the severity of the occurrence of the risks as well as agricultural, forestry and hydrological drought and local torrential rainfall on the affected territories of the South Moravian region. The project resulted in the development of strategies and complex design solutions that reduce the negative effects of climate change. Attention was paid to the development of a system of complex instruments for monitoring and evaluation of climate change impacts on the territory of SMR, proposals for modifications of the water regime of the landscape, leading to the total change in water management and risk reduction in the area of flood protection. Draft measures have been developed to link the planning agendas and teams to reduce the severity of the effect of agricultural, forestry and hydrological drought and torrential rainfall on specific territories affected by drought. The guidance for the selection and implementation of adaptation measures was provided to relevant economic bodies specifically for their land. The guidance was created in the form of demonstration projects and sample solutions. The results have been published in professional journals and presented at many conferences.

Expert Support at the Assessment and Management of Flood Risks

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Duration: 2013–2016

The project objective was the support to flood prevention in relation to the requirements of the Directive 2007/60/EC on the assessment and management of flood risks. The new planning cycle started in 2016; the timetables of the activities necessary for the fulfillment of the requirements of the Flood Directive were submitted.

The assessment of current delimitation of areas with a significant flood risk was carried out and approaches to delimitation for second planning period were proposed. Mainly the role of so-called preliminary delimitation was dealt with. Preliminary delimitation was prepared based on updated polygons of floodplains in the Czech Republic. The calculation followed up the results of primary calculation from 2009 and the estimation of procedure implementation and the effects of protection against floods from 2012.

Potential of Application of Nature-friendly Measures for Water Retention in the Landscape and Improvement of Ecological Status of Water Bodies

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Research team: Ing. Miloš Rozkošný, Ph.D., RNDr. Denisa Němejcová, doc. RNDr. Světlana Zahrádková, Ph.D., Mgr. Martin Caletka, Ing. Lukáš Smelík, Ph.D., Ing. Jana Uhrová, Ph.D., Ing. Kamila Zárubová, Ing. Pavel Richter, Ph.D., Ing. Kateřina Uhlířová, Ph.D., Mgr. Pavla Štěpánková, Ph.D., Mgr. Jana Ošlejšková, Mgr. Marek Polášek, Mgr. Jiří Kroča, Ing. Lucie Vysloužilová, Ing. Petr Tesař, Dr. Ing. Jaromír Macků (Forest Management Institute), doc. Ing. Petr Kupec, Ph.D. (MENDELU)

Duration: 2016

The objective was to assess the potential of semi natural measures to increase countryside water retention. The project describes and evaluates the various types of measures in a catchments (on agricultural and forest land), small water reservoirs (according to ČSN 75 2410) and water flow measures in relation to countryside water retention. Simultaneously, the potential impact of these measures on the biological component of the ecological status was assessed.

The results are the recommendations of appropriate types of measures to improve countryside water retention, which will also contribute to improving the ecological status of water bodies. The report deals in more detail with the principles for the restoration of decaying water features in the landscape, including wetlands. A separate chapter is devoted to assessing the effectiveness of different types of measures that were already implemented to improve countryside water retention. A set of measures on agricultural land was designed in the pilot catchment of Husí potok stream along with small water reservoirs; the effect of several variants of these measures on the reduction of surface runoff was modeled. The report also analyzes the current legal situation in relation to the proposed types of measures and gives recommendations for changes. The report also analyzes the current legal situation in relation to the proposed types of measures and gives recommendations for changes.

An Analysis of Past Experience of the Dry Season – part 2 of the Drought Project

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Duration: 2016

The objective of this part of the Drought Project was to find out what measures originated and arose directly in different sectors under the influence of adverse climatic conditions and what is potential of these measures to address the impacts of drought in the future. The main activity was the literature review. In order to create the entire proposal of the concept, it was necessary to find out how the whole society managed to deal with the effects of drought in the past. The project was focused on administrative measures at different levels of management and on practical technical measures. We used, alternatively reinterpreted, the information and outputs of relevant projects in TGM WRI and other organizations, publicly available statistic data and other data of professional organizations and operators.

The project results lead to the conclusion that both the residents and the economy sectors are constantly adapting to natural and social conditions. Today, there is not a society-wide agreement on what is to be achieved by the "fight against drought". If these objectives are clear, various

economic instruments and targeted subsidies can also be used to achieve them. It turns out that society responds to such stimuli very flexibly and creatively. The most important is the need to provide sufficient information to the relevant sectors (water management organizations, farmers, food industry, etc.) and to general public in order to be able to accept these current conditions appropriately.

System of Water Management Infrastructure Monitoring and Maintenance

Research 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 programme KUS of the Ministry of Agriculture.

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 administration 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 the Effects of the D4 Motorway and Expressway R7 on the Environment – Monitoring of the Biological Elements of the Quality of Surface Waters before the Construction

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Duration: 2016

The aim of the project was to obtain the underlying data sets that will be used to monitor the effects of construction and operation of motorway D4 and R7 Expressway in the immediate surroundings of Bratislava. The project had to carry out monitoring of selected biological elements of the quality of surface waters before construction on two sections of motorway D4 and three sections of the road R7.

A total of 18 sites were monitored in 2016. Monitoring of water and macrophyte was carried out at these sites; the samples of benthic invertebrates, benthic diatoms, phytoplankton were taken and processed. Chlorophyll concentrations were determined. The field work and analysis have been performed according to the standard operating procedures of the laboratory and the valid technical standards. The results have been processed into the form of the final reports, which were handed to the client.

Proposal of Integrated System of Flood Prevention and Drought Prevention on the Territory of the Micro-region Žulovsko

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Duration: 2016

The aim of the contract was to assess runoff conditions in the territory of the micro-region Žulovsko focusing on flood prevention and drought prevention. Individual activities were directed towards meeting the objectives of the contract representing a balance of processing of the surface runoff in extreme torrential rainfall for the whole of the area and for each micro-catchment, proposal of decentralized proposals for precipitation retention in needed volume on the level of micro-catchment and approximate localization of solution, processing of priorities of implementation of the proposed measures, the indicative budget of technically more demanding structures (reservoirs) designed to protection and retention or to slow down the surface flow in the territory and the delivery of the technical passportisation of each type of proposed measures.

The contract was processed from March to May 2016. The planned activities were carried out the contract was delivered to the contracting authority.

Monitoring of Long-term Changes in Biological Diversity of Running Waters during Climate Change: Design, Realization, and Implementation in the ARROW Public Information System

Research team: doc. RNDr. Světlana Zahradková, Ph.D., RNDr. Denisa Němejcová, Mgr. Marek Polášek, Mgr. Libuše Opatřilová, Mgr. Michal Straka, Ph. D., Ing. Jiří Musil, Ph.D., Mgr. Radek Novotný, Ing. Lucie Vysloužilová
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Duration: 2015–2017

The objective of the project is to expand the current system of surface water 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 project aims to create a monitoring network of localities to detect long-term changes in biodiversity in the Czech Republic, to carry out sampling and analysis of biota and surface water samples by standard procedures and to implement hydromorphological mapping including evaluation according to HEM methodology. The new approach how to evaluate, interpret and present newly acquired data in the context of historical data will be designed and a web portal will be created which will allow to clearly visualize and evaluate the change in the extent or the number of selected organisms in relation to environment variables, including those relating to the climate. The data evaluation program and web presentation for results visualization will be designed to allow seamless addition of further data from future studies with a ten-year periodicity. Department of Botany and Zoology, Masaryk University Brno and Hydrossoft Veleslavín s. r. o., Prague are collaborators on this project.

The project activities in 2016 continuously followed up the activities in 2015: Partial analyses of biotype samples were completed and additional sampling was carried out including analyses, hydromorphological mapping and assessment of monitoring network stations were carried out and data files were analyzed. New data on species composition were compared with data from earlier surveys carried out at the same sites in the 1990s and the last decade.

Based on the data, a proposal for a method of evaluation, interpretation and presentation of newly acquired data in the context of historical data was compiled. Creating of a web portal (tool for visualizing results) continued. The results were presented at seminars and a conference for the professional public.

Expert Support of the Czech Republic's Participation in the International Commission for the Danube River Protection

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Duration: 2014–2017

The objectives of the project are aimed at supporting a wide variety of activities, resulting from the participation of the Czech Republic in the activities of the International Commission for the Protection of the Danube River (ICPDR). The documentation provided is required to solve defined issues of the protection of waters in the Danube River Basin and it is directed to the planning process to achieve good water status. There are especially activities provided by Pressures and Measures Expert Groups (P & M EG), the Monitoring and Assessment Expert Group (MA EG) and the Task Group for Nutrients (N TG). In 2016, the activities followed the second Danube River Basin Plan, which was approved at the end of last year.

P & M EG continued in 2016 with activities related to the identification of pollution from point sources of pollution. The pollution load from these sources that can be only estimated (the number of inhabitants connected to sewerage for public use in agglomerations, the share of single and separate sewerage, the share of people using individual waste water treatment methods, other stages of wastewater treatment, etc.). New activity was to prepare supporting data on how to implement the document "No. 28: Technical Guidance on the preparation of an inventory of emissions, discharges and losses of priority and priority hazardous substances"(baseline document to implement the requirements of the Water Framework Directive – CIS No. 28 WFD), towards the unification of procedures for identification of pressures and the determination of the loads of these

substances in given river basins. Reduction of water pollution by the priority and priority hazardous substances still has a low percentage of required information and it requires a broader discussion and consultations on aiming, how to deal with pollution and how to assess the status. The activities of the MA EG were focused on the analysis of the results, which were reported in the second plan of the Danube River Basin.

Specifically, the project dealt with chemical substances that caused the unachievement of good chemical or ecological status, the preparation of the next joint survey of Danube in order to find new current topics for solutions and new approaches to ensure action. The expert group further discussed the extension of the monitoring activities in the network TNMN with: monitoring of mercury in aquatic biota, monitoring of the impacts of climate change on river basins and the harmonisation of the assessment of ecological status/potential in transboundary water bodies. Marginally, the attention was paid to plastic microparticles in water.

N TG continued the preparation of the methodological guidelines for agriculture, which should newly update status on national levels, define the pressures and proposals for appropriate measures aimed at reducing the loads of water nutrients from extensive agricultural activities.

Cooperation with the Slovak Republic on Transboundary Waters

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Duration: 2014–2017

The main objective of the task is to support the activities of the Czech-Slovak Working Group for Water Protection, which works under the Czech-Slovak Commission for Transboundary Waters. The project is run according to the protocols prepared at Commission meetings in accordance with approved Work Plan of the given Group. The main activity is the assessment of the results of monitoring transboundary watercourses according to national legal regulations, assessment of trends and issues of water quality accidents, prevention of harmful activities leading to improvement of transboundary water bodies.

In 2016, the project carried out the assessment of monitoring results from period 2015 at fixed monitoring sites of transboundary waters located on significant watercourses.

Furthermore, the quality of surface water was evaluated in selected rotating monitoring sites on smaller watercourses in accordance with the approved program. The time changes of water quality were assessed for selected parameters, for which the exceeding of the limit was proved more intensively. Temporal changes of water quality and trend diagrams contain the results of the joint monitoring carried out since 2000. The most important methodological differences were identified and processed for assessment of joint Czech-Slovak transboundary water body. Two joint meetings of Group OV were organized as every year. The meetings were focused on tasks that arose at Commission meetings and for preparation of common Czech-Slovak monitoring in 2017. The Group OV organized many monitoring inspections of pollution sources at transboundary waters. The practical solutions of the issues were discussed to reconcile the often divergent views of the two parties.

Non-invasive and Environmentally Friendly Approaches to Environmental Quality and Maintenance of Water Elements in the Context of Heritage Care

Research team: Ing. Miloš Rozkošný, Ph.D., Ing. Hana Hudcová, Ing. Miriam Dzuráková, RNDr. Hana Mlejnková, Ph.D., Ing. Eva Mlejnská, Ing. Alžběta Petránová, Ing. Pavel Sedláček, et al.
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Duration: 2016–2019

The main objective of the project is the comprehensive theoretical and practical elaboration of the quality of the environment of water elements of cultural monuments and historical settlements in the context of heritage care with regard to the assessment of the influence of possible changes of climate. Partial attention is paid to the optimization of fish composition of these water elements and their quantity while maintaining the requirements of all the functions of the given monuments from the point of view of monument care and cultural heritage.

In 2016, the project was initiated by the Ministry of Culture of the Czech Republic in programme NAKI II. Three stages of the project were developed. The first stage of the research consisted the search of specialized literature, the collection, study and processing of archive materials to selected monument-protected sites.

In 2016, a one-off survey of the state of water elements of several dozens of national cultural monuments and heritage reserves throughout the territory of the Czech Republic was carried out following the questionnaire investigations carried out in the NAKI I project DF12P01OVV035 – Identification of significant areas with cultural and historical values threatened by natural and anthropogenic impacts 2012–2015, principal investigator Ing. Milena Forejtníková). The survey included information from questionnaires, a local survey of water elements care, water quality of the site (water and sediment quality, composition of phytoplankton) and, in some cases, fish surveys.

The third stage was focused on the analysis of environmentally friendly and non-invasive technologies, the maintenance or improvement of the quality of the aquatic environment and the reduction of the quantity and hazardous properties of the bottom sediment of reservoirs of cultural monuments and historical settlements using modern and environmentally friendly technologies and biological enzyme preparations.

Data Processing for Innovation Voucher JIC

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Duration: 2015–2016

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

In 2016, the processing of documents for the Innovation voucher JIC for company Geosan, s. r. o., was finished. 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 one 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.

Additional activities were: i) data processing in the form of a database for viewing in MS Excel and the GIS environment (GIS browsers, ArcView), ii) handover of processed documents on innovative technologies that can be used in water management in small and medium-sized municipalities and iii) identification of the market potential.

Expert Activity

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Duration: 2016 (long-term activity)

The project is focused on small contracts for external customers and dealt with in Hydrochemistry and Hydrobiology Department of TGM WRI, p .r i., Ostrava Branch.

In 2016, 12 contracts were processed. The following activities were carried out: sampling of industrial technology and wastewaters, chemical and ecotoxicological analyses.

The example of more important contract is year-round monitoring of technology wastewater from neutralization station and expert consulting for Lakum-KTL, a. s., Frýdlat nad Ostravicí. Sampling and analyses of sludge from neutralization station in the scope of Annex No. 2 to Decree No. 294/2005 Coll., also for Lakum-KTL is another example. Examples of smaller contracts are: analyses of technology waters cooling and feedwater for UNIMETAL – engineering, s. r. o., analyses of wastewater for InterAuto Doležal, a. s., a domestic wastewater treatment plant and a dental office.

Evaluations of acute toxicity on the luminescent bacteria for Vodárenská akciová společnost, a. s., and ecotoxicological tests for the Technical University of Ostrava are examples from Hydrobiology Department.

The Assessment of the Project Plan for Road I/11 Nebory–Oldřichovice–Bystřice

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Duration: 2016

The project objective is technical expertise and project assessment in relation to Art. 4 (Art. 4.7) European Parliament and Council Directive 2000/60/EC of the Project Plan for Road I/11 Nebory–Oldřichovice–Bystřice.

The subject of the report is newly built road I/11 in the section Nebory–Oldřichovice–Bystřice. The road is the final solution of connection of D48 with the Slovak Republic via roads I/68 and I/11 in the section Třanovice (D48)–Mosty u Jablunkova. Road I/11 in the section Český Těšín–Mosty u Jablunkova is only section of E 75 in the Czech Republic. It is also the only connection in relation to the Jablunkov Pass from the Czech Republic and only road over which it possible to serve Třinec Iron and Steel Works at Třinec (80 thousand trucks were shipped in 2004). There was he daily mean was 22 thousand vehicles in municipality Vendryně in 2004.

The importance of the roads I/11 and I/68 is currently increased in relation to the Hyundai Motors Company in Moravian-Silesian Region (Nošovice locality) and requirements for capacitive connection with Kia Motors, Slovakia. In the assessment, the expected impact of the project was specified concerning the ecological status/potential of surface water bodies and the anticipated effects on the chemical status of relevant bodies of surface water and groundwater and quantitative status of groundwater bodies concerned in accordance with Annex V of Directive 2000/60/EC. Annex have been transposed into national legislation by decree No. 98/2011 Coll., on the assessment of the status of surface water bodies, method of assessing the ecological potential of heavily

modified and artificial surface water bodies and requirements of survey programs and of assessment of surface water, and by Decree No. 5/2011 Coll., on defining hydrogeological zones and groundwater bodies, method of assessing the status of groundwater and the requirements of survey programs and assessment of groundwater and in accordance with the applicable methodologies for assessing the status published on the website of the Ministry of Environment.

A Comprehensive Data Base of Actual Emissions into the Aquatic Environment in the Czech Republic

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Duration: 2014–2016

The main objective of the project is effective access data contained in the forms F_VOD_38_4 reported in frame of the Integrated system of reporting obligations (ISPOP) particularly necessary for ensuring the professional activities of the Ministry of the Environment of the Czech Republic and state authorities.

The data are sent annually in accordance with paragraph 4 § 38 of Act No. 254/2001 Coll., (Water act) as amended, which are transmitted by the polluter to the water authority, basin administrators and authorized professional body via the portal ISPOP in forms F_VOD_38_4. These data are currently only source of such information. Portal ISPOP does not offer any feature that would allow bulk processing of data contained in the forms. Consequently, the selected data from these forms were processed in 2016 (focusing on priority and dangerous substances) including their appendixes. The selected data were sent to ISPOP for reference year 2015. The comprehensive database created in this way was then supplemented by limits of the relevant legal authorization issued by the competent regional authorities. Selected data of ISPOP are published at web pages of HEIS VUV. It is possible to work further with the data (selection according the specific conditions and display the data on a map).

Support to the Participation of the Czech Republic in the Activities of the International Commission for the Protection of the Odra River against Pollution

Research team: Ing. Luděk Trdlica, Ing. Petr Tužil, Ph.D., MBA, Ing. Martin Durčák, RNDr. Přemysl Soldán, Ph.D.
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Duration: 2011–2016 (long-term activity)

Aim of the project is to support implementation of the provisions of the Convention on the International Commission for the Protection of the Odra River against Pollution (ICPO) and the Convention on the Reduction of Pollution of the Baltic Sea.

The objective of the project is to support the active participation of the Czech Republic (via representatives from TGM WRI appointed to working groups, subgroups and expert groups) in the activities of International Commission for the Protection of the Odra River against Pollution (ICPO) and expert support for the activity of the Czech delegation in this commission. It includes the preparation and processing of documents of given groups, or subgroups, preparation of supporting documents and statements for meeting of delegation heads and for the plenary meetings of

ICPO. Furthermore, the Presidency is provided in the group G1 (the Steering Group of the WFD) and G3 (accidental pollution).

Main activities in 2016:

Group G1:

- the coordination of the preparatory work for the third planning period,
- the processing of proposal on using MONERIS model for the entire Odra river basin in frame of next planning cycle.

Subgroup GP:

- activity in the 2nd update of the Odra river basin plan (activity program, significant water management issues),
- international harmonisation of the characteristics of border and cross-border bodies of water in the Odra river basin,
- update of strategy to fulfill the common goals for significant water management issues.

Subgroup GM:

- activity in extension of ICPO geoportal by module IMS – Odra (presentation of water quality in Odra river basin),
- harmonization of the assessment of the chemical and quantitative status of groundwater.

Group G3:

- support and operation of four operation exercises,
- continual update of Odra river Emergency Plan,
- regular updating of interactive map of potential sources of accidental pollution.

Cooperation in Transboundary Waters with Poland

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Duration: 2016 (long-term activity)

The main objective of the project is to collect and provide requested water management data for the activities of representatives of the Czech Republic and Slovak Republic for transboundary waters. Furthermore, the project deals with fulfillment of requests connected with issues of transboundary waters at Czech-Polish section on national borders.

The project activities are carried out in the frame of support to the state administration in water area as a fulfillment of international cooperation on transboundary waters. All activities are carried out on the basis of the appointment of the representatives of TGM WRI, p. r. i., in the working groups and expert groups as advisory bodies of the representative of the Government for border waters.

Main activities carried out in 2016:

- Collaboration on regime measurements in the areas: Police, Adršpach and catchment of Stěňava. The Collaboration included the participation in common measurement at transboundary waters in this area.

- Participation in the meetings of working group of hydrologists and hydrogeologists in the frame of water management collaboration on transboundary waters including the preparation of all requested supporting documents.
- Preparation and processing of supporting documents and statements requested from Czech partner in the frame of working group WFD, including the report on group activity for representatives of governments.

Expert Support to Legislative Regulations within the Water management

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Research team: Ing. Martin Durčák, Ing. Robert Kořínek, Ph.D., Ing. Jiří Kučera, Ing. Tomáš Mičaník, Ing. Alena Kristová, Ing. František Sýkora

Duration: 2011–2016 (long-term activity)

The project objective was the expert support at updating of legislative regulations related to water management in connection with fulfillment of transposition of the requirements of European Union law.

In 2016, the main project activity was the processing of supporting documents for updating of national legislative regulations related to water management. Mainly, the supporting documents for updating following regulations were processed:

- methodical guidance of the Department of Water Protection of the Ministry of the Environment of the Czech Republic to Government Regulation No. 401/2015 Coll., on indicators and values of allowable pollution of surface water, the requirements of a permit to discharge wastewater into surface water and in sewage systems and on sensitive areas;
- methodical guidance of Department of Water Protection of the Ministry of the Environment of the Czech Republic to Government Regulation No. 401/2015 Coll., on indicators and values of allowable pollution of surface water, the requirements of a permit to discharge wastewater into surface water and in sewage systems and on sensitive areas – Analytical methods for determination of the pollutants and their groups in the wastewater for the purposes of determining the emission limits by the water authority, monitoring compliance and control;
- decree 137/1999 Coll., establishing the list of drinking water reservoirs and the principles for the establishment and modification of protection of water resources, as amended;
- the review of existing values of environmental quality standards (EQs) No. 401/2015 Coll., according to a new document Technical Guidance on Deriving Environmental Quality Standards;
- cooperation with a professional staff of the Department of Water Protection of the Ministry of the Environment of the Czech Republic and with the department of Regulatory Impact Assessment of the Ministry of the Environment of the Czech Republic when discussing the draft amendment to Act No. 254/2001 Coll., on waters, as amended (fee Amendment).

The project dealt also with cooperation (statements, comments) of stakeholders, preparation of particular supporting documents for updating the aforementioned legislative regulations, including processing of requirements that arose from inputs by European Commission.

Expert Support of Monitoring and Evaluation of the Status of Surface Water and Groundwater

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Duration: 2011–2016 (long-term activity)

The project objective is ongoing expert support of monitoring and evaluation of the status of surface and groundwater for planning purposes in the water management.

In 2016, the intermediate project objectives were mainly following activities:

- collaboration with CHMI at updating of Frame program of monitoring including the settlement of comments of River Boards, s. e.;
- processing a methodological procedure for the analysis of long-term trends in the concentrations of the priority substances in sediments that are selected according to the requirements of Directive 2013/39/EU;
- assessment and comparison of results of analytical determinations of pollutants in sediments, suspension and sedimentable suspension from monitoring network of solid matrices of CHMI in 2015;
- the processing of study on update of localities where would be useful to delimit mixing zones (based on the results of the assessment of the chemical status of bodies of surface water within the 2nd River basin management plans);
- collaboration with CHMI at processing of supporting documents for the report on the monitoring of substances from the list according to the Commission decision of 20 March 2015, establishing lists of monitored substances for monitoring throughout the Union in the field of water policy in accordance with European Parliament and Council Directive 2008/105/EC;
- collaboration with Nature Conservation Agency of the Czech Republic and section 600 of the Ministry of the Environment of the Czech Republic at processing of proposal and needs of monitoring in relation to monitoring and evaluation of status of protected areas within the meaning of the framework directive, NATURA 2000 and Bird areas;
- expert support for participation of representatives of the Czech Republic, alternatively participation in selected working groups (WG Chemicals, WG Groundwater) for implementation of WFD and daughter directives concerning evaluation and monitoring of the status of surface and groundwater and processing of selected supporting documents for projects that would arise from activities of aforementioned groups.

The project involves also the coordination of collaboration with selected expert bodies at preparation of supporting documents for updating of some methodological procedures and collaboration with the Department of Water Protection of the Ministry of the Environment of the Czech Republic.

Evaluation of the Impacts of Drought in Bodies of Surface Water to Water and Water-bound Organisms

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Duration: 2016–2017

The project objective was the analysis of potential impact of drought on components and indicators of evaluation of the status of surface waters.

Following activities were carried out: literature research of analysis of the potential impact of drought on the individual components and indicators to assess the status of water bodies as a means of evaluating the quality of aquatic ecosystems within the meaning of Directive 2000/60/EC, literature research of possible measures to eliminate the negative effects of the drought on aquatic ecosystems, the proposal of degrees of drought treat for each Natura 2000 territory which is water-bounded, analysis of species properties for selected groups of water organisms in relation to the risks related to drought occurrence and summary of potential impacts of water reservoirs to ensure the protection of water and water-bound ecosystems.

Assessment of the Project Plans in Relation to the Article 4 (4.7) European Parliament and Council Directive 2000/60/EC

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Duration: 2016

The project objective was the processing of expert opinions and assessment of project plans in relation to potential influence on quality and quantity of concerned bodies of surface and groundwater in accordance with the requirements of Framework Directive 2000/60/ES.

The expected effects of the intended construction on ecological status/potential of surface water bodies are specified alongside with expected effects on chemical status of concerned bodies of surface and groundwater and quantitative status of concerned bodies of groundwater in accordance with annex V to Directive 2000/60/EC, which was transposed into national legislation by Decree No. 98/2011 Coll., on the method of assessing the status of bodies of surface water, the method of evaluation of the ecological potential for heavily modified and artificial bodies of surface water and the requirements of programs detection and assessment of the status of surface waters, by Decree No. 5/2011 Coll., on the definition of the main hydrogeological regions and groundwater bodies, how to evaluate the status of groundwater and the requirements of programs for detection and evaluation of groundwater status and in accordance with the applicable methodologies for assessing the status, which are published on the website of the Ministry of Environment of the Czech Republic.

Assessment activities concerned mainly selected construction of transport infrastructure, e.g. important roads (highways, expressways, bypasses), rail lines, modernization of waterways etc.

Quenchers Retardants in Products and in an Indoor Environment in the Czech Republic

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Duration: 10/2015–11/2016

The project objective was collaboration in the project Quenchers Retardants in Products and in an Indoor Environment in the Czech Republic (TB030MZP002). Project leader was E&H services, a. s., Praha.

The collaboration was focused on data survey: occurrence of quenchers retardants in water environment, selection of suitable municipal sources of pollution in the Czech Republic and sampling at selected sources (10 wastewater treatment plants) using passive samplers.

Software Tools for Evaluating the Hydromorphology of Aquatic Ecosystems and Proposed Measures in Relation to Biological Components

Research team: Mgr. Pavel Kožený, Mgr. Libuše Opatřilová, Ing. Jiří Musil, Ph.D., Mgr. Hana Janovská, Mgr. Eduard Bouše
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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 2016, the TGM WRI team sampled macrozoobenthos and fish communities in given habitats of six selected watercourses in the Czech Republic.

The taxonomic composition of the communities was assessed analogously to the procedures used for the assessment of ecological status for the purposes of the Water Framework Directive (2000/60/EC). The differences among the habitats were evaluated. The river wood had the greatest species diversity, it was followed by: samples from still water in gusty bank, samples from fast moving water in the main channel and herbs at the convex bank. In contrast, the lowest species diversity had sandy, shallow pools with the stored organic debris and deep pools. While some habitats were rich in species composition and macrozoobenthos abundance (river wood, fast moving water in the main channel), others were relatively poor in species, but they had high macrozoobenthos abundance (e.g. the aforementioned deep pools). Regarding abundance, sand alluvia belonged among the poorest habitats. Results of analyses will be transferred to the calculation engine of the evaluation software.

Fish Meat Security in Freshwaters and Aquaculture of the Czech Republic: Do We Know What We are Eating?

Research team: Ing. Jiří Musil, Ph.D., Ing. Tereza Barteková, Bc. David Štrunc
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Duration: 2016–2017

In the second year, the aim of the project is to propose a monitoring system for the verification of the quality of fish meat in terms of substances threatening human health, based on data analysis for selected fish species, selected pollutants and various types of freshwater localities in the Czech Republic, both for fish from aquaculture, and for free-range catches. This methodological approach will be based on the data obtained and analyzed in the first year. Evidence of potential health hazards should be primarily used by government authorities, professionals and the general public. Questionnaires and a web portal will be used to get information on level of public awareness of the fish meat quality in the Czech Republic. Another important goal for the second year of the project is the proposal of a special fishing management to minimize the pollutant load in fish meat.

The project is based on the first interconnection and use of existing data on the quality of fish meat in the Czech Republic, which are rather spot and are not centrally registered (data: State Veterinary Administration, Czech Food Inspection, Czech Anglers Union, Ministry of Agriculture, Ministry of Environment, FAO, AQS, WHO, Norwegian funds, CHMI, Povodí, s. e.). Data from different types of water will be used both for the methodical design of a single monitoring of the quality of fish meat in the Czech Republic and for the design of such fisheries management, that would allow the values of harmful substances in the fish muscles to be negligible. Both planned methodologies are new; they will help to make available the data on the quality of fish meat produced in the Czech Republic and potentially increase its quality (by special fishery management). The proposal also includes a plan to work with Czech Fisheries Union and the public in order to gain the widest possible awareness of the quality of wild fish and fish from aquaculture with the help of a web portal. The proposal also includes a plan to work with Czech Anglers Union and the public in order to gain the widest possible awareness of the quality of wild fish and fish from aquaculture with the help of a web portal.

Monitoring of Water in Selected Localities of Natura 2000 Network (Protected Areas within the Meaning of Section 23a (1) (c) of Act No. 254/2001 Coll.) with Occurrence of Species Limited by Water Quality

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Duration: 2016

*Sufficient and up-to-date information on the status of biotopes in protected localities are necessary for decision-making by state nature conservation authorities. The protected localities are e.g. localities of European relevance and small-scale protected areas. It especially applies to species and habitats subject to protection linked to the aquatic environment – in our case, the umbrella species, *Margaritifera margaritifera*. The aim of the project was to review the monitoring sites, to compile the data and to evaluate them.*

The main *Margaritifera margaritifera* occurrence localities in Šumava are watercourses Vodňanská Blanice, Zlatý potok, Malše and Vltava. Data were available from 2016. From evaluated data followed the increased flow during rain (almost flood flow) in July and October. Increased concentrations of suspended solids and total phosphorus were observed at all monitoring sites. On the other hand the decreased value of nitrates and the conductivity documented the partial flushing of the fish pond at Zbytiny. We recorded the flood conditions during the July sampling on river Teplá Vltava.

Assessment of Influence of Riding the Rivers Jizera and Ploučnice and Design of Potential Control Conditions (Localities of European Relevance Protected under WFD)

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Duration: 2016

Riding the rivers using small boats (usually canoeing) is a form of so-called soft tourism, but it is concentrated directly into the watercourse. The abundant attendance of boaters on the rivers Jizera and Ploučnice presents a significant potential risk for the conservation objects of the Natura 2000 sites

(localities of European relevance *Horní Ploučnice, Dolní Ploučnice and wallies of Jizera and Kamenice*). The project objective was to assess the influence of riding the rivers Jizera and Ploučnice on biotopes that are sensitive to stepping on or other disturbances related to riding, especially during the low flows. Other objectives were designing a method of qualitative and quantitative evaluation of this anthropogenic influence, proposing a system for tracking the number of tourists on the river (especially in the vegetation season) and potentially proposing conditions for regulation of riding the rivers.

The project was based on earlier projects in the TGM WRI, which dealt with the evaluation of the influence of water tourism on water and wetland communities and the method developed for the specific conditions of the river Teplá Vltava (Simon and Kládiová, 2005). The preliminary study (2016) was supposed to be followed up by standard (semi) quantitative monitoring between 2017 and 2018. During 2016, the applicability of this methodology was verified (correlation between the number of decayed nodules of aquatic plants and the number of riding boats). For Ploučnice sand-clay or sand-gravel substrates, the same quantitative method was recommended for evaluation of the disturbances by boaters. For Ploučnice sections with predominant gravel and sections with smaller and medium-sized pebbles on the Jizera, we proposed a method of labeled gravel or pebble grains on a known area and for a given amount of time (Parker and Huryn, 2011); alternatively the combination of both approaches always in relation to boats counts based on direct counting by a person and taking into account the water level (flow). The results should be assessed in the context of other components of the watercourses, in particular macrozoobenthos and fish.

Only if the unwanted influence of riding is considered as significant would it make sense to think about the forms of regulation of riding the rivers with regard to the protection of aquatic communities. Its methods (spatial or temporal regulation, limitation of water status, limitations of daily or hourly number of boats, limitations of heavy boats with a larger dive etc.) should reflect the character of the river section and control possibilities and, besides ecological and conservation aspects, also reflect socio-economic ties in Region, interests of municipalities, regional self-government and other local players.

Update of the Methodologies of Sampling Fish Populations and Evaluation of Ecological Status — Biological Component Fish for Major Rivers

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Duration: 2016

The objective of the contract was review of available/applied methodologies for sampling and evaluation of ecological status – biological component fish for big rivers, international exchange of experience and preparation of methodological publication on sampling of fish communities in major rivers, including the proposal of methodological strategy.

The methodology is intended for all entities (institutions, companies) that monitor fish communities on major rivers in order to assess their ecological status. The publication provides an overview of standardized sampling methods, e.g. for monitoring of changes in the quality of the environment of the large watercourses, for the evaluation of one-time or time-limited surveys, etc. The methodology is designed to ensure that it is possible to realize the basic evaluation of the communities of fish in selected sections of the large flows. The methodology contains basic information about the target group of the observed organisms, selection of sites for obtaining samples, description of the sampling, processing and evaluation.

Impacts of Drought on Water Quality, the Analysis of the Current Situation and Its Causes

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Duration: 2016

The aim of the project was to evaluate the available data on the quality of surface water and groundwater, and document characteristic changes for selected groups of parameters that are related to the occurrence of droughts in different areas of the Czech Republic.

The assessment was focused both on the evaluation of the long-term time-series data and the detection of the characteristic impacts of dryness on water quality, as well as on the evaluation of the impact of different types of sources of pollution (diffusive, point), to changes in concentration, and the values of selected indicators during a drought and aftermath a drought. Suitable operational and long-term measures were designed based on the evaluation of the impacts of drought on the selected indicators and the identification of key effects impairing the water quality. The measures should limit the risk of negative changes in the quality of water at the time of the decreased flows in the future. The results and conclusions of the project and proposals for appropriate measures have been implemented in the proposal of the concept for the fight against drought.

The Procedures and Validation of Water Footprint in Accordance with International Standards

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Duration: 2015–2017

The tools for the preference of the products and services with lower demands on the water become more important in connection with the forecast global challenges with the availability of water. Water footprint is one of them. Rapid development of methodologies to the water footprint is in recent years is connected with choice of different approaches. Therefore, the issue was covered by the ISO organization and standard 14046 Water Footprint was prepared. The existing approaches of determining water footprint are based on the assessment of the amount of water needed to produce the product/service. However, the discussed draft of ISO 14046 includes the impacts on the environment from the perspective of water quality.

In 2016, the pilot studies were carried out; water footprint studies were completed for waste paper with the company LeoCzech s. r. o. The results will be base for study of water footprint of moulded fibre packaging at company Huhtamaki Czech Republic, a. s. The methodological part of the project was focused on examining methods (characterization models) for the impact category of the availability of water. Within the completed pilot study of the process of production of electric and heat energy in nuclear power plants, two methods were tested to enable the use of local data for determination of specific values of local characterization factors. Furthermore, the use of data from generic database EcoInvent was tested in the project. The effect of these data on the value of the water footprint was tested. The project was presented at the workshop for those interested in water footprint, at a conference organized by the Czech Technical University in Prague and in scientific papers.

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

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Duration: 2015–2017

Project is based on current status of migration permeability of watercourses in the Czech Republic. Therefore the primarily objectives are:

(1) documentation of the status of fragmentation of the watercourses in order to propose a procedure for removing barriers, (2) broadening of the knowledge about the migration of fish, including evaluation of the effectiveness of these fish transitions, (3) to provide the aforementioned data sufficiently interpreted to target groups.

The project is divided into activities so that its applied result will in particular: (1) optimal targeting of funding instruments of the Ministry of the Environment in the area of decreasing the fragmentation of river ecosystems, (2) specific (localized) proposals for measures in the context of planning in the water management (the planning period of 2021–2027), (3) on the basis of the data obtained, the conceptual and methodological documents were modified or complemented, including creating a Migration Strategy of migration permeability of watercourses. Specific project activities are: A1 – a strategy of migration permeability of watercourses, A2 – monitoring of fish populations and migration, A3 – the preparation of pilot projects and A4 – publicity of the project. More information can be found on the project website <http://www.ochranaprirody.cz/druhova-ochrana/ehp-fondy/ehp-34-fragmentace-ricni-site>.

Monitoring Natura 2000 as a Tool for the Effective Management and Conservation of Autochthonous Crayfish Populations

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Duration: 2015–2016

*The objective of the project is focused on monitoring of the population of the critically endangered crayfish *Austropotamobius torrentium* Schrank (1803) at localities of European relevance (ERLs) and the critically endangered crayfish *Astacus astacus* Linnaeus (1758), including monitoring of quality of their habitats. Based on this knowledge, the principles for their protection will be established and proposal of management of localities with their occurrence will be processed. Measures will be based also on the determination of the limit/reference conditions for assessing the State of ERL as required by the WFD 2000/60/EC (Annex V 1.3.5.).*

In 2016, the monitoring continued at ERLs with occurrence of *Austropotamobius torrentium*. The monitoring was focused on common pollution of watercourses. However, dangerous micropollutants were monitored (polybrominated diphenyl ethers, PAHs, PCBs, or pharmaceuticals). The analysis was completed for bioaccumulation of toxic substances in muscle, hepatopancreas and gills of crayfish. The monitoring of the crayfish was repeated at the locations where, in 2015, there was a crayfish plague. The mapping of the structure of fish communities was carried out at 13 declared ERLs with occurrence of *Austropotamobius torrentium*. Monitoring of behavioral interaction of crayfish, fish, and major predators took place at three locations.

Comparison of different methods of capture of crayfish took place (with pots, diving equipment and using snorkeling). All data was stored in the internal database of the HEIS TGM WRI; data were evaluated and the results have been used in the draft of management measures. All the results have been published on the website crayfish2015.vuv.cz. Publicity and awareness-raising of the project was carried out by organizing lectures, seminars, articles, leaflets, by installing of information boards in the field and by using the website.

Chemical Monitoring and Biomonitoring of River Horní Malše Focused on Freshwater Pearl Mussel Demands

Research team: Ing. Věra Kladivová, Mgr. Ondřej Simon, Mgr. Kamila Tichá
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Duration: 2015–2016

*The project focuses on the Action Plan (AP) of freshwater pearl mussel (*Margaritifera margaritifera*) implementation in the Czech Republic, on the population of the river Upper Malse.*

The content of the project is to perform a basic chemical monitoring of freshwater pearl mussel habitat of the Upper Malse ERL. Data on the status of the aquatic environment are not yet available, with the exception of a single incomplete annual series in the preparatory study for the Management Plan. Attention is focused on the catchment area from Dolní Dvořiště upstream. Basic monitoring sites for long-term observations will be proposed, following the seasonal course and changes in ERL habitat. The water quality monitoring will be supplemented by the environmental monitoring using bioindications. The bioindications will contribute to comprehensive knowledge of habitat status of single Czech population with significant cohort of subadults from natural reproduction, found in one part of the area. Monitoring should be a base for a decision on what part of the ERL the AP conservation efforts should focus. It is already known that upper forested part (the Czech border–Cetviny) is less eutrophic, but cold, thus less suitable for the successful breeding of freshwater pearl mussel. Also, it is threatened by acidification and erosion. Middle part (Cetviny–Dolní Dvořiště) is threatened by eutrophication, however warmer. About the lower part of SCI (Dolní Dvořiště–Kaplice) is almost no information. The ERL is important by documented reproduction of freshwater pearl mussels in the middle, already partly eutrophic part, and the occurrence of residual population even in the lowest heavily eutrophicated part.

The Implementation of the Rescue Program (RP) of Freshwater Pearl Mussel, Detailed Monitoring of Chemical Processes in ERL Šumava and National Nature Monument Blanice 2016

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Duration: 2016

The project objective was monitoring of water chemistry in relation to the demands of freshwater pearl mussel at selected monitoring sites of ERL Šumava at locality Zlatý potok (7 sites) and in National Nature Monument Blanice (2 sites). Regular measurements followed up to previously monitored sites in the catchment of Zlatý potok and long-term monitored sites in relation to the both breeding distributary channels on river Blanice.

The values of pH and conductivity in the Blanice were on the upper border of the limits prescribed under the rescue program. Regarding nutrients, nitrogen in both forms (ammonium ions and nitrate) is far below limit and values of nitrite are also very low. Phosphorus was in the stream Spálenecký potok in 2016 under the limit value with the exception of two periods with higher flows. The values were often above limit in the river Blanice; rain periods increased runoff of phosphorus on the value of 0.1 mg/l. Stream Zlatý potok was regularly monitored from end of 2003 till 2009 according the financing possibilities. Only isolated data are available for later periods. Regular monthly monitoring was started in May of 2016 in this project. The values of pH and conductivity were above limits declared according the Rescue Program in most cases. Ammonium ions (indicator of fresh fecal pollution) were far below limit also in Tisovka. Only exception of first site above Skříňěřov. Nitrates are above the limit for freshwater pearl mussel in whole monitored section of the watercourse. The values are commonly above 6 mg/l in lower part of watercourse (limit for short-term maxims according the rescue program). It is caused mainly by Tisovka, where the values of nitrate are at 11–12 mg/l. Phosphorus was around upper limit to tributary of Tisovka with exception of the two periods with higher flow. Mean values were exceeded at all monitoring sites including the stream luční potok.

Preparation of the Sheets of the Measure A of Non-point Agricultural Pollution for River Basin District Plans

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Duration: 2016–2019

The aim of the project is to carry out a comprehensive localization and categorization of sites with non-point agricultural pollution threatening the water quality from surface runoff and from subsurface sources of contamination (drainage water) in the catchments of upper Vltava, Berounka, lower Vltava, other tributaries of the lower Danube River and the subcatchment of Želivka. The methodological guidance will be created for identification of critical points and categorization of localities (soil units) for both types of pollution. The sample catalog for decreasing pollution from non-point agricultural sources will be prepared for sheets of measures of type A and identification of suitable localities for proposals and realization of measures to decrease the non-point pollution. The project leader is Research Institute for Soil and Water Conservation and TGM WRI is responsible for evaluation of status of waters in studied catchments and assessment of degree of pollution load from different sources. It also cooperates on preparation of methodological procedures and evaluation of proposed measures to limit the non-point pollution.

In 2016, the project created a methodological guide that includes identification of the critical points and categorizes sites at risk of contamination of surface and subsurface area from agricultural sources for the whole territory of the Czech Republic in such detail that it can be used to create sheets of measure A. The procedures of identification of critical localities were processed where non-point pollution prevails the erosion washing or drainage outflows. The data of water quality in water bodies were evaluated with aim to select the catchments under risk from non-point agricultural sources. The water bodies under risk based on aforementioned procedures and critical catchments of fourth order were identified within water bodies where the risk is high of surface or subsurface pollution connected to the emissions of nitrates, phosphorus or selected pesticides. The measures to reduce non-point pollution of water should be implemented primarily in these catchments.

An Evaluation of Municipal Sources of Pollution in the Catchment of the Švihov Reservoir

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Duration: 2016

The phosphorus emissions from different sources in many water bodies are important obstacle to reach the good ecological status. The analysis of important point sources of phosphorus (municipal waste waters) in the catchment of Švihov Reservoir should answer the question: Which types of pollution are the most relevant for pollution of water environment and which type of wastewater management is the most hazardous regarding the phosphorus pollution in waters?

The aim of the study was to carry out a complete inventory of municipal wastewater treatment in the whole catchment of Švihov Reservoir on river Želivka. Reservoir is the essential source of drinking water for the Prague agglomeration and many other settlements in the Vysočina Region and in the Central Bohemian Region. A detailed survey of all parts of the municipalities in the studied catchments was carried out. The wastewater treatment plants were inventorized including their outlets. The outlets of public sewerage networks, outlets of rain sewers and selected individual waste water disposal systems were inventorized. During the inventory, wastewater samples were taken to determine the total phosphorus and phosphate phosphorus content. All survey results were processed in a detailed report. Outflows of waste water to the recipient or field was processed into separate layers in the GIS. The results of the study will be used by water administrator Povodí Vltavy, s. e., for the planning in water management and for the river basin management agenda.

New Nuclear Facility at Nuclear Power Plant Dukovany – The Possibilities of Water Demand and Impacts of Discharged Wastewater on Surface Waters

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Duration: 2016

The aim of the study was to evaluate the impact of the different variants of operation of the Dukovany Nuclear Power Plant (NPPD1-4) with the new blocks (NNF NPPD) or operation of only the new blocks on water quantity in the Jihlava River under current conditions and under conditions of projected climate change (+2 °C) and evaluation of water quality at gauge Jihlava under the Mohelno Reservoir (classical parameters of water quality including water temperature). Other objective was to evaluate the possibilities of wastewater discharge from NNF NPPD in the stream Skryjský potok.

The calculations of climate change impact on flow characteristics were carried out for evaluated gauges. The time series of uninfluenced flows were created. Consequently, the water management balance was processed of water quantity for all variants of operation of NPPD1-4 and NNF NPPD. The fulfillment of demands of water and securing of minimum residual flows at gauge Jihlava–Mohelno etc. The obtained data on flow characteristics influenced by different variants of NNF NPPD operation were used for simulations of water quality change and its influencing under parallel operation of NPPD1-4 and NNF NPPD. The analysis of selected water quality parameters at gauges above Dalešice Reservoir and characteristic changes of water quality in the system of reservoirs Dalešice–Mohelno were used for solution. Simple simulation model was built based on data analysis. The model predicted the changes of average annual concentrations of selected

parameters depended on changes in flows. The exceeding of the admissible values of selected water quality indicators was evaluated for all variants in 84 years time series according to Government Decree No. 401/2015 Coll. In addition to the impact assessment on the Jihlava River, the possibilities and limitations of wastewater discharges from NNF NPPD through the stream Skryjský potok into the Mohelno Reservoir were also assessed.

Monitoring of Macrophytes Community in Teplá Vltava Threatened by River Riding and Selected Chemical and Physical Variables at Specified Sites

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Duration: 2016

*The aim of the project is monitoring of submerged macrophytes vegetation of community *Myriophyllum alterniflori* Steusloff with focus on evaluation of water tourism on unique ecosystem of Teplá Vltava in territory of Šumava National Park. Second part of the project is focused on water quality above and below important pollution source the stream Volarský potok in connection with biotope demands of other components of this ecosystem.*

TGM WRI has been focused on river riding in this part of watercourse for long time (2005–2016). Long-term changes in degree of macrophytes cover in river section between the Soumarský most and Pěkná, also originally empty sites in meander outside the main channel are monitored. In the dry season of 2015 and 2016, the river was open for much of the season for a guided ride (a careful use of the river).

Young plants emerged at both originally empty sites. During the autumn rains of 2015 and during the spring flows in 2016, however, there was no usual flushing and deepening of the river channel. Throughout the river section, the channel was wide-spreading and smoothing. The curve of degree of macrophytes cover (describing the status of the river during monitored time) is negatively influenced by disappearance of macrophytes at meander site. At the same time, it shows the vulnerability of the flowing meander biotope and the susceptibility to change of state (burial, deepening and formation of pools and blind arms). The long-term nitrogen and phosphorus measurements carried out by the TGM WRI show that the water of the stream Volarský potok brings about two to three times the concentrations of these nutrients compared to the spinal flow. If the discharge of uncleaned waste water into the stream Volarský potok is considered, the resulting situation will depend on the period when this could occur and the actual weather (drought or torrential rain) during the considered time period. Amount of nitrate nitrogen between monitored sites (above the stream Volarský potok and Vltava-Pěkná). However, both sources of Vltava (Teplá Vltava and Studená Vltava) are connected above Pěkná and from long-term monitoring follows that Studená Vltava is a clean tributary.

Hydraulic Monitoring and Biological Assessment of Migration Permeability of Water Duct Děčín and Water Work Geesthacht

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Duration: 2016–2017

The project objective is to compare the migration permeability of water duct Děčín and water work Geesthacht in connection with obtained comments to Documentation EIA of water duct Děčín (WDD). The water work Geesthacht has a modern technical double-breeding fish passage allowing the passage of most fish species.

Hydraulic variables measured at the hydraulic modeling of WDD biocorridor will be compared with the fish passages on the water work Geesthacht obtained in the autumn and spring time fish migration. The hydraulic characteristics calculated by mathematical model will be evaluated according the design of technical fish passages on WDD in relation to technical norm and adequate legal provision in Germany. The velocities at water work Geesthacht will be compared with calculated values for WDD and in so-called Labské tůně. Evaluation of the monitoring will be carried out and options for migrating fish on water work Geesthacht will be evaluated, it will be compared with the proposed monitoring on WDD. Optimal monitoring system will be defined on this basis to monitor and assess fish migration.

River Wood in Watercourses of Ramena řeky Moravy National Nature Reserve: Current Status and Proposal of Management

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Duration: 2016

The aim of contract from Nature Conservation Agency of the Czech Republic was to process the study describing amount, nature and the spatial distribution of the wood in the channel of the river Morava and so-called Mlýnský potok in territory of the Ramena řeky Moravy National Nature Reserve. A substantial part of the study was risk assessment of floatable wood for structures on the river and design of river channel management policy.

According to the scale of joints in river bank, the velocity of riparian erosion and using analysis of aerial photographs, the river sections with rapid development were distinguished. The most dynamic section was the channel of Morava between the bridges Ostrovský most and bridge at Střeň. In total, 712 pieces of wood and 25 wood accumulation were mapped and described. The occurrence of river wood was bound primarily to the dynamically evolving curves of meanders and its volume rose with increasing height (age) of the riparian vegetation. The volume of trunks (individually or in accumulations) reached at section Morava 1 28.9 m³/ha in average, the average value of 32.8 m³/ha was determined for section Morava 2 and 5.6 m³/ha of river wood occurred in average on Mlýnský potok. For 13 hazard points in the area of interest, a risk assessment was carried out with respect to the floating river wood. The most of structures are not threatened by floating river wood. Approaches applicable in management of river wood and technical protection of high-risk sites have been summarized in the closing chapters of the study. Results of the study can be used as the basis for a management plan for the Ramena řeky Moravy National Nature Reserve.

Hydrological, Hydromorphological and Biological Research of Changes in Experimental Measures in 2016

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Duration: 2016

The aim of the contract was to verify the realized experimental riverbank bars on the lower Elbe on ecological status or their biological assessment. Monitoring followed the observations carried out from 2009.

Riverbank bars are built in order to concentrate the flow stream, protection gravel alluvia and to ensure the washing of the natural alluvia. Gravel and loamy alluvia are purposefully built for the extension of suitable habitats for endangered species of flora and fauna. Experimental riverbank bars are located on the right and the left bank of the Elbe River in the area of river kilometer 734. Experimental riverbank bars V1, V2, V3 and V4/5 are located on the right bank of the Elbe River. V7 is only experimental riverbank bar on the left bank. The river section with built riverbank bars is approximately 800 m long. It has been shown during the monitoring that the type/change of riverbank bar influences the most of biological components (macrovegetation, macrozoobenthos, fish).