



Natural Water Retention Measures

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A photograph of a young child with their back to the camera, sitting on a stone ledge and looking out over a large body of water. The water is calm, reflecting the sky and the surrounding landscape. In the distance, there are hills and a wooden pier structure. The overall scene is peaceful and natural.

Synthesis document n°8

"Windows of opportunities"

for Natural Water Retention Measures



Environment

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The present synthesis document has been developed in the framework of the DGENV Pilot Project - Atmospheric Precipitation - Protection and efficient use of Fresh Water: Integration of Natural Water Retention Measures (NWRM) in River basin management. The project aimed at developing a knowledge based platform and a community of practice for implementation of NWRM. The knowledge based platform provides three main types of elements:

- the NWRM framework with access to definition and catalogue of NWRM,
- a set of NWRM implementation examples with access to case studies all over Europe,
- and decision support information for NWRM implementation.

For this last, a set of 12 key questions linked to the implementation of Natural Water Retention Measures (NWRM) has been identified, and 12 Synthesis Documents (SD) have been developed. The key questions cover three disciplines deemed important for NWRM implementation: biophysical impacts, socio economic aspects and governance, implementation of financing.

They rely on the detailed delineation of what NWRM cover as described in *SD n°0: Introducing NWRM. Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes.* Evidences included into these synthesis documents come from the case studies collected within this project (see the catalogue of case studies) and from the individual NWRM factsheets which are available on the page dedicated to each measure (see catalogue of measures). This information has been complemented with a comprehensive literature review.

More information is available on the project website nwrn.eu.

Key words CAP Pillar I, CAP Pillar II, Common Agricultural Policy (CAP), European Agricultural Fund for Rural Development (EAFRD), Floods Directive (FD), Good Agricultural and Environmental Conditions (GAEC), Green Infrastructure (GI), LIFE Programme, Natural Water Retention Measures (NWRM), River Basin Management Plan (RBMP), Rural Development Programmes (RDP), Sustainable Urban Drainage Systems (SuDS), Urban Waste Water Directive (UWWD), Water Framework Directive (WFD) - Please consult the NWRM [glossary](#) for more information.

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I. Introduction

NWRM¹ are innovative approaches to pursue the objectives of water management by restoring nature and/or the functions usually performed by nature. As other nature based approaches, NWRM are not only means to produce one single service (such as water treatment, water storage or flood control) but come with an array of different co-benefits (in terms of enhanced biodiversity, mitigation of greenhouse gases emissions, energy savings, opportunities for rural development, etc.) that are distributed across the space to many different persons whose welfare is improved directly and indirectly.

The cost and the benefits of NWRM are not as well-known as the more traditional and better established alternatives, but the increasing evidence available unveil the fact that NWRM provide important opportunities to reach the objectives of water policy in a more cost-effective way. Besides their potential to improve the status of water bodies, manage flood and drought risks and to respond to other water related challenges, NWRM allow taking advantages of synergies with many other areas such as biodiversity, land planning, agriculture, nature preservation, etc. These synergies are essential to gain support for water conservation alternatives. NWRM allow seeing the objective of improving the state of European waters as a mean for progress rather than an impediment, thus enhancing the social acceptability.

The existence of such co-benefits opens the opportunity to make water conservation the common ground for different stakeholders from different business communities (agriculture, forestry, energy, tourism ...), public institutions and NGOs promoting nature conservation and other social goals. In this sense NWRM may serve to facilitate cooperation and help managing conflicts around water.

On the other side, when the benefits area is varied and sparsely distributed, it is possible that no one might have interest in taking the initiative. This is why sometimes when judged only for its benefits in terms of water improvement, some NWRM approaches can be seen as non-cost-effective. But, things would be radically different if all benefits are added and all cost avoided are counted: there may not be incentives to act alone but NWRM provide strong incentives to act together. NWRM are in essence multipurpose measures requiring the cooperation of different policy areas, economic areas and stakeholders. Taking advantage of the opportunities available still requires coping with significant financial and other barriers (see [policy documents 9 and 11](#)) and building up the kind of coordination required for an extensive implementation of NWRM (see [policy document 10](#)).

The above mentioned opportunities have already been recognised in EU water policy. With regards to water resource management, the European Floods Directive (FD) (Directive 2007/60/EC) directly refers to NWRM, and the flood risk management plans constitute a clear, highly topical opportunity to promote and introduce NWRM. With regards to the EU Water Framework Directive (WFD) (Directive 2000/60/EC), the positive contribution of NWRM is implicitly recognised, although the link to the improvement of the ecological status of water bodies - as the main objective of the directive - can be made more easily for some NWRM than for others. In any case, NWRM already form part of some river

¹ Please check the project website (www.nwrm.eu) for the catalogue of measures, and any NWRM case study mentioned in the following.

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basin management plans (RBMPs) (see for example the NWRM case study “Revitalization of the Upper Drau River in Austria”, or “Wetland restoration in Persina, Bulgaria”), and the programmes of measures (PoM) of the second implementation cycle are another clear opportunity to introduce this kind of measures.

However, NWRM can be and are currently applied also beyond the water resource management sector, notably in relation to nature conservation – in particular hydromorphological restoration, agriculture, forestry and urban planning. NWRM are actually actively promoted for climate change adaptation, and they are part of land planning in urban and rural areas. From a water manager point of view it might be less clear which opportunities exist to introduce specific NWRM in areas which are traditionally not in the focus of their work (e.g. forestry management) and to promote their implementation.

Past experiences demonstrate that there are wide opportunities for further implementation of these measures. At the same time, important barriers exist which need to be overcome (see synthesis document number 9 on barriers and success factors). The present synthesis document will provide information about the (policy) context in which NWRM are currently applied and will point at the "windows of opportunities"² to introduce them in the management processes of the different sectors concerned. The document is structured around sector specific focuses (NWRM linked to restoration, agriculture, forestry or urban development). A focus will lie on the European context, and (potential) links to the WFD and FD will be made explicit. This will be complemented by examples of opportunities created and used at national, regional or local level.

II. Windows of opportunities for restoration (hydromorphological) NWRM

NWRM which restore natural ecosystems and which influence hydromorphological aspects include for example the re-meandering of rivers, the restoration of wetlands, floodplains, deltas and lakes or the establishment of natural bank stabilisation (see the NWRM catalogue of measures). Also aquifer recharge forms part of this category.

As mentioned above, the EU Floods Directive (FD) - although it highlights the use of hard flood defence measures - explicitly addresses the importance of natural water retention. In particular, the guidance document on flood risk management and adaptation acknowledges that flood reduction requires a mix of structural and non-structural measures (Stella, 2012). The FD asks member states to include in their flood risk management plans sustainable land-use practices and the improvement of water retention, by taking - amongst others - as far as possible also floodplains as natural water retention areas into account (see for example Stella, 2012). Accordingly, in particular with regards to the restoration of floodplains, the flood risk management plans constitute a clear window of opportunity for introducing NWRM. Other nature restoration measures like wetland restoration, re-meandering or

² Please note that the "windows of opportunities" specified here do for example not include favourable political conditions, or similar "soft" opportunities, which could also be considered as success factors for implementing NWRM. A separate synthesis document ([SDn°9](#)) exists on success factors and implementation barriers.

basins and ponds are not directly promoted by the FD, but are directly or indirectly recommended by an accompanying note on better environmental options for flood risk management (European Commission, 2011).

NWRM can make important contributions to the WFD's objectives of good ecological and chemical status of surface waters, and good quantitative and chemical status for groundwater (European Commission, 2012b). The key tool for the implementation of the WFD is the river basin management plan (RBMP) and the accompanying programme of measures (PoM) (European Commission, 2012c). For the latter, basic, mandatory measures need to be included, completed by supplementary measures if basic measures are not sufficient to reach the objectives. NWRM can be found among the supplementary measures, and member states have the discretionary power to implement these measures in their catchments (Stella, 2012). A list of NWRM which are particularly relevant for the PoM is given in the box below.

Nature restoration NWRM with a direct link to the WFD

The role of restoring and recreating wetlands (see the measure factsheet for the NWRM N2) for water resource protection is recognised by the WFD, and proposed as one of the supplementary measures. The same applies to artificial groundwater recharge (N13), which also forms part of the supplementary measures listed in Annex VI of the WFD. Natural bank stabilisation (N10) and re-meandering (N4) are indirectly promoted by the WFD, by defining as "high status" the morphological conditions of the river that are in totally or nearly totally undisturbed conditions and which show a continuity of the river that is not disturbed by anthropogenic activities and which allows undisturbed migration of aquatic organisms and sediment transport. The measures furthermore contribute to improving the composition and abundance of aquatic flora of benthic invertebrate fauna, as well as the composition, abundance and age structure of fish fauna, as required by the WFD. A similar link can be made to the restoration of lakes (N12), as the WFD defines "high status" lake conditions as being (nearly) totally undisturbed conditions (see also Stella, 2012). Floodplain restoration (N3) forms part of the NWRM which are not directly promoted through the WFD. However, the measure is mentioned in one of the implementation guidance documents (European Commission, 2009) as positively interacting with the WFD's objective.

NWRM are seen by the European Commission as the better environmental option and alternative to grey infrastructures or projects (article 4.7 WFD).

The multifunctionality of NWRM is one of their most important characteristics (see also the synthesis document on "Introducing NWRM"). In the case of NWRM which restore natural ecosystems, the positive impact on biodiversity is very often the main objective pursued. Accordingly, many NWRM have in the past been implemented in the context of nature conservation efforts, with a particular link to the implementation of the Natura 2000 directives (Directive 92/43/EEC and Directive 2009/147/EC). In the same line, the creation or management of protected areas plays a particular role for applying NWRM (see box for case study examples).

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Another important window of opportunity for nature restoration NWRM is given through the financing possibilities provided by the EU LIFE programme, which co-finances environmental pilot or demonstration projects (please see the synthesis document on Financing NWRM for further information). The past LIFE programmes allowed co-financing of various water retention projects. However, funded activities remain project-based and are not sufficient to ensure a wider implementation of NWRM (Stella, 2012).

Selected case studies in which NWRM have been implemented in the context of protected areas:

- Wetland restoration in Persina, Bulgaria
- Floodplain Restoration in the Lonjsko Polje Nature Park in Croatia
- Restoration of Coastal Meadows in Matsalu, Estonia
- Kylmäojankorpi forested wetland, Vantaa, Finland
- Restoration of Wetlands in the Western Lowland Area of the Dümmer Lake, Germany
- Floodplain restoration of the river Slampe, Latvia
- Wetland restoration in the Senne and Medzibodrozie SPAs, Slovakia

River restoration on the Mura River in Slovenia – EU LIFE Nature Project

Intensive water use, activities in the river and riverside space and the change of land use in the Mura River catchment have considerably altered the river habitats. A LIFE Nature Project (“BIOMURA”) has been initiated to improve the riparian and adjacent riverine habitats, to protect endangered species and to restore and preserve the natural landscape. For this purpose, the main channel of the Mura River has been locally widened, and reconnected with the side channels. Bank protections have been removed, and gravel feeding installed.

For further information please have a look at the “Conservation_MuraBanks” case study.

Some potential for promoting natural restoration NWRM is also given through the rural development component of the CAP (see further below). Natura 2000 payments for example can promote measures such as wetland restoration (Stella, 2012).

Examples of other windows of opportunities for nature restoration NWRM

As shown above, nature restoration activities which also have the function of enhancing the retention of water in the landscape are promoted through European laws (Habitats Directive, WFD, FD) and instruments (LIFE). However, various windows of opportunities exist also at national, regional or even local level. The NWRM case study “Renaturation of the Seymaz river, Switzerland”, for example (including the elimination of cast concretes, widening the river bed and recreation of wetland areas) is part of the cantonal program which aims at improving ecological and countryside quality as well as reducing flood risk. In the Netherlands, for example, it is the national programme “Room for the River” which triggered floodplain reconnection on the river Waal (see NWRM case study “Room for the River: Nijmegen dike relocation, Netherlands”).

=> **In summary:** Windows of opportunities for NWRM which consist in restoring natural ecosystems - in particular river floodplains, wetlands and lakes - are provided by the Natura 2000 Directives, but also – depending on the measure – by the EU Floods and Water Framework Directives. NWRM are often implemented in the context of the management of protected areas. At project level, financing possibilities provided by the EU LIFE programme created valuable windows of opportunities in the past.

III. Windows of opportunities for agricultural NWRM

NWRM applied in the agricultural sector (e.g. maintaining meadows and pastures, buffer strips, no tillage, traditional terracing, etc.) are often not applied with biodiversity, water retention, soil protection and climate change adaptation as the main objectives. Nonetheless, they can make important contributions to the FD's and the WFD's objectives. With regards to the WFD, one of its guidance documents recommends for example sectoral measures such as agricultural soil moisture conservation practices, which can be linked to agricultural NWRM (Stella, 2012). The FD asks EU member states to take into account the promotion of sustainable land use practices and the environmental objectives of Article 4 of the WFD in their flood risk management plans (Article 7, FD). This gives an indirect incentive to implement agricultural measures such as buffer strips, soil conservation practices, no and reduced tillage (Stella, 2012). It is important to emphasise the link between water and agriculture, as water concerns might provide additional arguments to go further with promoting NWRM in the agricultural sector.

So far, the most important window of opportunity for agricultural NWRM is sector specific, and given through the Common Agricultural Policy (CAP). Both the first and second pillar³ are relevant and will be further elaborated in the following (see also the synthesis document on NWRM financing).

III.1.1. CAP Pillar I

Direct payments which farmers can receive under the CAP's first pillar are subject to cross compliance requirements (see for example Tropea, 2014). In particular the standards set under the Good Agricultural and Environmental Conditions (GAEC) promote different NWRM. This includes soil conservation practices, with for example minimum soil cover (NWRM A8) as a compulsory standard, or optional standards for crop rotation (NWRM A3). Also the protection of permanent pasture (NWRM A1) or the establishment of buffer strips along water courses (NWRM A2 or F1) as compulsory standards are important to mention, as well as retaining terraces as an optional standard (NWRM A10) (Stella, 2012).

With regards to the CAP Reform 2014-2020, in particular the new greening component under Pillar I supports NWRM. These measures involve a proportion of Pillar I funding and go beyond existing cross-compliance conditions. The uptake of these measures will be necessary for farmers to maximize their payments under Pillar I. The 'greening' measures include crop diversification, permanent pasture and ecological focus areas. With regards to crop diversification, an indirect link to NWRM can be made

³ Please check the NWRM glossary if you would like to have more general information on the two pillars of the CAP.

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through equivalent practices, as for example winter crops and catch crops are analogous to the "green cover" NWRM (A8), which decreases runoff and improves the soil structure.

The greening component of permanent pasture specifically requires that its extent in each member state or region should not decrease by more than 5%. Together with equivalent practices on the management of permanent pastures, this directly promotes the NWRM 'Restoring and maintaining meadows and pastures' (NWRM A1). It also links to several forestry NWRM as the 5% threshold does not apply where the reduction in permanent pasture is the result of afforestation.

Ecological focus areas, as the third component of the greening measures, should form at least 5% of arable land of any holding where the arable area exceeds 15 ha. Features listed under this article and the equivalent measures are directly related to a number of NWRM including 'buffer strips', 'field margins', 'green cover', 'traditional terracing' and 'beetle banks' (NWRM A2, A8, A10). A broader range of rural SuDS measures (e.g. filter strips and swales, U4, U6) could also be included as ecological focus areas whether as specific measures or in terms of the design of equivalent measures. In general terms, if the ecological focus areas are used contiguously along water courses, they can - together with the European Agricultural Fund for Rural Development (EAFRD, see below) - play a very important role in promoting the restoration of riparian areas in the agricultural context (European Commission, 2012a).

III.1.2. CAP Pillar II

Under the CAP's second pillar, member states can specify through their Rural Development Programmes (RDPs) which measures can be funded by the EAFRD. These can include NWRM and represent an important window of opportunity to introduce NWRM in the agricultural sector. The links which can be made between NWRM and the second pillar of the CAP are described in the box below.

The EU regulation No. 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) allows the following links with NWRM:

While setting out the priorities for rural development, Article 5 makes implicit reference to the use of NWRM. Paragraph 4 is directly relevant and concerns ‘restoring, preserving and enhancing ecosystems related to agriculture and forestry’ with a focus on a) restoring, preserving and enhancing biodiversity; b) improving water management; and c) preventing soil erosion and improving soil management. NWRM can deliver these objectives either as primary or secondary aims. Paragraph 5 indirectly relates to NWRM through ‘promoting resource efficiency and supporting the shift towards a low carbon and climate resilient economy in agriculture, food and forestry sectors’. In this case actions aimed at carbon sequestration or storage may provide also water retention benefits.

There are a number of key articles that relate to rural development support measures that are of direct relevance to NWRM, and only a selection will be mentioned in the following. Forestry NWRM are covered by several articles relating to afforestation and the establishment of agro-forestry (Articles 21, 22 and 23), the resilience of the environmental value of forest ecosystems (Article 25) and support for environment-climate commitments (Article 34). Forests are also mentioned with respect to Articles 17 and ‘Investments in physical assets’ and Article 20. ‘Basic services and village renewal in rural areas’. These articles also have potential links to ‘Nature’ NWRM, as does Article 30 ‘Natura 2000 and WFD payments’. They allow for non-productive investments and actions for environmental objectives such as biodiversity and habitat conservation that might include elements of NWRM.

Linking NWRM to rural development activities - including e.g. also eco-tourism - can significantly promote their implementation. In Germany, for example, it was a farmer who initiated a process which finally led to a very big dyke relocation and floodplain restoration project (see the NWRM case study “Dyke relocation on the Elbe river near Lenzen, Germany”). The project allowed the farmer to diversify his agricultural activities, including landscape management measures and eco-tourism, which was more advantageous than continuing the previous commercial activities (Damm, 2013).

As mentioned above, also EU LIFE projects may include agricultural NWRM.

French action programmes for preventing floods (PAPI)

In France, the national policy for flood risk management gives since 2002 local authorities the possibility to develop their own, integrated flood risk management projects. These so-called PAPIs (Programme d’action de prévention des inondations) are established in the form of contractual agreements between the state and the local authorities, and – when validated – allow access to additional national funds for the implementation of the flood protection measures (see for example MEDDTL, 2011). The programmes of measures which are developed within a PAPI can include very different types of activities, including river restoration, adaptations in the urban sector, or agricultural measures. One example of the latter is described in the NWRM case study on floodbreaking hedgerows in Southern France, which are part of the PAPI of the river Lèze.

=> **In summary:** The most important window of opportunity for agricultural NWRM is given through the Common Agricultural Policy (Pillar I and II). At the same time, this kind of measures can provide important contributions to reaching the objectives of the EU Floods Directive and the Water Framework Directive. It is therefore important to both further promote NWRM in the agricultural sector, by emphasising also the impact on water issues, and to consider agricultural NWRM within the programmes of measures of the FD and the WFD. Also EU LIFE projects may include agricultural NWRM.

IV. Windows of opportunities for forest NWRM

Forestry-related NWRM can be divided into four broad areas: (i) riparian and river bottom forests; (ii) large-scale land use conversion, (iii) production forestry measures and (iv) amenity forests. Riparian and river bottom forests are discussed in the section on nature and floodplain restoration. Large scale land use conversion from agriculture to forestry is often difficult due to EU or national regulations. However, targeted afforestation in Mediterranean catchments for “catching” precipitation may be justified on the basis of modelling studies and observed trends in precipitation. In many MS, short-rotation forestry for bioenergy production is possible on agricultural land. Short rotation forestry can potentially lower the rate at which precipitation recharges groundwater through increased rates of interception and transpiration compared to annual crop production. This may be beneficial in areas where precipitation exceeds potential evapotranspiration but could induce water shortages in already water-stressed regions of Europe. Short rotation forests can also slow flow velocities in periodically flooded areas. Production forestry related NWRM include for example riparian buffers, continuous cover forestry, coarse woody debris, water sensitive road planning and driving as well as various forms of sediment retention ponds or overland flow areas. – These trade-offs are not exclusive of forests, but occur for example also in soil conservation practices in agriculture and in sustainable urban drainage systems.

Forestry measures are neither directly mentioned by the FD, nor by the WFD (Stella, 2012; see also Futter et al., 2011). The latter can be understood by the fact that WFD water bodies are typically much larger than the ditches, ponds and streams in headwater forests. Furthermore, the WFD sets its objectives in improving water bodies, and not in improving the system that regulates the water cycle, to which forests may belong. Nevertheless, restoring natural assets and functions such as forest soil, drainage systems, etc. are opportunities to improve the status of water bodies. Forests have positive effects through reducing overland flow, and reduce peak discharges from catchments during high rainfall events. However, with regards to major flood events on big rivers, their impact seems to be limited (Read et al., 2009). This might look different with regards to flash flood events (see for example Colombo et al., 2002).

Amenity forests include urban trees, urban forest parts and projects such as the NWRM case study “Kylmäojankorpi forested wetland, Vantaa, Finland” on forest wetlands. Urban trees and parks may provide one of the best windows of opportunity for forest-related NWRM as they are often small-scale and can be readily incorporated into municipal planning. The value of amenity forests such as the Kylmäojankorpi wetland must be highlighted if urban forests are to be better incorporated into the spatial planning process.

In the case of forestry NWRM, it is more difficult to identify universal windows of opportunities. A special context is described in the NWRM case study “Water retention management in the broader area of Ancient Olympia, Elia, Greece”, which deals with the temporary installation of timber structures and reforestation of the hills of Ancient Olympia. The measures aim at retaining water, preventing erosion and mitigating flood risk in an area affected by significant wildfires.

Despite the apparent missing overall approach which can be proposed to introduce forestry NWRM, the potential of promoting them should not be underestimated. In the evolution of forest management, timber production has been the main function promoted for forests, rather than conservation. However, the hierarchy of functions for forests has nowadays partly been changed towards nature conservation and also recreational functions of forests. The water retention capacity of forests needs to be brought into the discussion, to increase its importance (Schüler, *pers.comm.*).

National forestry legislation may provide opportunities to enforce the use of NWRM. Furthermore, a specific window of opportunity could potentially be created through certification schemes, pressure from environmental NGOs and other non-regulatory measures such as eco-labelling. For example, NWRM could be included in the Forest Stewardship Council (FSC) (Schüler, *pers.comm.*), or PEFC (Programme for the Endorsement of Forest Certification) management standards. Although being a voluntary mechanism, certification and eco-labelling standards provide economic incentives for forest owners. Certification standards are adapted to the regional or national level and regularly reviewed. New propositions can come from any stakeholder (FSC, *na*).

As mentioned above, forestry measures may be included in LIFE projects, and are promoted through the new greening component of the CAP. They form also part of the rural development measures financed by the EAFRD.

=> In summary: Forests are essential for water provision, flood control and sediment retention. Examples of specific water retention measures in forests are often cited in the context of research projects, or integrated in floodplain restoration projects. Municipal planning is important to introduce trees in urban areas as well as urban forest parks. Forestry NWRM can furthermore form part of LIFE projects and are promoted to some extent by the new greening component of the CAP. The FSC certification standards may represent a very interesting potential window of opportunity for introducing forestry NWRM.

V. Windows of opportunities for urban NWRM

Urban NWRM include for example green roofs, rainwater harvesting, permeable surfaces or infiltration basis. They are mainly small-scale measures applied on private or public areas, and involve a particular set of stakeholders (private property owners, architects, rural planners, municipalities). Responsibilities for implementing urban NWRM might be less clearly distributed than in other sectors (see illustration box below).

Feedback from the first Baltic NWRM workshop with regards to NRWMs:

From the first regional workshop in the Baltic region it turned out that a clearer institutional set-up is desirable for the urban area. In the UK, for example, new regulation gives more responsibility to water companies on water drainage (which via water bills goes back to public). On the other hand, municipalities are responsible for delivering SuDS and water companies are responsible for maintaining SuDS. Such a shared approach to costs, risks and benefits could be applied elsewhere in Europe. In Finland, for example, the responsibility used to be on water companies but now it is on municipalities. There is a lack of clarity as to who is responsible for what. In Latvia, the open drainage system is in the responsibility of one authority. The drainage system based on pipes is the responsibility of another agency. That raises the question of who pays for what? (Futter, 2014)

Urban NWRM are neither directly mentioned by the WFD, nor by the FD. However, for point and diffuse sources of pollution, the WFD points to the Urban Waste Water Directive (UWWDD). The UWWDD in its part asks member states to implement measures at the source of pollution. Furthermore, one of the guidance documents which supports the implementation of the WFD mentions SuDS as win-win measures that reduce flood risk and at the same time improve water quality (Stella, 2012; European Commission, 2009).

Whereas one part of the urban NWRM implemented today is going back to private initiatives, another part is included in laws - at local, regional or national level. In Belgium, for example, a national law from 2002 makes the installation of rainwater harvesting systems mandatory for all new constructions. The water is to be used for the purposes of flushing toilets and external water use (Yudelson, 2010). Already in 2008, 300 000 households had been equipped (AREHN, 2008). In Copenhagen, it was after a big flood event in 2011 that a governmental decision to change planning law has been taken. All new buildings with flat roofs need to be greened since (Santato, Bender and Schaller, 2013). It can regularly be found that new development areas are used to introduce urban NWRM (Schüler, Gellweiler and Seeling, 2007). In Dresden, Germany, for example, the use of permeable surfaces for new parking areas is compulsory (Prokop et al., 2011). A project based example is provided by the NWRM case study "Sustainable stormwater management and green infrastructure in Fornebu, Norway", which deals with a brownfield development project. The former airport of the city of Oslo is transformed to a residential and commercial area, while taking strongly issues of sustainable stormwater management and green infrastructure into account.

As urban NWRM often concern private property owners, several examples can be found where responsible authorities make use of financial incentives to promote the implementation of NWRM. In France, for example, tax incentives exist since 2007 for rainwater harvesting systems (MEDDE, 2013). In England, households can receive a reduction on their water bills if their surface water drainage does not discharge to the sewerage network, which may be achieved partly through the use of permeable paving. Other instruments include guidance documents for property owners (see for example Administration de la Gestion de l'Eau (ed.) (2013) for the management of rainwater in Luxembourg. As mentioned above, also LIFE projects may include urban NWRM.

=> **In summary:** In many cases, urban NWRM are included in laws or are going back to private initiatives. In particular new urban development areas are a good opportunity to introduce them. Financial incentives and guidance documents are used to support private property owners.

VI. Conclusions

NWRM are very diverse, and so are the windows of opportunities to implement them. Very important opportunities are provided through European policies (WFD, FD, Natura 2000 directives, LIFE programme, CAP), but it is up to the member states to seize them for the implementation of NWRM - and much scope is still left. What is common to all of these windows of opportunities, however, is that they fix the situation for several years (e.g. programmes of measures for the WFD or the FD, Rural Development Plans, etc.), which makes it even more important to be aware of them. Although the WFD and FD clearly mention certain NWRM (e.g. restoring wetlands, artificial groundwater recharge or the restoration of floodplains), this is not directly the case for others (in particular NWRM applied in the urban and forestry area). Nevertheless, all of them can be considered as being in line with them. Furthermore, although it might be difficult to establish for example a direct link between an individual NWRM applied in a forest and the status of water bodies – their cumulative effect throughout the catchment might still be important.

Other windows of opportunities for NWRM are country- or region-specific, and include plans and programmes developed by responsible authorities, e.g. for flood protection or nature conservation purposes. In addition to that, an important number of case studies reviewed in this project show the importance of individual initiatives, which actually created such opportunities by looking for partnerships and financing. Informing about the benefits of NWRM is hence very important.

VII. List of references

Please note: Case study specific literature can be found under the links provided to the NWRM case study factsheets. They have not been included in the following list.

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