

T3.2.4 CATALOG OF MEASURES AND GUIDELINE:

T3.2.4 METHOD OF SELECTION MEASURES FOR SPATIAL PLANNING DOCUMENTATION

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T3.2.4 Catalogue of measures and guideline: Method of selection measures for spatial planning documentation

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1.1. Project content

The RAINMAN CE 968 international project is concerned with developing tools and methods for identifying risk areas and proposing measures to mitigate the damage associated with torrential rains and pluvial floods. The project aims to reduce losses in both undeveloped and built-up areas caused by torrential rainfall and the creation of tools for integrated risk management of torrential rainfall by local, regional and national public authorities. The basic prerequisite for reducing flood risks is the prevention of flood damage, especially in the form of flood protection measures. An important aspect that plays a role in permitting these measures is the fact that the territorial permitting process takes into account spatial planning documentation in the Czech Republic. It is beneficial to know which measures can be included in the spatial planning documentation. Therefore, the RAINMAN project also deals with the issue of spatial planning in relation to the protection of the territory against the effects of torrential rain.

1.2. Goals

The aim of this output is to evaluate the existing measures preventing the negative effects of torrential rainfall, from the point of view of their possible anchoring in the spatial planning documentation (hereinafter also "ÚPD"), which is a basic prerequisite for their subsequent implementation. The Catalog of protective measures applicable to the protection of the area against damage caused by torrential rain from the T. G. Masaryk Water Research Institute was used to select possible measures, subsequently modified for the implementation of this catalog into the "TOOLBOX". RAINMAN.:

- determination of criteria for the selection of measures that can be reflected in the ÚPD
- selection of measures that can be implemented in the ÚPD
- inclusion of selected measures into individual types of ÚPD
- processing the previous points in the form of a table, which will serve as input for the material T3.2.5 "Selected measures reflected in the spatial planning documentation" (how to apply the selected measures to the ÚPD)
- summary of the findings

1.3. Spatial planning documentation in Czech Republic

The following text and scheme briefly describes the structure of spatial planning in the Czech Republic, respectively, it indicates what the system component is dealing with. It is evident that each of the levels of land-use planning can address the area in different detail. This fact has been taken into account when deciding whether or not it is possible to incorporate the measure into this documentation. A brief presentation of the types of documentation is necessary for a basic overview of whether the proposed measure can be included in this documentation.

1.3.1. Explanation of the term „Land-use planning documentation“

Land-use planning documentation is a documentation that, if acquired, represents binding conceptual requirements and conditions for decision-making in the territory. It consists of a textual and graphic part and according to the extent of the solved area we divide it into three types - the principles of territorial development, the land use plan and the zone plan. Each of these documentation has a different processing scale and hence the resulting detail. The principles of territorial development must be acquired, in the case of a territorial and zone plan their acquisition is voluntary.

1.3.2. A brief structure

The brief structure is shown in Scheme No. 1, where the continuity of documentation can be seen in relation to its details and the solved area. The scheme begins with the territorial development policy, as it is a strategic nationwide document. This document does not contain drawings, but only schemes of the most important projects.

1.3.2.1 Spatial Development Policy of the Czech republic (PÚR)

Does not address all issues of spatial planning and is a conceptual document containing priorities of spatial planning of national importance, containing areas with requirements or specific interests of international and national significance, defines schematically areas and corridors of transport and technical infrastructure of international and national significance. From the point of view of flood protection, the PÚR determines the task to create conditions for preventive protection of an area against potential risks and natural disasters within it (floods, landslides, erosion, drought etc.) in order to minimize the damages. In particular to ensure protection of spaces that are necessary for new constructions and measures against floods, and for delimitation of spaces intended for controlled overflows. In the Water Management chapter, it defines a water reservoir area with cross-border significance and a dry reservoir area designed to reduce flood risk across multiple regions. The territorial development policy consists of a textual part, with nine thematic schemes with the most important projects attached.

1.3.2.2 The Spatial Development Principles (ZÚR)

Issued for the whole territory of the region and solving overlocal contexts. Specify the intentions and develop the priorities set by the PÚR - they must respect it and be in line with it - including setting priorities for the development of the region, set out basic requirements for the organization of the region and its effective use define areas and corridors for intentions of overriding importance, ie. significant for the whole region, selected intentions can be defined as public benefits or measures, define the requirements for coordination of municipal planning activities. It must not contain details of the content of the spatial plan, the zone plan and the

follow-up decision. This documentation defines, for example, technical infrastructure corridors in the area of water supply, territorial reserves for surface water accumulation, sets conditions for specified types of landscape and the main principles for environmental protection, which the subsequent land-use planning documentation should meet. It consists of a textual part (proposal and reasoning) and the graphic part consists of drawings in the scale usually 1: 100000.

1.3.2.3 Spatial Plan (ÚP)

It solves the whole territory of the municipality in the context and details of the territory of the municipality. It specifies the intentions and develops the priorities set by the PÚR, ZÚR (it must respect them and be in harmony with them), sets the basic concept of community development, protection and development of its values, urban conception, concept of public infrastructure, concept of landscape arrangement, divides the whole municipality into areas with different use and setting conditions of use for them, defines corridors of transport and technical infrastructure of local importance, ie in the context and details of the territory of the municipality, Selected intentions can be defined as public utility buildings or measures. The proposal is coordinated with the territorial planning of neighboring municipalities. It may not contain details pertaining to the content of the regulatory plan, a subsequent decision, unless the municipal council has decided on the acquisition of a zoning plan with elements of the regulatory plan. The zoning plan contains the concept of flood protection, it can propose specific intentions in the field of water management, erosion control and determines the conditions of use in individual designated areas. It consists of a textual part (proposal and reasoning) and the graphic part consists of drawings in a scale of 1: 5000.

1.3.2.4 Spatial Plan with elements of Regulatory Plan

For selected territories in Spatial Plan, it adds elements of the Regulatory plan to the solution. Thus, in these territories, its detail and scale is greater - it may be as in the Regulatory plan, in other parts it corresponds to the 1: 5000 zoning plan scale. In the evaluated catalog of measures, only Spatial plan and Regulatory plan were chosen, as the Land use plan with the elements of the zone plan may have a similar solution to the Regulatory plan in selected territories and therefore falls under the category of "Regulatory plan".

1.3.2.5 Regulatory Plan (RP)

It solves only part of the territory of a region or municipality, where it lays down detailed conditions. It defines individual lands and sets out detailed conditions for their use (as opposed to the Land Use Plan, which addresses areas and not land details). It lays down detailed conditions for the location and spatial arrangement of buildings, the protection of values and the nature of the territory, defines land and lays down detailed conditions for the location and spatial arrangement of public, in particular transport and technical infrastructure. The zone plan

may propose specific locations for flood control measures and the basic design of buildings and conditions in vulnerable areas. It consists of a textual part (proposal and reasoning) and the graphic part consists of drawings in a scale of usually 1: 1000.

1.3.2.6 Planning Study (ÚS)

It solves only part of the territory of a region or municipality, where it lays down detailed conditions. The scale is similar to a zone plan, but rather a substantial factual solution is in the drawings. It consists of a graphical and textual part describing the proposed solution. As this is not a Land-use planning documentation, but only the background that can be used for decision-making in the territory, this documentation was not included in this output.

1.4. The key to the selection of measures that can be implemented in the Spatial planning documentation

In the RAINMAN project, the T. G. Masaryk Research Institute of Water Management, in cooperation with other project partners, designed a Catalog of protective measures applicable to the protection of the area against damage caused by a torrential rain. Subsequently, this catalog was modified for the needs of implementation of this catalog into the "TOOLBOX". The basic parameter is the wording of the Building Act, which stipulates that individual levels of the ÚPD are limited by their details. The detail of the regulatory plan was chosen as the criterion whether the given measure can be included in the ÚPD. Due to the above-mentioned types of ÚPD, the regulatory plan represents the greatest detail for the solved measures. When selecting measures that can be included in the ÚPD, a division into two categories was considered:

- Spatial Plan (ÚP)
- Regulatory Plan (RP; it also includes a variant of the spatial plan with elements of the regulatory plan)

For the sake of clarity and overall context, the Spatial Development Policy of the Czech Republic was introduced in Chapter 1.3, but it is not a Spatial planning documentation and the Spatial Development Principles. Both types were not included in the further assessment because of their small details. Planning Study was not further utilized as it is only a spatial planning basis.

The Spatial Plan sets out a comprehensive concept of its development, including protection, manifested mainly by the proposed areas, corridors, or routes, and setting conditions for their use. The Regulatory Plan, due to its focus on a smaller part of the area of the municipality, is a proposal for the specific location and shape of the buildings and detailed conditions.

The modified catalog of measures describes different types of measures, both in built-up and non-built-up areas. Each line of the catalog contains one proposed measure (e.g. baulk, furrow, small water reservoir), exceptionally a set of measures (e.g. measures to drain surface water from buildings and increase retention and infiltration, sustainable urban drainage systems for collecting, diverting and retaining surface runoff, multifunctional traffic routes and parking areas

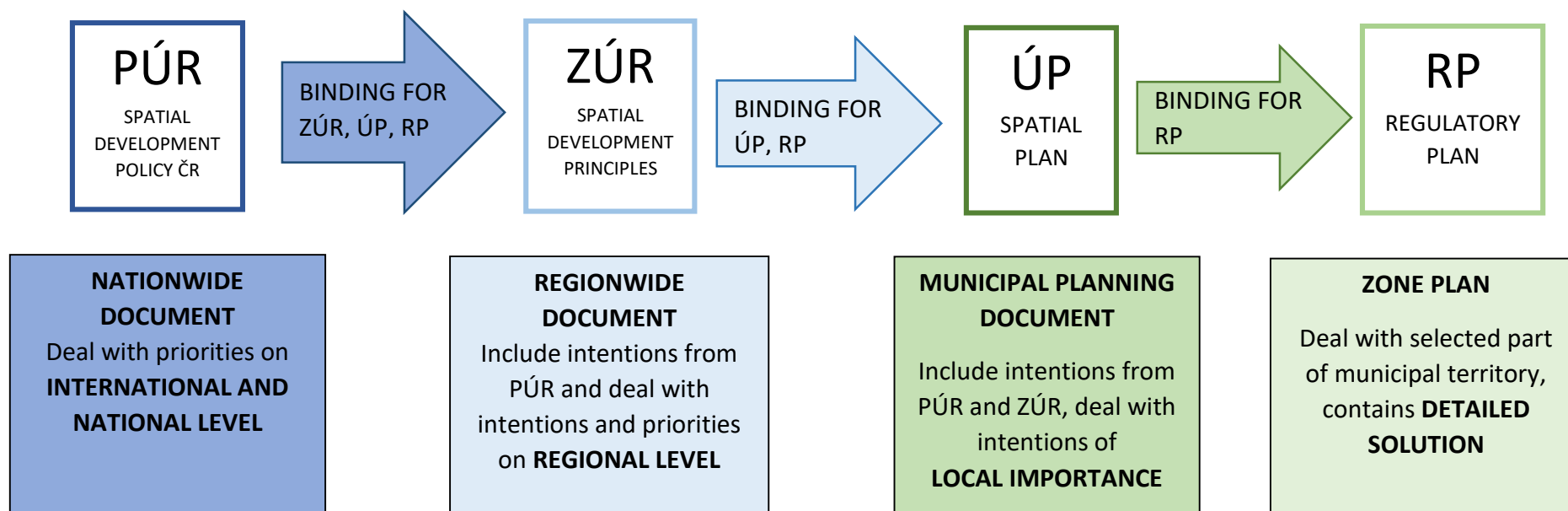
intended for drainage or as a temporarily flooded floodplain) with its description, advantages, its possible scope and other contexts. For the needs of our output, we have preserved only columns with a meaningful value:

- measure number, name, description, field of application, the possibility of implementation of measure in the ÚPD.

In incorporation of the measure, its description and sometimes the mentioned source of more detailed information were especially important. The main criterion is the detail of the proposed measure and the question of whether it can be reflected only in the spatial plan or is it possible to solve it in a more detailed way within the regulatory plan. The regulation plan addresses the location and arrangement of buildings, their connection to the infrastructure and other conditions only to a certain detail. There are also such measures in the catalog that, in their detail, exceed the scale of the regulatory plan. In these cases, these measures would have to be the subject of spatial and construction proceedings, which are no longer dealt with in this material. If it is a question of dividing the measures into the spatial and regulatory plan, then in the first case it is a certain draft concept, which is then subsequently developed in greater detail in the second case. This link applies to all proposed measures that can be implemented in spatial planning documentation. An important question in the incorporation of the measure was how it will be reflected in the graphic part of the ÚPD, where the text part always describes the proposed measure in more detail.

The resulting division of the measures in the catalog is shown in the table in Chapter 1.5, which is also the entry into activity T3.2.5 - Selected measures reflected in spatial planning documentation.

Scheme NO. 1 - Spatial Development Policy and Planning Documentation in the Czech Republic



RELATION TO THE HEAVY RAIN RISK:

REDUCTION MEASURES PROPOSED IN THE CATALOGUE (T2.1.2)

PROPOSED MEASURES:
cannot be included

Request for heavy rain risk reduction is possible to include as a priority for fulfilment of Municipal Planning Documentation

PROPOSED MEASURES:
cannot be included

Request for heavy rain risk reduction is possible to include as a priorities and tasks for solution in Municipal Planning Documentation

PROPOSED MEASURES:
selected measures can be included

Heavy rain risk reduction measures is possible to design in the graphical part and describe in the text part

PROPOSED MEASURES:
selected measures can be included in greater detail

Heavy rain risk reduction measures is possible to design in the graphical part and describe in the text part

1.5. Assessment of proposed measures in relation to spatial planning documentation

No.	Name of measure	Description	Field of action						Spatial planning documentation	
			Farmland	Forest	Watercourse	Settlement area	Building	Early warning and disaster management	Risk communication	Spatial plan, Regulatory plan
1	Event and damage documentation; event analysis	All pluvial flood events with damages should be documented and analysed regarding causes and impacts. The measure includes the assessment of buildings and infrastructure concerning their usability (e.g. transport routes, water supply, waste water disposal). Collected data are the basis for compensation requests to insurance or public disaster funds (if available). Moreover, lessons learnt can be drawn and measures be planned on the base of an analysis. This contributes to damage reductions at future events. Last but not least, collected data can be used in order to improve the quality of model calculations. A proper damage documentation requires a predefinition of criteria and standards.	x	x	x	x	x	x	x	no
2	Risk area identification, mapping and designation	A proper hazard and risk assessment is the essential basis for starting an integrated risk management process at all levels of action. The assessment is a challenging multistep task, which requires – besides from clear objectives - some input data (e.g. about historic event and damages, methodological skills and decisions as well as resources. Based on the assessment results, the definition of an acceptable risk is necessary and the designation of land with a high risk of pluvial flooding for planning of appropriate risk mitigation measures is possible.	x	x	x	x	x	x	x	no

3	Strategic documents	The measure covers all kinds of planning documents for the improvement of land management in order to counteract dangerous phenomena of soil erosion and surface runoff in risk areas or minimise their effects (e.g. natural retention programs, urban adaptation plans for climate change, etc.). All regulations aim at determining directions of proceedings to reduce the occurrence of risk.	x	x	x	x				yes
4	Coarse seedbed preparation	This measure helps to significantly reduce the risk of erosion on farmland. Due to the roughness of the surface structure, it helps the surface water to pass into the subsoil. In addition, surface water runoff is significantly decreased by a number of temporary storage spaces and a high level of turbulence. However, the measure is contradictory to other measures aiming on protective soil management and should be used with caution.	x							no
5	Field subdivision	Field subdivision aims to grow various, alternating arranged crops in a strip-type pattern, preferably in combination with cultivation across the slope. Crops prone to surface water runoff, erosion and ground cover are hence protected by crops with higher ground cover that reduce the risk of surface water runoff and erosion. Field subdivision should be combined with cross-management. Arrangements among farmers might be necessary.	x							no
6	Crop rotation, intercropping, cover crops	Crop rotation is adapted to suit the specific requirements of slopes. Intercropping is the practice of growing two or more crops in proximity. The use of cover crops prevents soil from being left without plant cover for extended periods of time. Among other benefits, such farming practices reduce erosion when it comes to surface runoff in case of heavy rainfall.	x							no
7	No- or low tillage incl. mulching and direct seeding	No- or low (conservation) tillage totally or largely foregoes the use of ploughs. Instead, tillage tools are used that do not turn the soil (e.g. cultivators, disc harrows) or disturb the structure of the soil while leaving crop residues (= mulch) near or on the surface of the soil. The idea behind is to create a stable soil texture that is not highly susceptible to soil sealing while maintaining or increasing load capacity. The measure is very efficient for heavy rain risk reduction on farmland by increasing of soil water retention and decreasing runoff.	x							no

8	Terracing	Terracing is an ancient technology allowing the farming and building on steep and indented terrain. Farmland terraces consist of terrace platforms and terrace slopes or walls. In rural settings, the measure can reduce erosion and surface runoff by slowing rainwater to a non-erosive velocity. The measure is recommended for farmland with slopes >15°. However, terraces pose a significant impact. They can, therefore, violate the landscape's ecological mechanisms. For this reason, they should be considered as an ultimate solution for the utilisation of land as farmland or building area and only if other land uses (e.g. afforestation) are impossible.	x			x				yes
9	Infiltration belts (grass) and buffer strips (permanent vegetation)	Infiltration belts should be projected on slopes in the direction of a contour. In the vicinity of reservoirs, watercourses and built-up areas they protect them against penetration with eroded material. Buffer strips offer good conditions for effective water infiltration and slowing of surface runoff. Hedges across long, steep slopes intercept and slow surface run-off water before it builds into damaging flow, particularly when there is a buffer strip alongside.	x			x				yes
10	Cultivation across the slope, avoidance of downhill furrows; strip cropping	The development of runoff routes can be prevented and retention can be improved by cultivating farmland across the slope along contours. Ideally, the soil should be farmed in a chequerboard pattern to control and slow down the flow of surface water. Strip cropping is a farming method for hilly terrain and crops with a tendency for erosion like corn or sugar beet. It alternates strips of closely sown crops.	x	x						no
11	Stabilisation of runoff pathways	Pathways of concentrated surface runoff are usually stabilized by grassing. They can be reinforced by stones so that they are able to transfer the concentrated surface runoff without the occurrence of erosion on the pathway. The most common shape is a parabola with a low depth, which is most similar to that of the naturally created pathways. The measure requires an occupation of agricultural land. It should be implemented if protective soil measures are ineffective to protect soil from erosion. When accompanied by appropriate vegetation, they can be a part of the territorial system of ecological stability. The effect is enhanced when other measures exist in the	x							yes

		contributing area. The consolidation of property rights relations might be necessary.								
12	Permanent grassing of plantations	Permanent grassing or establishing of perennial vegetative cover of vineyards, hop gardens, and orchards reduces runoff and erosion. Vegetation controls erosion by protecting soil from displacement by raindrop impacts and by reducing the velocity and quantity of surface runoff. The measure should be accompanied by other linear biotechnological measures (e.g. ditches) and be implemented especially on slopes >7°; >4° on less permeable soils)	x							no
13	Protection and preservation of existing meadows and pastures	Surface runoff at meadows and pastures is attenuated compared to land under arable crops. Thus, a high proportion of meadows and pastures increases the retention capacity of agricultural used land and reduces the surface runoff. Therefore, the preservation of existing meadows against cultivation of crops or building activities especially in head water areas, on slopes, in runoff pathways and along watercourses is a contribution to heavy rain risk reduction.	x			x				yes
14	Small dikes and pits	Series of small inter-row pits and dikes/elevations are created on arable land to slow down the surface runoff and support the infiltration into soil.	x							no
15	Baulks	Baulks are belts of uncultivated land separating fields from each other. If baulks are oriented in the direction of a contour, they can slowdown surface runoff and support infiltration. The highest efficiency is achieved when the measure is accompanied by an infiltration belt located above and a furrow located under the baulk. Implementation is recommended in case that other types of structural measures are ineffective or can't be implemented.	x							yes
16	Furrows	Furrows are shallow and wide ditches on arable land with mild slopes and a small longitudinal gradient. They allow interception, infiltration and alternatively drainage of surface runoff. They should be dimensioned properly for meeting functional requirements and require maintenance.	x							yes

17	Barrages	Barrages act as barriers to swift creeks and gullies or usually dry pathways of concentrated surface runoff. They can be constructed in form of a sill or a step. The measure reduces the longitudinal slopes, serves the accumulation of surface waters and controls the velocity of the concentrated surface runoff during intense rainfall events. It should be implemented in case of ineffectiveness of less intensive measures and requires usually permission.	x		x	x				yes
18	Drainage ditches; swales	Ditches allow intercepting, infiltrating and alternatively draining the surface runoff without causing damage. They should be dimensioned to the corresponding return period of the discharge, meet functional requirements and get regular control and maintenance. Ditches on farmland are usually proposed in areas where the space for constructing furrows is limited. Within urban areas they are part of the urban drainage system and can have a variety of cross sections to suit the urban landscape. They can include the use of planting to provide enhanced visual appeal and water treatment. The measure requires an occupation of land. Therefore, settlement of property rights relations is necessary.	x	x			x			yes
19	Conversion of arable land into grassland/ deciduous forest or short rotation plantations	Heavy rain risk can significantly be reduced by converting farmland into grassland/deciduous forests or short rotation plantations. The measure increases the surface roughness constantly (effect: reduction of flow velocities) and decreases soil erosion (effect: reduction of mud deposition). The measure is well-suited for steep slopes with light soils, for fields prone to flooding, and for drained areas near water courses.	x		x					yes
20	Local subsidies and voluntary agreements for action exceeding mandatory management standards	There is a large set of EU-requirements and standards that land managers have to meet in order to receive support scheme payments ("cross compliance"). However, local risk assessment may require exceeding mandatory standards. Here, voluntary agreements between farmer, land owner and municipality and local subsidies may help. Subsidies and agreements should accommodate the likely changes in precipitation and flooding patterns derived from climate change	x	x						no
21	Conservation leases	Lease contracts are legally binding agreements between a lessor and a lessee of land. They contain terms and conditions to which the	x	x						no

		property has been leased out. The need for renewal of such agreements in case of a new lessee or expiring term of lease from time to time provides opportunities for the owner to implicate pluvial flood prevention measures by the insertion of restrictions (e.g. for a protective soil management or for a change of land use).								
22	Land consolidation processes	Land consolidation is a planning process likely to clarify land ownership, reduce fragmentation of agricultural land ownership and to improve rural infrastructure and living conditions. This way it can reintroduce technical measures into collectivized field blocks, and positively influence landscape fragmentation for improving water retention and avoiding uncontrolled hazardous surface runoff. Land consolidation processes should accommodate the likely changes in precipitation and flooding patterns derived from climate change.”	x	x	x	x				no
23	LEADER processes	LEADER is an integrated development process in rural areas funded by EU CAP funds and designed to engage, enable, resource and empower local (rural) communities. The LEADER approach comprises e.g. bottom up elaboration and implementation of area based local development strategies; integrated and multi-sectoral actions; networking and cooperation. Heavy rain risk reduction can be assigned as development strategy and implemented through related structural or non-structural actions. LEADER processes should accommodate the likely changes in precipitation and flooding patterns derived from climate change.	x	x	x	x				no
24	Protection, rehabilitation and rejuvenation of forests esp. on slopes	Because of their retention effect and because they protect slopes from erosion, forests reduce surface water runoff. Forest management should be adapted to suit the specific needs of vulnerable objects further down the slope. Large-scale logging operations, for example, need to be avoided. Forest composition should be managed to achieve a water retention level that is as high as possible.		x						no

25	Good state of forests	This measure resides in maintaining good forest health conditions through appropriate management (e.g. multifunctional forest and forest fragmentation, reduction of spruce in the 3rd altitudinal zone, uniform shelter-wood systems and partial systems, coppice forests). The aim is to increase the soil infiltration, slowing surface runoff and reduce the risk of soil erosion by improving the forest health conditions. The management in forests should be focused on bringing them to natural state in order to increase their resilience and hence their ability to retain rainfall water and reduce the risk of flash floods in watersheds.		x							no
26	Risk reducing during cutting and remediation procedures	The measure resides in eliminating the risk of forest soil damage due to cutting. Specifically, the measure includes for example use of cable transport systems, caterpillar tractors, and avoidance of transport in the same routes. If damages of the forest soil occur, it is necessary to remediate them immediately in order not to disrupt the natural soil processes. Any remediation activities depend on the specific damages and should be conducted immediately after finalizing the cutting.		x							no
27	Afforestation in headwater areas and on hillslopes	Headwaters are the source areas for rivers and streams, crucial for sustaining the structure, function, productivity and complexity of downstream ecosystems. In areas of high relief, afforestation of headwater catchments can contribute to slope stabilization and may reduce the risks associated with landslides.		x							yes
28	Immediate reforestation of areas damaged by natural disasters	Reforestation a very effective measure of vegetation restoration and erosion control. Natural vegetation development and succession processes is comparably and risk of uncontrolled runoff and soil erosion is high for a long time. Also evaporation slows down the succession.		x							no
29	Dry detention reservoirs and depressions of any capacity	Natural or artificially created detention basins and depressions with a specific retention capacity can be used as temporary water reservoir for runoff water during heavy rainfall. They slow down the surface runoff; thus they contribute to a delay and attenuation of flood waves. They can be located at the deepest point in almost any surrounding – farmland, forests, along watercourses or within settlement areas on public or private ground. They fall dry during dry periods. Surface	x	x	x	x	x				yes

		drainage water needs to be diverted towards them; regular maintenance needs to be assured (material accumulation).								
30	Dry retention reservoirs with a constant flow	Variety of dry reservoirs located on watercourses. They consist of a large, dry, upper level, which is submerged during heavy rainfall and from a trough in which there is always water or shallow wetland.			x	x				yes
31	Small retention reservoirs	Small reservoirs (protective reservoirs) are constructed to intercept surface runoff and transform flood waves, so they can protect objects underneath them from the negative effects of floods and from the transported soil particles from erosion processes. The ideal is the design of multipurpose reservoirs that can perform multiple functions simultaneously. The measure requires an occupation of (often agricultural) land. Therefore, settlement of property rights relations is necessary. Design documentation, planning permission, and realization might be demanding.	x	x		x				yes
32	Increasing the retention capacity of existing channels and floodplains by restoration	The measures reside in terrain modifications of channels and floodplain to increase their ability to slow down the runoff and to create inundation zones so that potential consequences of surface runoff would be reduced. They can include individual modifications that are generally termed "restoration". Specifically, modification of the channel's course, branching of streams, channel stabilisation, restoration of oxbows, accompanying riparian vegetation. The effect of the stream modification itself is not decisive in terms of surface runoff. However, if the modification is a part of a set of other measures in the contributing area, it can certainly play a positive role in slowing down the runoff and reduction of peak discharge. In general, the goal is to bring the stream as close as possible to the near-natural state.			x	x				yes
33	Decommissioning of farmland and forest roads	Small (unsealed) roads within forests and on farmland often cause surface runoff and erosion or they are damaged themselves in case of heavy rain. Furthermore, the road density can have a decisive influence on the water drainage of larger areas. Existing road network within forests and on farmland should be checked for its necessity and decommissioned if possible and necessary for reduction of pluvial flood risk. Desealing and improvement of infiltration can be aim of land consolidation processes.	x	x						yes

34	Appropriate design of unsealed roads and stream crossing in forests	Design of forest roads should be done in a way that surface water is diverted to the forest aside. Various surfaces cross drain solutions with a different level of maintenance need are available (e.g. rolling drain dip, culverts, rubber strips). They need to be combined with ditch dams for directing runoff. New forest roads should be planned carefully and only in exceptional cases. An interesting solution for small stream crossings can be the substitution of bridges or pipes by fords – e.g. after damages caused by flooding. This reduces the danger of blocking and flooding.		x	x					no
35	Restoration of floodplains and floodplain forests, natural succession	Identifying and re-establishing of flood plains and deposition areas, such as by removal of protection structures for agricultural land, contributes to the retention of water along rivers and, thus, to heavy rain risk reduction. In the past, most floodplains have been taken over for other uses; former floodplain forests are separated from river and runoff pathways and modified into residual low-density forests without natural regeneration. Land use of flood plains can be different. Most space is required by self-regenerating floodplain forests (“mobile ecosystems”) - much more than floodplain grassland or reed beds. Restoration of such forests is a demanding and long-lasting process and requires planning; however, it is a crucial measure for climate change adaptation and mitigation.	x	x	x	x				yes
36	Restoration of wetlands	Among other benefits, the measure serves as a heavy rain risk reduction measure as it delays and attenuates also water on its way to a stream. Wetland provides water retention and improves the hydrological regime of degraded land. Rewetting includes a wide variety of large and small-scale measures, e.g. impounding measures like blocking of drainage ditches or changes in the forest practice. Wetland restoration is a long-term measure, requiring a long-term-constant strategy and constant review.	x	x	x					yes
37	Creation of inundation zones	The main goal of this group of measures is to enhance the transformational and accumulation effects of existing and re-developing floodplains by terrain modifications like lowering of banks, offset or demolition of flood protection dikes etc. This allows the water to flood the floodplain during the periods of increased discharges.	x	x	x					yes

38	Regulation of torrent streams and gullies	This measure is usually carried out in form of sets of barrages built in a direction perpendicular to a stream's direction. The aim of the measure is to modify the erosion and accumulation processes in torrent streams through the retention of water and eroded material, e.g. when settlement areas are at risk. Its effect is enhanced when applied together with other measures in the watershed. The material used for the barriers depends on the natural conditions of the area of interest and on hydro-technical calculations. Permission by water management authority and nature conservation authority may be required.			x	x				yes
39	Small elevation oriented dikes	Such dikes aim to shorten the length of slope, thus slowing down surface runoff and reducing soil erosion on arable land. They also support the infiltration into the soil. They need to be constructed in the direction of contours with a zero longitudinal slope. Both, the area in front of the barrier and its height must be corresponding to the need for retention volume of water, including the volume of deposited eroded material. Most frequently, they are constructed in the form of an earth embankment reinforced by grass.	x							yes
40	Embankments in the bump curves of streambeds, boulder structures	Embankments in the bump curves of the brook course can prevent overflowing and erosion of banks.			x					no
41	Constructions for sediment and debris retention, (sediment capture ponds, wooden rakes, trash racks)	Sediment capture ponds are engineered ponds placed in networks of forest ditches. They slow the velocity of water and cause the deposition of suspended materials. To prevent debris from clogging channels in forests and on farmland, also simple wooden rakes within ditches and brooks can be constructed to hold materials back. Trash racks are steel structures preventing debris from clogging the entrance to the storm water drainage systems. They are usually used in areas closed to urbanised areas. Any constructions for sediment and debris retention require regular control and maintenance.	x	x	x	x				no
42	Linear protection measures	Linear protection measures help to direct the water to areas, where it does not cause harm. Such measures are flood protection dams, flood protection walls, mobile flood protection systems, water drains	x			x				yes

		(enhancement, removal of obstacles), storm water drainage and culverts, emergency waterways, flood channels, road drainage in case of new constructions and refurbishment. They have in common that they need maintenance, training in operating to ensure the functional capability.								
43	Rainwater management in decentralised systems	This group of measures includes linear and aerial permeable elements, furrows, rainwater reservoirs, vegetation roofs and vegetating for decentralised management of rain water aiming on better infiltration and evaporation in settlement areas. Applied in a complex, it can reduce not only the total volume of surface water but also the speed of surface runoff significantly. The measure has a large number of benefits for the environment.				x				no
44	Buffer zones of riparian vegetation and areas with hydrophilic treatment plants for protecting water bodies from pollution	The measures describe vegetation-covered systems which are in varying degrees saturated with water. They pre-treat rainwater and extend the retention time. They can serve as buffer zones around water bodies. Pollutants are removed as a result of intensive sedimentation and assimilation by aquatic vegetation and adsorption in biogeochemical barriers e.g. in the form of gabions filled with dolomite or limestone and covered with a coconut mats. They are particularly important in the case of inflow of heavily polluted waters after heavy rain events.			x					no
45	Sequential sedimentation and biofiltration systems	Such systems consist of a variety of a hydrophyte treatment plants for eco-hydrological regulation. They are structured in three zones: a zone for intensive sedimentation (in which a combination of fixed and portable structures modifies the hydrodynamics of the chamber and increases sedimentation); another zone for intensive biogeochemical processes (where thick limestone fractions capture phosphorus compounds); and a third zone for biofiltration (for the removal of biogenic compounds using macrophytes). The zones are separated from each other by gabions from thick gravel, which additionally filter water.			x					no
46	Establishing and considering of local and	Land-use planning is an effective instrument to reduce future flood risk. The flood risk can decrease significantly, if changes of use, adjustments of use, restrictions of use or flood-adapted construction	x	x	x	x	x			yes

	regional land-use planning	and development in flood prone areas are considered in both phases of planning: formulation and implementation of plans. The power of the instrument is very limited for existing built up areas in hazardous locations. Land use planning must be accompanied with other actions and should accommodate the likely changes in precipitation and flooding patterns derived from climate change.								
47	Avoidance of building in hazard zones: Adaptation/re-zoning/shifting of building areas	Zoning plans for undeveloped plots of land which have already been designated as development areas are adapted to account for the risk to these areas; if necessary, a new area is designated as planning area for the revision stage (while the municipality revises the zoning/development plan).				x				yes
48	Avoidance of building in hazard zones: Prevention by designation of specific grassland or protection zones in development or zoning plans	Damage from pluvial floods can be excluded by taking pluvial floodwaters into consideration in development and zoning plans and by establishing free pathways for runoff. This can be done by building regulations, e.g. by designation of special grassland or protection zones in risk areas in the zoning plan. Such zones serve for retention and a controlled discharge of the water masses in case of heavy rain.				x				yes
49	Avoidance of building in hazard zones: Refusal of building permission	Pieces of land which have been zoned for development but are as yet undeveloped are declared to be unsuitable for building, or building permission is not granted.				x				no
50	Avoidance of building in hazard zones: Appropriate location of	Exclude new developments that would increase the damage by shifting the location of the planned building outside the hazard area of the property.				x	x			yes

	houses on properties								
51	Precautionary measures when granting of building permit provisions	Requirements are expressed when granting building permissions, in order to prevent negative consequences of pluvial floods for buildings and for third parties.				x	x		no
52	Green roofs	Through the vegetation of the soil substrate on the roofs water is retained and can evaporate. Two system of green roofing can be distinguished based on the level of maintenance.				x	x		no
53	Creation and maintenance of retention areas in urban areas	Retention areas should be placed in the lowest points of urban areas. Surface drainage must ensure that water is diverted towards these areas – preferably on the surface (hollows, streets etc.). Receiving waters and soil needs to be protected from pollution. The realisation of central retention areas is greatly dependent on available space and the topographic condition. Development and zoning plans provide opportunities for implementation.				x			yes
54	Multi-functional traffic and parking areas dedicated as thoroughfare for runoff or as temporary inundated retention area	Public and private space such as streets or parking areas, play- and sportsgrounds can be designed for temporarily use as thoroughfare for runoff and/or temporary retention area and thus help to direct and/or slowdown runoff water in case of a heavy rain events. Temporary inundated areas or water squares are open areas in an urban environment which take up urban stormwater (e.g. from roof drainages). The incoming water is filtered first and, after temporal retention of up to 48h, is then delivered to streams or to the sewer system.				x			
55	Rain / stormwater gardens, bioretention cells	Rain gardens are small-scale vegetated gardens used for storage and infiltration. They are typically applied at a property level and close to buildings, for example to capture and infiltrate roof drainage. They use a range of components, typically incorporated into the garden landscape design as appropriate.				x	x		yes
56	Infiltrating pavements/permeable	Permeable paving is designed to allow rainwater to infiltrate through the surface, either into underlying layers (soils and aquifers), or be stored below ground and released at a controlled rate to surface water. Sealed surfaces can be replaced by different materials, such as gravel	x	x		x	x		no

	surfaces; unsealing	turf, grass pavers, concrete pavers with drainage or porous concrete. This is suitable for parking lots, cycling paths, walking paths and access roads, terraces and yards.								
57	Underground tanks / water squares	Underground tanks work as retention basins. They can be integrated in the planning process of urban infrastructure in the underground like underground car parks.				x	x			no
58	Soakaways	Soakaways are buried chambers that store surface water and allow it to soak into the ground. They are typically square or circular excavations either filled with rubble or lined with brickwork, pre-cast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. They can be built in many shapes and can often be accommodated within high-density urban developments, and can also be retro-fitted. (Source/copyright: NRW-catalogue)				x	x			no
59	Infiltrating trenches/cells	Infiltration cells/trenches and gravel drains reduce runoff rates and volumes by retention/detention and therefore can help replenish groundwater and preserve base flow in rivers. They treat runoff by filtration through the substrate in the trench and subsequently through soil. They are effective at removing pollutants and sediment through physical filtration, adsorption onto the material in the trench, or biochemical reactions in the fill or soil.				x				no
60	Living walls / vertical gardens	Walls using in its construction vegetation fed with atmospheric precipitation. During rainfall, some rainwater is used to wet the surface of the plants and their life needs, while the part returned to the atmosphere in the form of evapotranspiration.				x	x			no
61	Blue and green infrastructure	All kinds of blue and green infrastructure in the settlement areas (rivers, river valleys, water reservoirs, natural and artificial wetlands, parks, squares, orchards, gardens, allotments, green street strips, grasslands and other) decrease runoff and increase retention capacity. Preservation of the existing elements and creation of new elements is a contribution to heavy rain risk management and has a large number of additional benefits.				x				yes
62	Absorbent wells	Wells filled with infiltration material and covered with soil, stones or other covering that absorb water from nearby paved surfaces				x	x			no

63	Absorbent pans/basins, filtration pans	Overgrown slopes with low gradient, high water penetration rate and low speed (<0.15 m / s). Increased infiltration of rainwater, groundwater supply, pre-treatment of rainwater				x	x			yes
64	Sealing of ground-reaching buildings; black tanks	The measure is for waterproofing buildings against ground moisture and seepage water at below-ground structural elements like walls. There are horizontal or vertical sealing methods existing. Horizontal seals prevent that moisture rises up. Vertical seals prevent moisture to enter the building from the sides. There are several solutions available with bitumen (black tank) and with synthetic materials. It is important that vertical seals reach up to 30cm above ground with at least one horizontal seal.					x			no
65	Walls and dams for the protection of areas at high risk	By diverting the water away, adverse consequences in areas at risk are prevented in the event of floods up to design event levels. E.g. the property or parts of the property can be protected by a wall that surrounds the building and keeps running surface water away from it. However, before constructing a wall, investigations have to be carried out to determine whether the diversion of pluvial flood water does not infringe on the rights of third parties and if capacities for retention of water falling directly on the property are big enough. If necessary, additionally water retention measures have to be taken into consideration.				x	x			no
66	Drainage installations for diverting surface water away from buildings and increasing retention an infiltration	Predefined flow routes aiming on diverting surface water away from building can be built on the property or along its boundaries, e.g. by a change in gradient, ground sills, creation of depressions or by building of water diverting structural elements like walls. Areas on the property such as basins or trenches may be constructed for collecting the water and providing a controlled infiltration into the soil. Definition of requirements by municipality is possible.				x	x			no
67	Sustainable urban drainage systems for collecting, diverting and	Traditional surface water drainage systems are often overloaded in case of heavy rain and thus cause flooding and damages. They can be developed further to “sustainable urban drainage systems” aiming on increasing their capacity e.g. when it comes to heavy rainfall and aligning them with natural water processes. There is a large collection				x				no

	retaining surface runoff water	of structural measures that belongs to this group measures. Some of them are listed in this catalogue. They have in common that they require regular cleaning and maintenance.								
68	Sewerage water lifting units	Sewerage water lifting units are designed for the disposal of waste water from below the flood level in buildings or parts of buildings to above flood level so that it can then flow into the sewerage system.					x			no
69	Raised light wells and basement entrances	Relevant building openings are protected against the entry of water by constructing steps or flights of stairs with raised platforms and/or raised light wells. The edge of light wells at buildings should be placed 15 to 30 cm above the ground level dependent on the situation of the premises and risk. For basement entrances, additional roofing is recommended.					x			no
70	Flood barrier systems	Flood barrier systems consist of side holders (installed permanently at a building, wall or dam) and a ground glider. In the time of need a dam bar can be inserted quickly, e.g. next to the front door. The bottom of the dam bar has to be sealed. The suitability of the measure might be limited for risk reduction in case of heavy rainfall as they happen unexpectedly and suddenly. Operational readiness requires precautionary behavioural measures, training for quick activation and regular maintenance of the system.				x	x			no
71	Back flow valves	Back flow or closing valves are connected to the piping system and close in case of back flow. Valves needs to be cleaned regularly.					x			no
72	Waterproofing of pipe passageways	If water could enter the building through pipe passageways, heavy-rain-proofing requires waterproofing them.					x			no
73	White tanks	Base plate and outer walls of new buildings can be constructed as closed tank by using concrete with high waterproofness. As no sealing is necessary such constructions are called “white” tanks. The measure is comparatively expensive.					x			no
74	Holding stocks of sandbags, boards, lids and flaps	Relevant building openings can be protected against the entry of water by sandbags, boards or sandbag replacement systems, or secured additionally by lids and flaps. The measure requires some time to be operational – which is not available everywhere when heavy rainfall occurs. Additionally it requires training.					x			no

75	Light wells, flood defence windows, window shields and shutters, guide rails with waterproof seals	Relevant building openings can be protected against the entry of water by installing waterproof windows, shields and shutters, waterproof gates, or permanently installed self-rising floodgates.					x			no
76	Raised ground floor level	The ground floor level of new buildings can be constructed in such a way that it is raised above expected flood levels. To achieve this, the following methods (among others) are available: 1. building on solid block foundations 2. raising the building on pillars 3. building on backfilled foundations What all designs have in common is that - as a rule - there is no cellar.					x			no
77	Predefining of runoff pathways through subsidiary buildings	If water cannot (or can only insufficiently) be prevented from entering the building, predefined flow routes in the building may help to minimise the damage. Ideally, provisions should be made for relief openings in the building to ensure that the water can flow away.					x			no
78	Promoting and enforcing property protection measures	Potentially affected persons – esp. property owners – have to take personal provisions. However, establishment and maintenance of private protection structures is challenging and often not done on a regular basis. Authorities should promote and stipulate appropriate property protection measures at least by provision of information on web sites and written material.				x	x			no
79	Catchment based concepts and plans; inter-communal cooperation	Land use and land cover changes as well as intensification or extensification of land use are altering the hydrologic system and have potentially large impacts on flooding in lower lying areas. Upstream and downstream interconnections, interactions and action's intereffects should be taken into consideration in planning activities, especially when problems occur in settlement areas. Formal as well as informal planning procedures aiming on integrated spatial development, rural development, climate change adaptation or other purposes are feasible for planning approaches covering entire catchment areas. Concept and plans should accommodate the likely	x	x	x	x				no

		changes in precipitation and flooding patterns derived from climate change. Inter-municipal cooperation is one possible approach. It allows e.g. better cooperation among fire brigades, improvement of retention and management of surface runoff etc.								
80	Resettlement and reallocation	In case of a major danger, it might be useful to relocate existing buildings. Due to the avoidance and removal of the damage potential the resettlement and reallocation effects the risk reduction permanently. Financial support facilitates the implementation of the measure. Resettlement and reallocation measures need to be assessed and reviewed in advance. Social and personal burdens need to be taken into account.				x	x			no
81	Generating operation regulations for pluvial flood endangered facilities: commercial and industrial plans	Pluvial flooding should be considered in areas at risk. Damages in facilities can be reduced significantly, e.g. due to placement of electric installations, as well as damages originating from facilities, e.g. storage of dangerous goods and material. Periodical coordination with civil protection helps to avoid environmental damages. Plans should accommodate the likely changes in precipitation and flooding patterns derived from climate change.					x			no
82	Establishing and operating monitoring systems, forecast models and warning systems	Continuous and long-term observation of natural phenomena increases the possibility of predicting them, estimating dangerous phenomena, and planning effective counteraction. Monitoring, forecasting and warning models and systems are usually established and operated by national institutions. They assure constant data collection, provision and quality control, as well as further development according to the state of the research. However, local or regional observation and monitoring may qualify such information or add additional information for decision making under time pressure in case of heavy rainfall events.						x		no
83	Establishing disaster control plans for coping	Disaster control plans are an important support for public safety authorities and organizations during a flood event. They are a strategic element in disaster management. They help, in particular, at the tactical level to direct the task forces at the right time to the right place, to implement the right measures and, thus, to minimize the extent of losses. Lives can be saved and damages to asset values can be reduced.				x				no

84	Ensure preconditions for the implementation of disaster control plans	Preparation work is made, that in case of emergency all needed equipment and well-trained staff is available in a sufficient quantity.							X		no
85	Measures at flood protection structures and the drainage system before and immediately after an event	Organisational precautions as well as emergency measures are taken immediately after an event in order to guarantee the functionality of structures that aim at the protection against pluvial flooding (e.g. removal of debris and mud).	X	X	X	X	X	X	X		no
86	Assessing and clearing of flood damages at constructions and infrastructure	The measure includes the assessment of damages at buildings and infrastructure (e.g. transport routes, water supply, and waste water disposal) concerning their usability and the necessity for restoration after an event. In case that support from public disaster funds is available, procedures and criteria's need to be defined (beforehand).	X	X	X	X	X	X	X		no
87	Assessing and clearing of environmental flood damages	The measure includes the assessment of damages to the environment, mostly caused by accidents at sources of pollution e.g. containers with hazardous materials. Procedures and criteria's need to be defined (beforehand).	X	X	X	X	X				no
88	Development and implementation of effective emergency response plans	Effective and periodically updated emergency response plans help civil protection units to get a quick overview on measures to be taken and also on their prioritisation. They need to be set up by responsible institutions (e.g. in Germany and Austria: municipalities)				X	X	X			no
89	Implementation and usage of early warning systems incl. collection and	Flood early warning systems – if existing for the area – provide information that allow the actuation of emergency action (e.g. set up of a command unit, observation of risk areas) prior to the event and before damages occur. However, reduction of losses is possible only if early warning information are interpreted and assessed correctly, if				X	X	X			no

	assessment of supplementing information	they are underpinned with a risk assessment and action plans considering different scenarios. The collection and supplementing information from different (also from local) sources may facilitate and qualify the assessment of the information by the responsible personnel.								
90	Considering of pluvial flooding as disaster for precautionary measures of civil protection and whole crisis management system	The measure aims at preventing disastrous consequences of heavy rainfall events as one of many different possible crisis situations. On all levels of administration there should be clarity about the responsibilities of state services, including mutual information and warning.						x		no
91	Visualisation and explanation of the specific risk situation at site	Visualisation of specific hazard and risk at site (e.g. on maps, installed billboard at locations etc.) is an effective way of pointing out dangers to affected persons and institutions. Maps indicate the specific hazard and risk on site and could be provided on the municipality's online portal for example. Easily understandable information for the interpretation and a contact for questions are necessary.	x	x	x	x	x		x	no
92	Provision of information as reading materials	Easily understandable and accessible information is important to raise flood risk awareness and support the implementation of private risk reduction measures. It can be made available as reading materials, for example in print products (handbooks, guidelines, brochures, flyers) or on online platforms. The products should be tailored to a specific target group, e.g. citizens, homeowners, companies, forestry, agriculture, etc. A large number of high quality information materials have already been developed by various actors. The use of existing products should therefore be checked. Easy access to the information needs to be guaranteed, i.e. on a central platform or place. Additionally, public relation and media work support the distribution of information.				x			x	no
93	Interactive communication and	To increase the knowledge on heavy rain risk management different forms of interactive events and participation formats can be organized. The objectives and size can range from information (big or small events) to trainings and even individual consulting services.							x	no

	participation formats	Participation formats for active involvement shall be included. An event or a participatory process could focus on, for example, the explanation of mapping activities and results, the identification of possible risk reduction measures and the explanation of best practice examples. In addition, events also serve networking and learning from each other. The integration of heavy rain risk specific contents into existing and well-known events or formats or the combination with other topics is possible.								
94	Communication activities in education	Risk communication activities in education can help to increase awareness and knowledge of risks in the future. The younger generations are particularly important for the future development of dealing with heavy rain risks. In addition, they are already exposed to the dangers today. Education on e.g. alternative methods of rainwater management raises awareness of younger people and help to establish sustainable practices.							x	no
95	Natural hazard insurance for buildings	Insurance against natural hazards protects home owners against the financial consequences of floods caused by high water, heavy rainfall, backwater, earthquakes, subsidence, landslides, snow pressure, avalanches and volcanic eruptions. Most homes are not adequately insured against such natural hazards, although support from disaster funds is not expected. In Germany, for example, only 43 percent of all buildings are properly protected against the financial consequences of natural hazards.					x			no
96	Intra-communal cooperation	All relevant actors in a community should be involved for developing an awareness of the risk and for starting cooperation. This can be done e.g. by establishment of a coordination circle ("round table") with the participation of all actors from affected municipal departments, community council, citizens, emergency services, etc. An audit for recording the strengths and weaknesses of the existing precautions against all types of flooding can be an initiative. Creation of a municipal specification sheet "Flood prevention", improved communication ways, networks or a master plan incl. prioritisation of action can be the result of such a process.				x		x		no

97	Culverts - suitable hydraulic design	When flood occurs, safe drainage from the affected area is often dependent on the state of culverts and small bridges. These objects are often jammed by debris and thus cause local flooding. Often, the object itself is also damaged and as a result the traffic route is interrupted. Appropriate design in terms of capacity and clogging protection is very important. This measure represents a measure on small streams and ditches whose wrong design can have major impacts. Picture: Picture is available in drawn version, made by us and can be provided immediately.	x	x	x	x				no
98	Cross-border cooperation	Trans-border risk assessment, communication of hydrological forecasts, the harmonisation of technical standards; cross-border cooperation on emergency planning and consideration of the cross-border impact of projects exist for the management of fluvial floods. They can be improved for the management of heavy rain risk.						x		no
99	Flood protection certificates for buildings	Specialized flood risk building consultants (engineer or architect) bring in their technical knowledge and experience. They assess the physical flood vulnerability and determine the effects of implemented flood risk mitigation measures. In some countries standardised procedures might be available according to which the experts proceed and issue flood certificates stating risk status advice for additional protective measures to house owners. The certificate might be required for insurance rating purposes.					x			no
100	Contact persons and consultation hours for citizens' consultation	Risk awareness grows and turns into action when recurring and continuous information and personal expert advice are provided to private home owners as well as to public bodies. Contact persons and public consultation hours offer a greater guarantee of success than online information services or advertising campaigns. Acceptance of measures can be additionally promoted if they are implemented in municipal buildings in a way that is effective for the public.	x	x	x	x	x	x	x	no

1.6. Summary

The input for this material was the Catalog of protective measures applicable to the protection of the area from damage caused by torrential rain from the Research Institute of Water Management T. G. Masaryk, subsequently modified for the implementation of this catalog in "TOOLBOX", which is the one of main outputs of the RAINMAN project. Subsequently, according to the procedure described above, a selection of measures which can be implemented in the spatial planning documentation was made. The catalog presents 100 measures, 31 of which can be implemented in the spatial and regulatory plan. Tabular output in Chapter 1.5 is the basis for the output T3.2.5 "Selected measures reflected in the spatial planning documentation", this material deals with a specific way of projection selected measures into the spatial or regulatory plan.

For effective implementation, it is often necessary to build a set of these measures that work together. The creation of this material also showed that the measures can be proposed in the relevant documentation, but the final implementation depends on other stages that are not a direct part of the spatial planning process. This is, for example, the issue of subsidy policy of the state and the European Union, which supports the proposal of measures, their implementation, maintenance and overall necessary concepts (among them is a very important Land consolidation). Building the necessary measures raises the question of the public interest and the determination of the balance between the interests of private persons and the question of possible compensation.

RAINMAN Key Facts

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RAINMAN website &
newsletter registration: www.interreg-central.eu/rainman



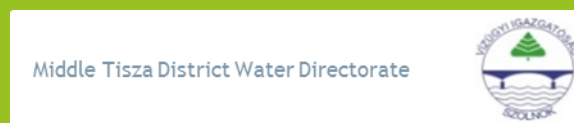
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