PILOT ACTION MIDDLE TISZA
OUTPUT O.T3.10 PA8

WORK PACKAGE T3 - IMPLEMENTATION AND FEEDBACK - TOOLBOX VERIFICATION

Lead Institution	Middle Tisza District Water Directorate
Lead Author/s	Gábor Harsányi
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List of contributors Gábor Harsányi, Dávid Vizi, Péter Sólyom, Dr. János Fehér, Judit Palatinus - MTDWD

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1. Introduction

Testing of the Toolbox beta version by project partners (PPs) in pilot actions (PAs) will provide:

- documented learning experience, where PPs from different countries and disciplines will verify the Toolbox applicability and
- an important communication tool where project results will enable important outreach and key post-project capitalization leverage supporting bottom-up participatory principles in water management planning processes, generally drafted by the Common Implementation Strategy for the Water Framework Directive (WFD CIS No.11).

The Toolbox will also be tested by stakeholders during training workshops and in the post-training implementation phase, when strategies will be discussed. These stakeholder interactions will enable clarification of needs and provide recommendations for Toolbox improvements (bottom-up approach) and for direct local and regional implementation of the Toolbox.

Middle Tisza District Water Directorate will test the jointly developed CC-ARP-CE and the related toolbox, to assess the risk and impacts of climate change and to raise awareness in the stakeholder groups to enforce them to use selected tools from the toolbox.

2. Basic data about pilot action

2.1. Geographical description

The pilot area is located in the hearth of the Hungarian Great Plain. The area is almost a perfect plain, the level difference is negligible. The area's topography was shaped by rivers.

The selected pilot area is part of the Tisza-Körös Valley Water Management System (TKVWMS), and part of the Middle Tisza District Water Directorate (MTDWD) operational area. The size of the pilot area is 2950.9 km2 which is bordered by the Tisza River from the west, and by the Lake Tisza from the north. The eastern border is the Hortobágy-Berettyó River and the Tiszafüred main irrigation canal, and the southern border of the area is the Hármas-Körös River (Figure II.1). The area is characterized by low elevation (79-100 mBf).

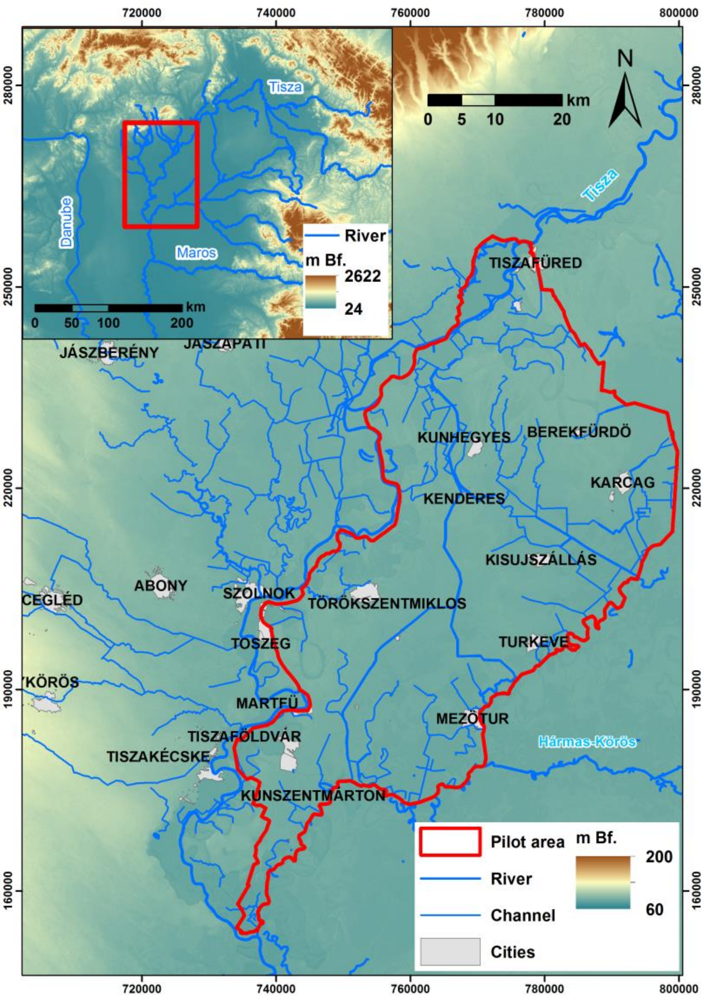


Figure II.1. Topographic map of the pilot area

In the Tisza subbasin the lofty sedimentary rocks dominate in the top 10 m caprock formations. Most of the soils are typically well-productive, so a significant part of the pilot area is suitable for agricultural activity. The typical genetic soil type in the region is the chernozem. Large areas covered with meadow and alluvial soils, which are common in the floodplains. The proportion of alkaline soils is exceptionally high in the Hortobágy-Berettyó region.

For fertility the physical, chemical and biological properties of the soils are good, the adverse soil damage is relatively low; the soil conditions, in general, are more favourable than in other part of the Tisza or Danube Basins.

2.2. Climate characteristics

The area has a dry continental climate, and it has the driest climate in Hungary. In the middle of the Hungarian Great Plain, the annual average temperature is between 10-11°C, and the monthly average temperature in July is around 21°C. The mean annual temperature fluctuation is 23.0-24.5°C. The annual amount of sunshine hours in the Hungarian Great Plain is over 2000 hours.

Based on the hydrological measurement data of the MTDWD, the annual rainfall is about 520 mm in this area, which is the lowest annual average rainfall in the whole country. The territorial and temporal distribution of the precipitation is also extreme. The annual rainfall also varies within wide limits (Figure II.3). Some years (eg. the year 2010) had a lot of precipitation and it caused floods and inland excess waters. In the last some decades, even in the same year after a wet period a dry and warm period occurred with heavy drought.

In addition to water supply data it is also important to collect meteorological data, which is a major part of the water cycle. Regarding to meteorological data of the pilot area the precipitation and the air temperature measurement stations are significant (Figure II.2). These also serve as basic data for the modelling of the pilot area, in terms of incoming water volume and evaporation. In the pilot area there are 39 rain gauges and there are 10 air temperature measuring stations. For both types of stations data recording is continuous, so detailed data are available.

Figure II.2. Precipitation and temperature monitoring network on the pilot area

2.3. Hydrology

2.3.1. Surface waters

Hungary's water network is basically determined by the fact that the country is located in the middle of the Carpathian Basin. In the country, about three-quarter of the water resources is transported by the Danube and the Drava Rivers, while almost only a quarter of the available water resources is transported by the Tisza River.

The Tisza is the second most significant river in Hungary. The Tisza’s full gradient is 30 m (5 cm/km) in Hungary. Based on the MTDWD’s hydrometric data, the minimum discharge of the river is 41.8 m^3/s, and the maximum discharge is 2 950 m^3/s at Kisköre. The long-term average discharge is 507 m^3/s at this river section.

The Lake Tisza is the biggest artificial surface water in Hungary. The lake was artificially created when the Kisköre Barrage was constructed. The lake is operated as a reservoir, so it has two different operating water levels, one for summer and one winter season. The summer water level usually lasts from the middle of March to the end of October, and it is 88.57±0.05 m. The winter water level is 87.47±0.05 m. The surface of the Lake Tisza is 127 km^2, with a volume of 253 million cubic meters. Out of this amount, more than 130 million m3 can be utilized. Lake Tisza can be considered as a multi-purpose water management facility. The main utilizations are: water supply, hydropower (at the Kisköre Barrage), fishing, nature.

The main irrigation canal in the pilot area is the Nagykunság main irrigation canal. This canal gets water from the Lake Tisza through a water intake structure controlled by the local Water Directorate, and passes the water to the Hármas-Körös and the Hortobágy-Berettyó Rivers. The water inflow is around 20-35 m3/s in irrigation season (from April to September). The canal is split into two branches near Örményes. The overall length of the main canal is 74.5 km (including the western branch). The eastern branch of the canal is 18.07 km long. The Nagykunság main canal flows out at the 144 + 642 km section of the left bank levee of the Tisza and reaches the Hármas-Körös River at the right 33 + 752 km levee section. The Eastern branch of the Nagykunság main irrigation canal flows out from the Nagykunság main canal, reaches the Hortobágy-Berettyó River at the right 16 + 200 km levee section.

2.3.2. Flooding

In the course of flood waves of the past years not only the defenders had to give proof of their aptness but also those in charge of forecasting had to demonstrate their preparedness and had to prove the reliability of the forecasting models elaborated by them.

At the time of a flood there is a fundamental need for forecasting the multitude of parameters characterizing the actual flood wave (like the height of culminating water level, its point of time, the shape of the flood wave). In order to be in position of elaborating good forecasts it is of essential importance to be familiar with the hydrology, hydraulics, meteorology, mathematics and not to forget the individual characteristics of the given river system.

Table III.1 demonstrates the height of significant flood waves culminating over 800 cm that were measured at four water gauges on the River Tisza with the indication of the year, the number of years elapsing between them as well as the time differences of breaking the records.

The flood wave in 1855 was an important event in the history of floods of the Tisza Valley as well as in that of flood prevention arrangements. Its extraordinary dimensions have applied pressure on the government for taking measures considering the matter of regulations. This event may be considered as the last flood before the regulation works; and following this the flood levels have considerably increased as a result of raising embankments and decreasing the area of the flood plain.

Following the flood prevention and water regulation works lasting through almost a half of a century, the first significant flood that caused damages had already of moderate extent as compared to those of earlier times, passed down on the River Tisza in 1895. Following 1895, owing to the results of enormous construction works, there was no considerable bursting of dam on the constructed embankment system. Exceptions are those that were caused by explosions during the war.

The flood along the Tisza Valley in 1970 proved to be the greatest among the registered floods of the River Tisza considering both its continuance and the culminating values. The flood endured for 125 days with flood control preparedness in the stage III for 103 days out of those on numerous prevention sections.

The maximum length of protection levees reached up to 2.425 km. In the course of the Tisza Valley flood in 1970 the greatest number of people participating actively in the protection work reached up to 43 thousand. All together 95 thousand residents of 69 settlements were evacuated. The value of total damages caused by the flood exceeded 8 billion Forint.

Between the years 1998 and 2001, there were four disastrous flood waves following each other. These floods stand without reference in the history of floods on the Tisza River. These have unavoidably arisen the reconsideration of flood prevention measures both in domestic and international relation. The flood on the middle section of the River Tisza in spring 1999 and then at the same time in 2000 meant an increase close to 1.5 m as compared to the flood level of the year 1970. An increase of such an extent had not happened for more than 100 years.

The floods in November 1998, in March and April 1999, in April 2000 and in March 2001 have opened a new chapter in the history of flood prevention management in the Tisza Valley. The floods have caused huge damage, the restorations have consumed huge amounts of money. It can be stated that the situation may have resulted from the combined effect of several factors.

After the World War II, the main aim of the flood protection was to increase the elevation of the levees. But over the past decades, the floodplain area of the river has narrowed due to sediment deposition, and dense vegetation. It became clear that raising the levees cannot be the only solution anymore.

The solution was found in a program called Extension of Vásárhelyi Plan (EVP). The idea is that two types of technical measurements will solve the problem of flooding. One of them being to bring down the floods in a shortest possible time, and the other, to bring the harmful water surplus to the newly built floodplain reservoirs along the river. In addition to the flood protection solution, the program also includes the regional development of the Tisza Valley (infrastructure, environment and nature protection, ecotourism, etc.).

The conception of the project determines reducing the flood levels for enhancing flood safety in the Tisza Valley by raising the conveying capacity of the flood bed, and by developing the potential retention storage sites in the Hungarian part of the flood plain.

6 reservoirs were built in the first phase of the project, namely Cigánd, Tiszaroff, Hanyi-Tiszasüly, Nagykunság, Szamos-Kraszna, Bereg. Three of them (Tiszaroff, Hanyi-Tiszasüly, Nagykunság) are in the Middle Tisza region. The main aim is a 60 cm flood peak reduction which is expected over the most critical Upstream- and Middle Tisza sections. Partial loading of the Tiszaroff reservoir (with 60 % capacity) took place during the 2010 flood. Based on the restored water levels, the reservoir's flood-reducing effect was 14 cm at Kisköre, and 36 cm at Szolnok.

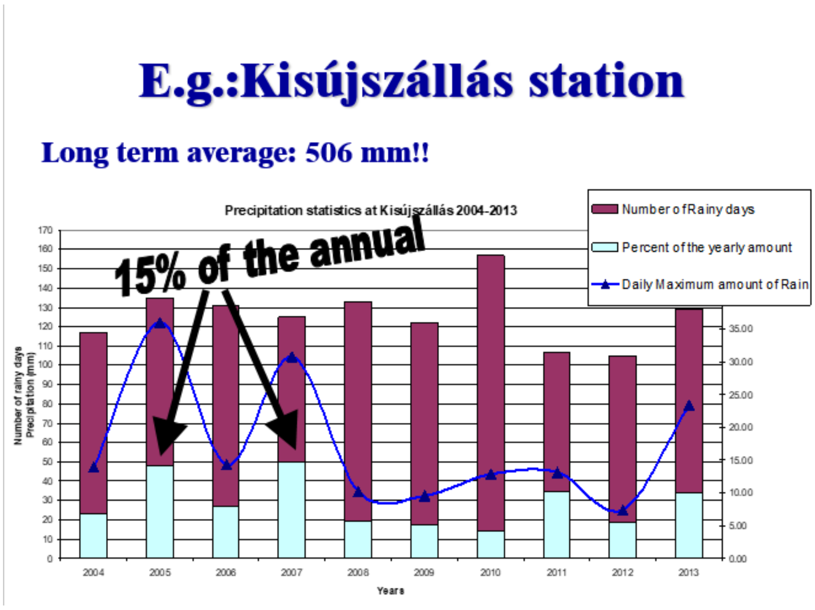
2.3.3. Heavy rain

The area of the pilot action is located in the Middle Tisza District, in the the Great Cumanian Region. The annual average precipitation is approximately between 480-550 mm in the area. A great number of high intensity rainfall events occurred in the last 15 years in the pilot area, which caused damages both in private and public ownerships as well. Due to the heavy rainfall 280 facilities were damaged in 2002, and 200 residential and several community facilities were damaged in 2006.

In the vast majority of the cases, the inland water occurs at the end of the winter and at early spring. In this period of the year the soil is saturated. With rapid snowmelt, and large amount of precipitation (especially heavy rains), the soil cannot whelm this volume of water, and because of the geomorphology (the area is almost flat the ground level changes between 86,00 m B.f. – 89,00 m B.f.) only slow runoff can evolve. Due to these affecting factors, large inundations can appear inside the settlement and in the rural areas. This is classically the so called inland water (flat flood). Usually this water can be removed by pump working, with installing temporary pumping stations.


Effects of inland excess water in rural areas

On the other hand the summer heavy rains are becoming more and more frequent, causing serious problems to settlements that don't have sufficient drainage capacities. Even 15% of the annual precipitation can fall on one day.




Effects of heavy rains in urban areas

2.4. Hydrologeology

Provide a map (e.g. IAH map or detailed hydrogeological map) and a short description (type of aquifers, GW flow, GW levels / spring discharges statistics, …)

2.5. Land use

The proportion of the agricultural land is the largest in Hungary in the Tisza sub-basin, but from agro-ecological point of view this land use is considered to be the most unfavourable structure. Large area is arable land and they have low proportion of intensive cultures (vegetables, fruits).

Using the CORINE CLC50 categories can be analysed the biological activity value of the catchment area. The biological activity value in most parts of the area is moderate (54%) or poor (30%) certified. Natural vegetation can be found only in Hortobágy region in a larger coherent spot in the Great Plain. Concentrated anthropogenic impacts are limited to smaller areas, such as cities and industrial areas.

Figure II.3. Distribution of land use in the pilot area

2.5.1. forestry

Provide a list and map of forest types and composition and if known tree stands (current composition and target composition for future)

2.6. Protected areas

The size of protected areas is important in the pilot area, where there are National Parks with several significant landscape protection areas and Natura 2000 sites (Table II.1).

Table IV.1. Types of protected areas in the pilot area

Type	Area (ha)	Distribution in percentage of total pilot area (%)
National Park	11 308	3.83
Nature 2000 SPA	21 570	7.31
Nature 2000 SCI	24 006	8.14

The national park is an area whose ecological consistency must be preserved for present and future generations. The individual areas must be protected from agricultural and industrial exploitation. It is possible to carry out not only academic, but also educational and leisure activities. In the selected area there are the Hortobágy and Körös-Maros National Parks (Figure II.4). The total area of National Parks is 11 308 ha, where the Hortobágy is 10 808 ha and the Körös-Maros is 500 ha. The National parks distribution is 3.83 % of total area.

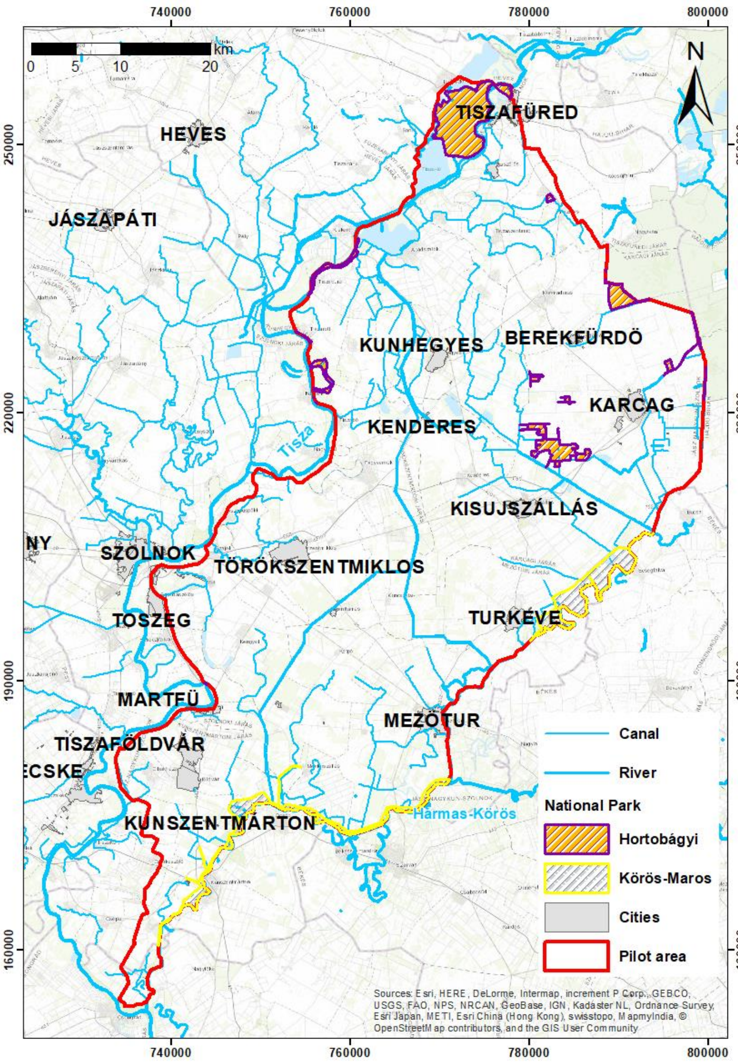


Figure II.4. National Parks on pilot area

Natura 2000 sites were created according to European Union directives. It is a coherent European ecological framework that ensures the conservation of biodiversity and contributes to the maintenance and restoration of a favourable conservation status. It is a green infrastructure that ensures the ecosystems of Europe's natural habitats and their preservation in good condition. In the pilot area there are two types of Natura 2000 sites: 1. Special Protection Area (SPA); 2. Site of Community Importance (SCI). The Special Protection Areas are internationally important areas that are critical to the survival of wild bird species. The designation of Site of Community Importance is the basis of community-relevant species and habitat types. The most Natura 2000 marking areas (SCI, SPA) are also located in Tisza Lake, along the Tisza and the Körös Rivers. The total area of Natura 2000 is 32 400 ha, where the SPA is 21 570 ha and the SCI is 24 006 ha. The Natura 2000 sites distribution is 15.5 % of total area.

There are water management activities which also serve natural conservation purposes. Determination of the summer and winter water levels of the Lake Tisza also helps this purpose. The local Water Directorate jointly with the local government, nature conservation organizations, and NGOs is involved in defining the water levels, and the process of changing from summer to winter operation. The exact definition of this procedure is important for the protection of wetlands.

The water level of the Nagykunság main irrigation canal is also set. The minimum water level is kept during the non-irrigation period. The water supply of the Körös River is also done with the Nagykunság main irrigation canal.

2.7. Drinking water sources and protection

Provide a list of drinking water sources (wells/springs/accumulations…) and short description (location, which area is supplied, water consumption (sold water)…

Which drinking water sources are legaly protected with drinking water protection zones (map of zones, short description of major limitations, legislative act….)

3. PA issues concerning TEACHER-CE topics

Middle Tisza District Water Directorate was involved in several international projects concerning water management related issues such as floods, heavy rains, droughts and water retentions.

3.1. Heavy rain

ASSESSMENT AND MAPPING OF THE PLUVIAL FLOOD RISKS

Heavy rains can cause serious problems in the Pilot Area as it is described in 2.3.3. Therefor the assessment method for assessing heavy rain and inland excess water risks were developed in the RAINMAN project. As a result of the process a study was created.

Problem/Background:

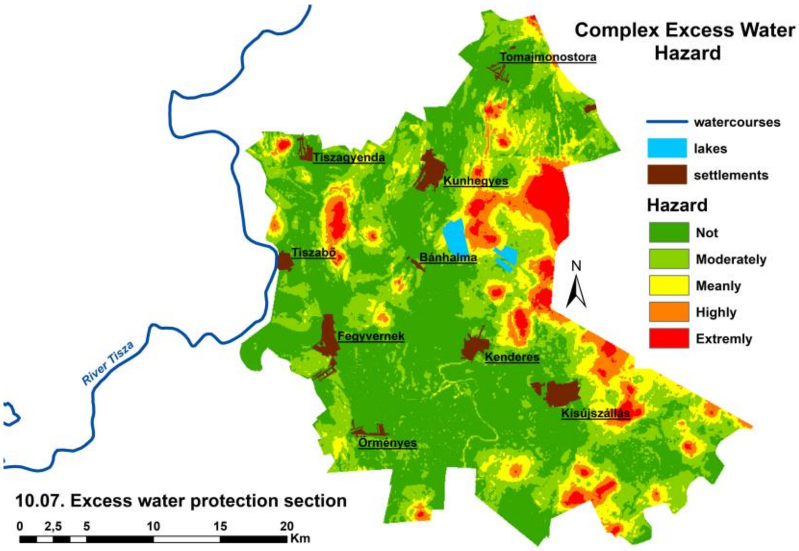
The average annual precipitation may show extremely high territorial and temporal variability in Hungary because of three climatic effects (continental, oceanic, Mediterranean). Under such conditions a considerable part of precipitation is lost by surface runoff, downward filtration and evaporation, but principally in the flat-land regions the excess waters cause several problems and damages mainly in the agricultural areas having basin-bottom character of Carpathian basin. The excess water is a form of temporary water inundation that occurs on flat lands due to extreme precipitation, sudden melting of snow, and high groundwater level, which can emerge on the surface (so called under flooding or water uprush). Damage caused by excess waters can be occurred about 1.8 million hectares, from which 60% is located in the arable-land in Hungary.

Description of outcomes:

For modelling the complex relationship, we collected suitable and available spatial information on the predictor variables, which properly represent the influencing factors. Topography (relief) has a primary influence on runoff conditions. The position and type of the geomorphologic features determine the potential location of inland excess water occurrence. The topography was characterized by a high-resolution digital elevation model. In this case, we used the relevant part of the HYDRODEM provided by the General Directorate of Water Management. HYDRODEM is a countrywide digital elevation model (DEM) with 50 m spatial resolution and corrected for hydrological errors. The geomorphologic features were taken into consideration based on numerous derivatives calculated from the HYDRODEM by System for Automated Geoscientific Analyses (SAGA) GIS tools. The hydrometeorological conditions were described by long-term averages of yearly mean temperature, precipitation, evapotranspiration, aridity index, and a humidity index (HUMI). HUMI is used for the characterization of water stress periods; it was calculated by a 10% possibility of occurrence of root square of sum of monthly weighted precipitation and sum of monthly weighted potential evapotranspiration ratio. The geological conditions can affect the occurrence of inland excess water in two aspects. (a) The permeability of the surface and near surface horizons determines the speed of infiltration of the precipitation. The closer the uppermost aquitard is, the more the permeability of the near surface layers prevails. Additionally, the thickness of the uppermost aquitard also has an effect on the permeability. (b) The hydrostatic level of groundwater below surface has impact on the back-damming of infiltrating precipitation. The hydrogeology of the GHP was spatially represented and was taken into consideration by (a) the depth and the thickness of the uppermost aquitard, which data was provided by Geological and Geophysical Institute of Hungary, and (b) the standard depth of groundwater calculated on the average 10 highest values within the last 50 years. This groundwater parameter came from well observations provided by General Directorate of Water Management. The interpolation of the well data was carried out, taking into account major natural influencing factors of groundwater level. The applied method was co-kriging with the use of DEM, precipitation and evaporation data, soil texture, land cover (characterized by NDVI), and distance from surface water bodies. Soil properties also play a major role in the occurrence of inland excess water. The permeability and storage capacity of the soils are determined by soil texture, compaction, organic matter content, and soil depth. The effect of soil on the occurrence of inland excess water was modelled and spatially represented by the physical soil property layer of the Digital Kreybig Soil Information System (DKSIS, MTA ATK TAKI). Its categories were elaborated according to water retention capability, permeability, and infiltration rate. Land use also affects the formation and occurrence of inland excess water. The permeability of the total surface has a strong connection to land cover and land use, it has a high impact on the infiltration/runoff ratio. Land use also provides some kind of information on anthropogenic driving forces of inland excess water inundations. The effect of land use was characterized and spatially represented by a numeric coefficient based on the National CORINE Land Cover 1:50,000 database (CLC50). The CLC50 categories were parameterized with expert-based land use indices characterizing their role in the formation of inland excess water. According to our method, the lower the values of land use factor (i.e., artificial areas 0.6–1.0; arable lands 0.3–1.0; permanent crops 2.5; pastures 0.6; forest and natural vegetation 1.0–5.0; wetlands 0.1; etc.), the more significant their role in IEW development is.

In the present case, we have built up the regression kriging model as follows. The target variable of the modelling was the inland excess water inundation frequency. The multiple regression analysis was carried out on the generated inundation frequency point data (as dependent variables) and the influencing factors (soil, agro-geology, relief, groundwater, land use, and hydrometeorology) of inland excess water (as independent variables). A 5% significance level was applied. The explanatory variables used by the multiple regression, were selected by a stepwise method. Regression residuals were calculated from the resulted models and the original data set, which were subjected to exploratory analysis. Semivariogram models were fitted to the calculated empirical semivariograms by a semi-automated method provided by SAGA GIS environment. The vectors of the kriging weights assigned to the original point data set were determined by the semivariogram models. An interpolation was carried out to spatially extend the local residuals made by ordinary kriging. The final result of inland excess water inundation was derived by the integration of the regression model and the kriged residuals. Besides the predicted map, its spatial reliability was also obtained in the form of kriging variance map. By the validation of the map results, the overall accuracy of the prediction was checked by the validator data set. The predicted inland excess water inundation frequency and reference values were compared in 5,000 points. The following error parameters were calculated: mean error, mean absolute error, root mean square error (RMSE), and root mean normalized square error. The best performing model was selected based on the smallest RMSE value.

Result/ Map example:



Complex Excess Water Hazard map of the 10.07 Excess Water Defence Section

“VÍZ24” APPLICATION

Further result of the RAINMAN project was the development of a mobile phone application for early warnings of heavy rains, and raising awareness of the affected population and the stakeholders.

Problem/Background:

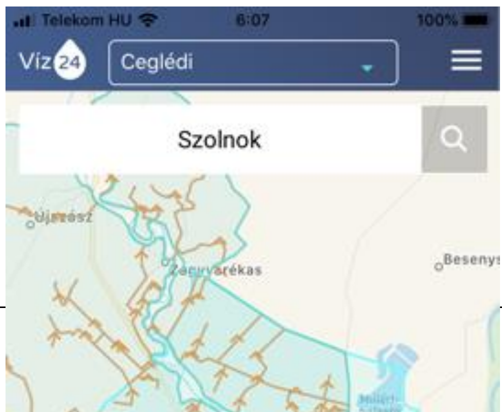
The municipalities are responsible for the protection against pluvial flood in urban area. Every municipality has water management plans for pluvial flood situation. The plans contain the most important data for the risk reduction in case of pluvial flood. But these documents are placed physically in the buildings of the municipalities, So these huge documents can hardly be used in a a pluvial flood situation.

Description and aim:

Our aim was to create an application for mobiles and tablets for different systems (android, Ios), which contains every important data for the risk reduction in case of pluvial flood, and to make the defense woks more smooth for people who are involved in such a situation. The application has high quality graphic design and user interface. The users can reach the water management plans of municipalities, variable maps (GIS, picture format), phonebook, and can reach weather and rain forecasts as well. The VIZ24 mobile application contains water management plans, maps and contact list for more than 100 settlements in the Middle Tisza District. The application is available on google play and app store at the moment.

Effect of measure:

The most significant effect of the measure is to support protection and defense against the pluvial flood in urban areas. The people who are involved in flood defense cases can reach every important information via their mobiles and tablets.



Screenshot of the application

OPTIMIZED RAIN WATER STORAGE AT KAKAT POND

Besides the development of the methodology for assessment and mapping of the heavy rain risks, the Middle Tisza District Water Directorate decided to put the results in practice. A storage area at Kakat channel was improved as a Pilot Investment.

Problem:

Before the Pilot Investment implementation there were partly insufficient capacity regarding rural rainwater and excess water storage next to Kunhegyes Town. The stormwater system within the town has been developed, that caused much higher discharge coming from the territory of the municipality. Due to this process the risk and possibilities of the inundations rose.

Description and aim:

The retention basin is created to mitigate the negative effects of heavy rain in the catchment area. This type of water management facility is a side storage that means the storage area is parallel along the main canal. The recipient of the stormwater system of Kunhegyes is the Kakat channel. The main aim of this storage is to cover the the whole discharge coning from the territory of Kunhegyes.

The capacity of the storage area is almost 12.000 m^3, its length is 550 meters The depth of the water in the storage area can reach 2 meters. The storage has two structures with which the water level is controlled.

So with this facility, the effects of heavy rains (pluvial floods) can be reduced more easily, controlled more accurately and safely.

Effect of measure:

With the implementation of the pilot investment, pluvial hazards and risks are practically reduced. Now, there is a water management facility that ensures the storage and drainage of the whole volume of a heavy rain event.

The transnational effect of this investment is illustrated by the implementation of the experiences into the RAINMAN Toolbox. We show how the knowledge gained on storage areas in lowlands has been put into practice.

Drone photo of the storage area

3.2. Drought

The pilot area is situated in the driest part of the Hungarian Great Plain. The entire area endangered by drought very heavily.

The Middle Tisza District has always been characterized by extreme weather conditions. The rainy weather is often followed by long lasting dry, warm periods. In recent years, increasing emphasis has been put on creating a method for drought prediction and prevention (*Somlyódy 2011, Tamás 2016*).

A lot of different indexes have been developed to determine the severity of drought (*WMO 2016*). The indexes corresponding to the type of drought (meteorological, hydrological, and agricultural) are usually derived from time series analyses and remote sensing data. Indexes quantify an event that has already happened. They only allow the assessment of the drought status of longer periods.

In Hungary, the most widely used Pálfai drought index (PAI) is capable to characterize the meteorological drought.

The following equation describes the calculation of the Pálfai drought index:

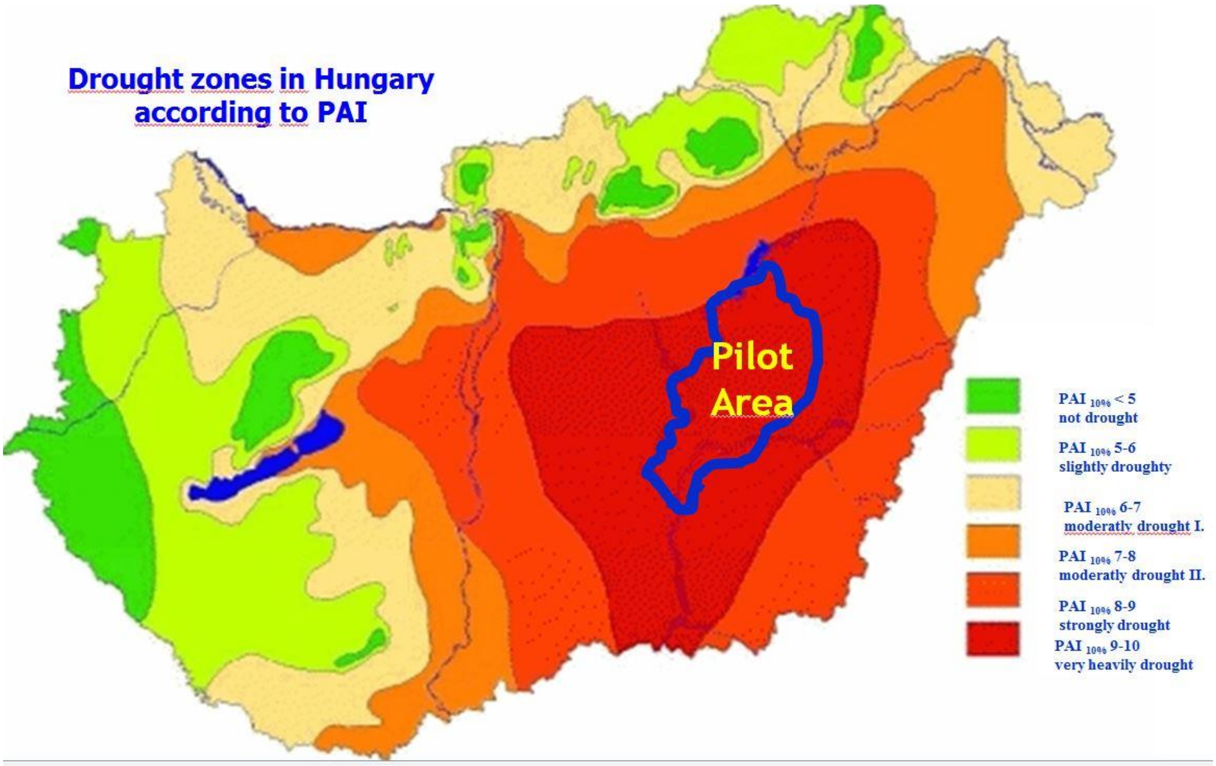
PAI = kt * kp * kgw * PAI0,

Where: kt - temperature correction factor

kp - precipitation correction factor

kgw - groundwater correction factor

$$\text{PAI0} = \frac{100 * \text{mean air temperature (from April to August)}}{\text{weighted sum of precipitation (from October to August)}}$$



Drought hazard map

The most serious drought events of the last decades were in 2003, 2012, and in 2003, when the PAI was 14.68 °C/100 mm at Szolnok, which has never reached this high value here before. In 2012 the drought index was 14.02 °C/100 mm, which was the second highest value.

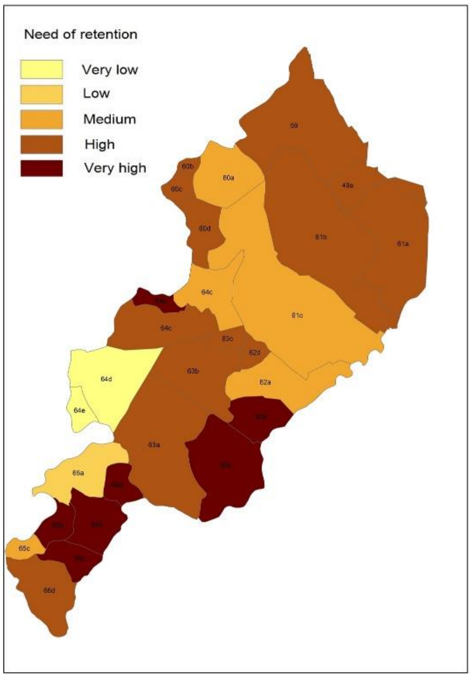
In the pilot area the longest water shortage period was recorded in 1863 when pastures dried out, 78 % of the livestock died, and the people were starving.

Years when water scarcity was recorded in recent decades: 1997, 2002, 2003, 2011, 2012.

Of these years 2003 deserves special attention. In this year low precipitation was associated with high temperatures: the number of heat-days, when the maximum temperature exceeded 30°C was 45 in national average and this has broken earlier records. Damage done to the agriculture in this year by drought was estimated to amount 50–55 billion HUF.

In the FramWat project the project team of the Middle Tisza District Water Directorate used the developed FroGis tool to determine possibilities for Small Water Retentions for drought mitigation purposes.

The results of the study is demonstrated on the following figure that shows needs for small water retentions for drought mitigation purposes.



Final valorisation map for Drought mitigation purpose

3.3. Floods

The whole pilot area is threatened by floods, with very high risk in terms of fluvial floods. Therefor the following pilot action was taken:

Floodplain restoration at Lake Bivaly - sustainable land use management of the newly reconnected active floodplain area of the Tisza River

The project area is located on The Great Hungarian Plain, along the middle section of the Tisza River, in Jász-Nagykun-Szolnok County.

Lake Bivaly is a floodplain on the left bank of the River Tisza, south of the town of Szolnok. In 2008, a project was implemented on this site, to relocate the flood levee and to broaden the foreshore to improve flood channel capacity. With the implementation of the project nearly 600 hectares of new foreshore area was created, with new habitats and new utilization opportunities.

At the pilot site both useful and harmful processes can be experienced, e.g.: the degradation of newly created habitats, the appearance of invasive species, the decline of flood capacity. The project aims to regulate these processes in a controlled way.

In Hungary, the central part of the River Tisza is essentially aluvial lowland in nature. Following the 21st-century comprehensive regulations, one of the main problems of our time is the management of water management, water damage and land use risks in the aftermath of changed run-off and water conditions. In addition to the construction of the current flood protection system and the environmental and social impacts of flooding and harmful periods of water depletion and the current forms of exploitation of the former flood areas (exempt flood protection bays) and the wavefield, it is necessary to address both the significant or exceed flood ingress and the harmful water deficient periods. In recent years, in order to reduce flood risks, on the basis of a comprehensive development concept (VTT), a number of flood protection and related territorial infrastructure investments have been made throughout the Hungarian part of the River Tisza. In order to ensure the draining of significant flood water yields, the expansion of the wavefield, the settlement of wavespace by filling relocations have been carried out, and flood-peak reduction reservoirs have been established to deal with significant flood situations.

In 2008, a new floodplain area was created during the so-called Buffalo Embankment relocation of the main protection line on the left bank of the Tisza. As a result of the intervention, in addition to improving flood ingress, natural values, new habitats and new exploitation opportunities have also been created. The expected results of such interventions, their long-term impact, can be achieved and maintained through an integrated exploitation concept adapted to environmental conditions and societal expectations. In addition to reducing flood risk, it is of utmost importance, in accordance with the Floods Directive (FD), to comply with the requirements of the Water Framework Directive, the Habitats Directive.
Both useful and harmful processes can be seen according to the different recovery and treatment functions, at the site of the plot. Degradation of newly created habitats, the emergence of invasive species, the loss of flood ingress capacity... Etc. The aim of the project is to define these processes and their effects, as well as to develop their regulated management, good practice and model along the aforementioned directives.

Actions and means involved

Evaluation of the implemented embankment relocation and the environmental impacts generated by the planned interventions and land use. Investigation of flora, fauna and water management elements. Acquisition and installation of applicable monitoring tools. Survey of forest stocks, detailed fauna survey with special regard to grasslands. Flora and fauna survey in periodic and permanent water cover areas, assessment of vegetation changes, fisheries monitoring to examine the extent of natural fish reproduction, and examination of hydro chemical and aquatic biological parameters to examine the conditions of planned utilization. Hydrographic measurements to analyse the effects on flood waves and to determine the water management tasks of near-natural water replenishment of wetlands. Preparation of hydrological statistical examinations and assessments, water cycle analysis, determination of frequency durability for water level ranges related to project activities.

One-off interventions to achieve a baseline adapted to land use and maintenance practices.

Controlled planting of grasslands, recultivation of infected grasslands with different technologies, spontaneous afforestation, control of invasive plant species on grasslands. Restoration of existing intermittent and permanent wetlands. Creating the conditions for controlled flooding, water retention and drainage by good maintenance of existing and natural water management routes.

Designation of sample and reference areas using different maintenance methods.

Development of methodologies for good maintenance and management practices. Maintenance of grassland and forest areas, wetland management. Activity up to a result monitor in comparison with the reference sample areas, analyzing the effectiveness of each treatment method.

Investigation of the impact of planned interventions and land uses on flood runoff.

Structure of a hydrodynamic model, running model tests to determine the target state for elaboration of variant analyses.

Development of an integrated land use concept, where water management, environmental, nature protection directives and other utilization needs prevail.

Development of a practical methodology for sustainable floodplain use, supporting the evaluation of model and monitoring project elements. Determining the expected results and examining their environmental and social impacts with a cost-benefit analysis.

picture oft he Pilot Action area

3.4. Forest management

Not relevant.

3.5. Drinking water sources protection

Not relevant.

4. Testing of the TEACHER-CE toolbox CC-ARP-CE

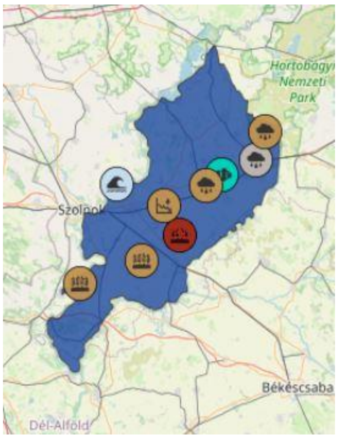
Numerous experts (each from different fields of water management and water quality management) participated at the workshop. Altogether there were twenty participants. Out of twenty-four epresentatives were from regional water supplier companies namely the Tiszamenti Regionális Vízművek Zrt. (Tisza District Regional Waterworks Ltd) and the Víz-és Csatornaművek Koncessziós Zrt. (Water and Sewerage Concession Ltd). The chairman of the Jász-Nagykun-Szolnok County Assembly was also present and he shared his ideas in his contributing comment speech. The Chief Adviser of the Chief Executive Officer of Tisza District Regional Waterworks Ltd came to share her visions, as well as. The regional media reported the event in Szolnok Tv and on the www.alfoldhir.hu electronical journal.

Before to the testing process, we added some water management problems related to climate change on the CC-ARP-CE interface, through which the processes and results could be presented and which were suitable to generate discussion. We also provided suggestions for action from the catalog of measures in advance.

During the testing, we also demonstrated the operation and applicability of the tool in an interactive way and encouraged participants to identify problems and suggest actions for their own areas of expertise.

The most relevant 'Field of Actions' related to the Pilot Area were mentioned as:

- Fluvial flood risk (management)
- Pluvial flood risk (management)
- Irrigation water (management)
- Water scarcity and drought risk (management).



Issues in Hungarian Pilot area

Based on the feedback from stakeholders, the catalogue of measures is sufficiently detailed. It contains all the measures to deal with water management problems in the Pilot Area. Based on the feedback, the report was completed for the pilot area.

The AHP Criteria classification was basically understood by stakeholders, although the classification was found to be somewhat complicated because the individual parameters (robustness, multifunctionality, etc.) were not sufficiently defined. It is suggested by the participants that in the menu of ranking and catalogue of measures.

In concluding the overall opinion of the participants of the workshop it can be stated that the tool in general is a useful one which could help the practitioners in their water management planning work. It was also highlighted that the in its current development stage provides a good baseline for further development what the participants supported.

5. Synthesis of the National Stakeholder Workshop

The main purpose of the workshop, in addition to presenting the project, was to introduce the operation of the CC-ARP CE program developed in TEACHER-CE project for the stakeholders, and to show the developments that have taken place since the last stakeholder workshop. An additional aim was to provide opportunity for a wide range of stakeholders to identify problems, challenges that exist in the pilot catchment and already affected by climate change as well as to choose from the catalogue of measures available in the Toolbox or propose new measures to mitigate problems. It was also expected from the workshop to gain feedback from the workshop participants on the usability and features of the program.

Numerous experts (each from different fields of water management and water quality management) participated at the workshop. Altogether there were twenty participants. Out of twenty-four representatives were from regional water supplier companies namely the Tiszamenti Regionális Vízművek Zrt. (Tisza District Regional Waterworks Ltd) and the Víz-és Csatornaművek Koncessziós Zrt. (Water and Sewerage Concession Ltd). The chairman of the Jász-Nagykun-Szolnok County Assembly was also present and he shared his ideas in his contributing comment speech. The Chief Adviser of the Chief Executive Officer of Tisza District Regional Waterworks Ltd came to share her visions, as well as. The regional media reported the event in Szolnok Tv and on the www.alfoldhir.hu electronical journal.

Taking into consideration of the number of workshop participants no group discussions were held rather all topics were discussed in the plenary. Participants received a short questionnaire to evaluate the usability of the Toolbox in four categories selecting values between 1 (worst value) and 4 (best value).

The questions were the following:

1. Does the Toolbox reach its goal as an identification and decision support platform for issues + measures for stakeholders?
2. Does the functionality and usability of all parts of the toolbox convince the stakeholders?
3. As regards the complexity of the Toolbox – Do stakeholders see an applicable instrument for enhancing the decision process?
4. Regarding user expectations – Can stakeholder imagine using the Toolbox in their field of responsibility?
5. How is the user experience - Do stakeholders know, how to use the toolbox and does it meet user expectations?
6. What are the decision-making processes in the user's fields of responsibility – do stakeholders think decision support systems enhance public acceptance of the results?

The overall evaluation of the workshop indicates that the participants were dominantly satisfied with the Toolbox. 78 % of the answers was 4 (best value).

Stakeholders were satisfied with the Field of Action part as well. All of them found possibilities for their work and the settings related to their field of specialization. No proposal was made for a new field of action.

The most relevant 'Field of Actions' related to the Pilot Area were mentioned as:

- Fluvial flood risk (management)

- Pluvial flood risk (management)
- Irrigation water (management)
- Water scarcity and drought risk (management).

Based on the feedback from stakeholders, the catalogue of measures is sufficiently detailed. It contains all the measures to deal with water management problems in the Pilot Area. Based on the feedbacks:

- It would be worthwhile to apply a filtering option in the system, based on the geographical location (lowland, hilly, mountainous measures),
- When selecting the type of measure, the bottom line is “CC adaptation measure” instead of “measure affected by climate change”.
- By clicking on a specific measure in the list of proposed measures, a detailed description of the measure will appear in the English version, not in the Hungarian version.

The AHP Criteria classification was basically understood by stakeholders, although the classification was found to be somewhat complicated because the individual parameters (robustness, multifunctionality, etc.) were not sufficiently defined. It is suggested by the participants that in the menu of ranking and catalogue of measures, the list of final ranked measures should be made exportable.

The climate indicators, their presentation, and the scenarios contains a number of options, so there was only a brief opportunity to demonstrate them during the Workshop. Stakeholders understood the wide range of climate variables, their incorporation and the presentation of scenarios.

What was mentioned by them are as follows:

- Climate indicators are listed in English in the drop-down menu not in national language.
- The legend does not contain dimensions.

The use of the tool can deliver relevant and evaluable results if all the interested stakeholders add their suggestions on the expected problems and possible measures. Unfortunately, contrary to what was previously promised, stakeholders did not record such, they merely accepted what we proposed. Future practical application is only conceivable if active and wider stakeholder involvement can be achieved primarily through organised training courses. The biggest limitation of the programme is that not every part is translated yet. eg.: adding a new issue, etc.

In concluding the overall opinion of the participants of the workshop it can be stated that the tool in general is a useful one which could help the practitioners in their water management planning work. It was also highlighted that the in its current development stage provides a good baseline for further development what the participants supported. According to the majority of stakeholders, the system should be supplemented by some specific cost estimate assigned to each measure.

6. Conclusions

The results based on the process of the stakeholder involvement and focus group meetings was that the CC-ARP-CE toolbox is a good initiation. Testing all components of the Toolbox was a long process since the testers came from various scientific and technical backgrounds.

In general, the stakeholders agreed that the Toolbox is an appropriate platform for the identification of local or regional issues. The tool gives stakeholders the opportunity to take part in the initial planning stage by raising water related issues directly coming from the Pilot Area. It was important for stakeholders to know that their added issues will be governed by the right institution, and will have the possibility for solution or will be funded.

In contrast, some partners viewed the tool quite critically. The main problem was the language, since it was not available in Hungarian. In connection to this a big limitation in the implementation was also the requirements of General Data Protection Regulations, which means that the issue recording process was completely anonymous leading to some misinformation or misunderstandings.

Some members of the Focus Groups were very gladful of the idea of CC -ARP- CE. They liked the functionality and the idea as a decision support system.

One of the main outcomes based on the remarks of the stakeholder and focus group, that the tool is not a daily working device. It is mainly an information gathering platform for confirming needs coming from the territory, for institutions who are in charge of the spatial planning or implementation of certain measures.

Another problem could also be that, by providing detailed data and information, some stakeholders felt that it is only a platform for problem identification and not supporting them in the solution, especially in expensive measure types.

The tool provides support in decision making processes for different institutions and stakeholders. However, it should be emphasized that, the use of the Toolbox requires specific technical and scientific knowledge. The user experiences were that the use of the Toolbox can be learnt quite easily, though there is need for further explanation of certain definitions.

The general impression of the stakeholders was that the Toolbox is a good initiative, though it needs further development.