



Pilot Project - Atmospheric Precipitation - Protection and efficient use of Fresh Water: Integration of Natural Water Retention Measures in River Basin management

Final report



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Final report: Pilot Project - Atmospheric Precipitation - Protection and efficient use of Fresh Water: Integration of Natural Water Retention Measures in River Basin management - 2015

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Executive summary

There is an increasing policy interest in so-called Natural Water Retention Measures (NWRM) for improving the state of aquatic ecosystems. To respond to this interest, DG ENV launched a dedicated study entitled ***Pilot Project - Atmospheric Precipitation - Protection and efficient use of Fresh Water: Integration of Natural Water Retention Measures in River basin management (2013-2014)***. The two overall objectives of the pilot project were:

- To develop a structured knowledge base on NWRM that can easily be accessed by all within the Water Information System for Europe (WISE); and,
- To contribute to the development of an active European “community of NWRM practitioners”, thanks to the launching of different regional networks and the development of a practical guide for supporting the practical design and implementation of NWRM.

The present document is the final report of this DG ENV pilot project. It has been developed by the consortium¹ in charge of the pilot project following inputs and guidance from DG ENV desk officer in charge of the pilot project.

The final report is composed of 6 parts.

The first part (Part I) summarizes the key objectives of the pilot project as well as the tasks organisation and the project’s deliverables. Part II to part V (chapter II to VII) present the achievements of the 4 main tasks of the pilot project:

- Part II (chapter III: Transversal task) presents general communication activities and related matters of project management;
- Part III (Chapter IV: Task 1-Building the knowledge base) focuses on the development of the information system dedicated to NWRM, building on a catalogue of 53 NWRM (divided into 4 categories: urban, agriculture, forestry and hydromorphology) and the presentation of 125 NWRM cases studies;
- Part IV (Chapter V and VI: Task 2-Launching of a European NWRM community) and part V (Task2-Implementing NWRMs in the four Regions: feedbacks from regional processes) present regional activities in particular the management of discussion forum and regional workshops;
- Part V (Chapter VII: Task 3- Supporting future NWRM implementation) presents the different material and products that aim at promoting and supporting the implementation of NWRM in Europe.

The pilot project was initially planned for a period of 14 months (from September 2013 to October 2014). However, its implementation was extended by 10 months as a result of challenges faced with collecting available evidence and unforeseen translation efforts.

The work developed by the pilot project followed as closely as possible the progress of the different Working Groups (WG) of the WFD Common Implementation Strategy (CIS). Key

¹ The consortium led by OIEau was composed of 10 partners : Acteon, Amec Foster Wheeler, BEF, Enveco, IACO, IMDEA, REC, REKK, SLU and SRUC

products from the pilot project such as the NWRM concept note, the catalogue of measures and the structure of the knowledge base were presented and benefited from comments and inputs from WG members, in particular the WG PoM (that developed in parallel guidance on NWRM), the WG Agriculture and the WG Floods.

To cover the specificities of geographical and water management issues throughout Europe, information exchanges were organised for four EU regions (namely the Mediterranean, Western, Baltic and Danube networks). Dedicated activities rapidly started after a few months from the kick-off of project to ensure the plurality of examples on NWRM would be gathered along the line of NWRM promotion adapted to the variety of audiences. LinkedIn was used to set respective regions fora under a common umbrella of NWRM forum. And regional workshops were organised to share experiences, strengthen the knowledge base and identify recommendations for supporting the cost-effective implementation of NWRM in different regions.

Through the lifetime of the pilot project, the consortium ensured an active mobilisation of a wide range of stakeholders from the different fields: researchers and experts (through direct interviews for building NWRM case studies and via regional workshops), (water) managers at the regional and national levels (through regional workshops); and representatives of MS and of European level organisations (through the pilot project Steering Committee and the participation in the different CIS WG). This interactive process proved effective in delivering strategic documents and materials on NWRM (all being available at the NWRM website), in particular:

- A series of 11 synthesis documents addressing issues such as NWRM main biophysical impacts, links to EU policy objectives, socio-economic benefits, barrier and success factors to implement these measures; etc. see <http://nwrn.eu/implementing-nwrn/synthesis-documents> ;
- The catalogue of the 53 NWRM available per sectors and benefits (see <http://nwrn.eu/measures-catalogue>);
- The NWRM cases studies providing examples of NWRM implementation in practice (see <http://nwrn.eu/list-of-all-case-studies>)
- The practical guide to support the design and implementation of NWRM.
- Identity Cards (ID) presenting in a short summary the salient features of each of the 53 measures (see <http://nwrn.eu/id-card/#1>);

Overall, the pilot project contributed to a structured promotion and to raising awareness on NWRM. The pilot project also stressed the need to develop additional evidence on the NWRM effectiveness in contributing to multiple policy objectives. In the end it demonstrated NWRM added value compared to grey/standard measures.

I Introduction

The role of nature-based solutions to protect water resources and address at the same time other policy challenges such as flood risk management or drought risk management, has gained momentum in the European Union (EU) Freshwater Policy agenda in recent years. This is reflected in particular by: specific references to nature based solutions in the *Blueprint to Safeguard Europe's Water Resources* of the European Commission (EC) adopted in 2012 (EC, 2012), where the role of Natural Water Retention Measures (NWRM) in particular has been highlighted, by discussions on the role of green infrastructures and NWRM in supporting the achievement of the Water Framework Directive (WFD) and Floods Directive (FD) in the context of the Common Implementation Strategy (CIS) or by the inclusion of specific provisions for supporting the implementation of NWRM in existing EU financing instruments (i.e. partnership agreements via European Structural and Investment Funds (ESIF), conditionality criteria under the Common Agricultural Policy (CAP) pillar I, research and innovation funds, L'Instrument Financier pour l'Environnement (LIFE), and other financial instruments such as European Investment Bank (EIB) funds).

Further to the Blueprint, the role of NWRMs has been stressed in: the White Paper on climate change adaptation and its accompanying impact assessment (EC, 2009) emphasising on the efficiency of these measures; the information package "Towards Better Environmental Options in Flood Risk Management" (EC, 2011) on natural flood management; the EU Adaptation Strategy Package, including the Climate Change Adaptation Strategy (EC, 2013) emphasising on ecosystem-based management; and the Green Infrastructure Communication (EC, 2013), critical to understand the multiple benefits of NWRM.

In this context, and in order to respond to demands from river basin managers and stakeholders for a better knowledge on NWRM, the Environment Directorate General (DG ENV) of the EC launched a specific Pilot Project dedicated to these types of measures. This project aimed at supporting the implementation of NWRMs in the integrated management of water resources in Europe. More specifically, the project had two complementary operational objectives: (i) to develop a sound and comprehensive knowledge base on NWRM, and (ii) to contribute to the development of the European NWRM "community of practice"

The NWRM Pilot Project started on September 5th, 2013 and ended in July, 2015². The objectives, the organisation of tasks and activities, and the different deliverables of the project are described in the following parts of this final report of the project.

- Part I (rationale of the work organisation) reminds the Commission's expectations and the key objectives of the pilot project as well as the organisation of tasks and expected deliverables as presented at the beginning of the pilot project.

² A period longer than the initial 14 months duration that had been specified in the Terms of Reference of the project.

Part II to part VII go through the main achievements of the 4 main tasks of the pilot project:

- Part II (Transversal task) presents how was implemented a transparent and effective communication with the Commission, within the consortium and related matters of project management: as planned in the technical offer, regular meetings (in Brussels and on the phone) with the Commission were carried as well with the Steering Committee. In terms of project management regular web conferences were organised involving all the partners and involving sub-groups related to the regional activities. The transversal task also dealt with the reports and deliverables, the quality assurance mainly focussing on the regional processes and the translation in 15 languages in the latest phase of the project of the practical guide and in 5 languages of the NWRM identity cards (IDCards).
- Part III (Task 1-Building the knowledge base) focuses on how was the information system dedicated to NWRM containing the catalogue of 53 measures and the catalogue of 125 cases studies set and fed. The catalogue of measures required a deep analysis on how best to organise the measures. Tacking stock from the state of the art on NWRM, the consortium proposed a new structure of the measures where 4 main categories were used: urban, agriculture, forestry and hydro morphology³. Building the catalogue of cases studies also required considerable work. A template was set by the partners in the early stage of the pilot project with the related database. To ensure that as many cases studies as possible could be gathered from the very well documented to those with less information available, it was decided that the catalogue would contain two types of cases studies: the in-depth cases studies (corresponding to the first option) and the light cases studies (corresponding to the second option).
Based on the expertise from the consortium, the collection of information and feedback from the regional workshops, SC, CIS WG, a specific literature review and policy documentation were used to deliver a series of synthesis documents covering most of the NWRM issues.
- Part IV (Task 2-Launching of a European NWRM community) and part V (Task2-Implementing NWRMs in the four Regions: a view from the regional processes) present the overall process related to the regional activities in terms of fora and workshops. Two series of workshops were held in each region (Danube, Baltic, Mediterranean and Western) over the first 10 months of the project. The first one set the NWRM scene and presented the preliminary catalogue of measures with a detailed concept note that was simplified for focussing on key aspects of NWRMs and was proposing a first list of NWRMs, the second series were about presenting the progress of the pilot project, gather more feedbacks and case studies on NWRM and open up the discussion on the practical guide.
- Part VI (Task 3- Supporting the future implementation) presents the key legacy of the pilot project in terms of communicational material aiming at promoting and supporting the implementation of NWRM. After the synthesis documents, we are here referring to

³ 'Hydro morphology refers to the management and structure of water bodies (e.g. rivers, lakes and wetlands) and their interface with adjoining land. These measures, although distinct from agricultural, forest and urban management can be implemented in adjoining spaces as well as (semi)natural habitats.'

the poster, leaflets, role playing game to promote NWRM and insure SPI and the practical guide.

- Part VII (Transversal task) presents how a transparent and effective communication with the Commission, within the consortium and related matters of project management was implemented: as planned in the technical offer, regular meetings (in Brussels and on the phone) with the Commission were carried as well as with the Steering Committee. In terms of project management regular web conferences were organised involving all the partners and involving sub-groups related to the regional activities. The transversal task also dealt with the reports and deliverables (presented in a table in section VII.2), the quality assurance mainly focussing on the key deliverables of the project: NWRM factsheets, NWRM case studies, synthesis documents, glossary, guide, on the translation in all EU languages of the leaflet, in 14 languages of the guide and in 5 languages of the IDCards in the latest phase of the project.

The conclusion of the final report summarises the different outcomes of the project according to its objectives and opens on recommendation based on the summaries of the lessons learnt (more details on recommendations can be found in section VII.2).

II Rationale of the NWRM pilot project

This first chapter summarises the objectives, organisation and expected deliverables of the pilot project.

II.1 Key objectives of the pilot project

As stated the in the technical offer based on the tender specifications, the main objective of the pilot project was “to improve the knowledge base on NWRM and their delivery as part of policy implementation and to foster knowledge dissemination and exchange at the various levels of stakeholders so as to promote their implementation in the second River Basin Management Plans (RBMPs) and first Flood Risk Management Plans (FRMPs)”. This was translated into five specific operational objectives:

- (i) To collect the state of the art knowledge, available data and information and best practices in the current application of NWRM for managing fresh water precipitation across EU (...);
- (ii) To provide a detailed assessment of effectiveness, costs and benefits of NWRM, supporting further scenario modelling with the JRC integrated water modelling platform;
- (iii) To further develop and maintain a catalogue of measures and cases studies (...);
- (iv) To link to NWRM projects and good practice examples across a range of geographies and land use, so lessons can be extracted from these experiences and be shared (...);
- (v) To contribute to the WFD CIS and to identify or create operational tools that can be used at national, river basin and/or local level to facilitate the inclusion of NWRM in the RBMPs and FRMPs. (...)

Those general and specific objectives have been presented as followed by the pilot project:

- Objective 1: to develop a sound and comprehensive knowledge base on NWRM through:
 - The mobilisation of all existing knowledge, from research, studies, available data and information, grey literature... to available practical knowledge from practitioners;
 - Structuring the information within a catalogue (database) of measures and case studies;
 - Easy access via an integrated semantic platform (“wiki”);
 - Maintenance and regularly update after the end of the pilot project;
- Objective 2: to contribute to the development of the European NWRM “community of practice” by:

Launching and facilitating a process that involves a wide range of local practitioners, river basin managers, other stakeholders, scientists, technical experts and policy developers;

Developing operational tools (organised knowledge with access tools, related data-extraction modules for facilitating the access to, and use of the database/knowledge, completed by a practical guide) that can support the design, planning and implementation of NWRM;

Raising awareness on the potential of, and benefits from, NWRM – through the organisation of a series of events and the development of information/communication material (web-based forum, presentations, leaflet...).

In operational terms, the pilot project was expected to:

- Cover the entire European Union (27 Member States - MS) and Croatia, plus countries associated to the implementation of the WFD such as Norway and Switzerland;
- Recognise regional features and specificities in terms of knowledge (e.g. expected impacts and implementation constraints being different for a given NWRM depending on the region/river basin where it is applied), good practice and opportunities for NWRM, and process (specific regional networks being established);
- Address all dimensions of NWRM including: technical specificities, environmental impact and effectiveness, socio-economic impacts (costs and benefits), implementation and institutions/governance....
- Further test the methodology proposed in the parallel DG ENV pilot project on the Integration of Ecosystem Services Approach with WFD and FD implementation for ensuring ecosystem service delivery is optimised while achieving the objectives of the WFD and FD.

Overall, the pilot project had to contribute to:

- Supporting water-policy implementation at the MS level (in particular the implementation of the WFD, the FD and water-related adaptation strategies) and the integration of NWRM in the following RBMPs, FRMPs or more local catchment-based management plans;
- Supporting the development of shared information systems and reference datasets in an EU coherent way, with an open source approach and close connection to (coherence with) WISE and INSPIRE, using the latest development in terms of semantic approaches;
- EU-wide water policy making, feeding into the WFD Common Implementation Strategy (CIS), the activities of the European Environment Agency (EEA) and the current scenario modelling initiative of the Ispra Joint Research Centre (JRC);
- Identifying gaps in knowledge and information that will demand further research at the MS, regional and European levels to support effective NWRM implementation in the medium- to long-run.

II.2 Organisation in tasks

The project was organised in four main tasks supporting the achievement of the above objectives.

- Task 1 entitled Building the knowledge base: typology of measures and assessment impacts, costs and benefits and implementation potential was divided into three sub-task (see figure below). Its overall objective was to kick-off and sustain the implementation of an information system dedicated to NWRM to support the design and implementation of NWRM in all EU MSs ;
- Task 2, entitled “Launching a dynamic process”: create networks of best practice exchange, organise meetings with practitioners and stakeholders and participate in CIS workshops aimed to launch support to the establishment of an European NWRM community of practice, recognising its regional differences and challenges.
- Task 3, entitled “Supporting future implementation: practical guide for planning and implementation measures at the catchment level developed awareness raising communication and a practical guide to support the planning and implementation of NWRM at the catchment and river basin scales.
- These three tasks were supported by a transversal task encompassing a series of supporting activities set to ensure smooth implementation of the pilot project. It dealt with project management at the consortium level (meetings within the consortium, inception phase, meetings with the Commission and Steering Committee (SC), interim and final reports), the development and maintenance of the project’s website, translation of documents and quality control mechanisms.

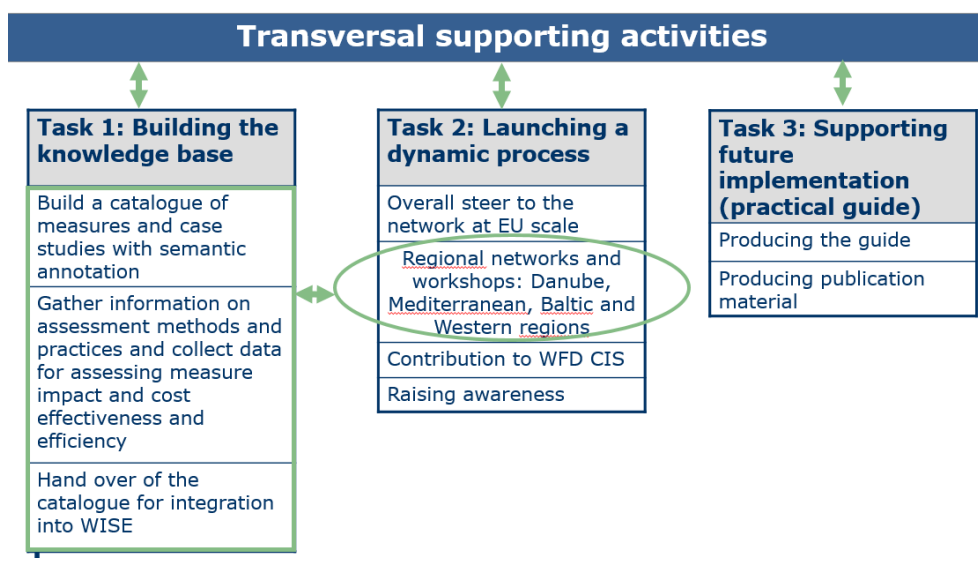


Figure 1: Organisation of the NWRM project work in tasks

II.3 Expected deliverables

The pilot project was expected to produce a series of deliverables for public use, complemented by specific reports, notes and meetings & workshops minutes that were supporting the pilot project implementation. These different internal and external deliverables are summarised in the following table.

Table 1: Expected deliverables from NWRM project

Task	What?	For whom?	How?	When?	Comments
Supporting activities & management	Inception report	DG ENV & study steering committee	Electronic format, in English	T ₀ + 1 months	Maximum 50 pages
	Web-based discussion forum	Public, restricted links to the dedicated CIRCABC space sections established for the study	Electronic/web-based	T ₀ + 1 months for its launching, regular updates up to the end of the project	Simple but attractive design in coherence with existing CIS/DG ENV/EC Identity
	Interim report	DG ENV & study steering committee	Electronic format, in English	T ₀ + 6 months	Maximum 100 pages + annexes
	Synthesis of steering committee meetings	DG ENV & study steering committee	Electronic format, in English	Draft version within 7 calendar days of the meeting, final version within 7 calendar days after comments	Will include a front (one) page summarising key issues and decisions
	Background documents for the CIS/DG ENV group meetings	Members of the CIS/DG ENV groups	Electronic format, in English	Two weeks prior to each individual meeting	Need for well-targeted documents
	Final report	Steering committee members for the draft version, publicly available for the final (validated) version	Electronic format, in English, with EC Visual Identity		Including a stand-alone executive summary, and the semantic Wiki, the final version of the guide, and the collaborative database as annexes
Task 1	Detailed database with catalogue of measures and case studies	Access restricted during the study to the Steering Committee and potentially participants in the regional networks	Electronic, in all EU languages for the database fields/general presentation, in English and national languages for content	First version (data model, codelists, metadata) at T ₀ + 3 months Second version at T ₀ + 12 months Third version at T ₀ + 14 months	
	Specific note identifying key areas for further research	Steering committee members (+ DG R&I if not)	Electronic, in English	T ₀ +12	Final version included in the final report

Task	What?	For whom?	How?	When?	Comments
		already member)			
Task 2	Background documents to the regional network meetings	Potential participants at the network meetings Also accessible via the web-based discussion forum to wider audience	Electronic, in English and translated in key regional languages	Two weeks before the date of each regional meeting	
	Minutes of the regional network meetings	Participants at the network meetings also accessible via the web-based discussion forum to wider audience	Electronic, in English	Draft version within one week after each regional meeting sent to all participants, revised/final version sent to DG ENV no later than 3 weeks	
Task 3	Detailed structure and format of the practical guide	Steering committee	Electronic format	T ₀ + 4 months	
	Minutes of the Guide Support Group workshop	Steering committee	Electronic format, in English	One week after the workshop for workshop members, three weeks after the workshop for DG ENV	
	Practical guide	Steering committee (all versions), participants in the regional networks (from second version onwards), public (final version)	Electronic version linked to the database Printed copies: 500 in EN, 200 in each of the following DE, ES ,FR, and PL.	T ₀ + 6 months for the first version T ₀ + 10 months for the second version ⁴ T ₀ + 14 months for the final version	High-quality professional graphic design, easy-to-use
	Publication – presentation	Publicly available	Electronic version, in all EU languages	T ₀ + 12 months for the draft version T ₀ + 14	

⁴ Note that this is two months earlier than specified in the pilot project's terms of reference, because of the importance of the testing and reviewing phases proposed for the guide.

Task	What?	For whom?	How?	When?	Comments
				months for the final version	
	Publication – 2 page leaflet	Publicly available	In all languages, electronic & paper-based (100 copies per language)	EU T ₀ + 12 months for the draft version T ₀ + 14 months for the final version	

III Task 1: Building the knowledge base

A key objective and feature of the NWRM project was the development of the NWRM knowledge base that mobilises a wide range of information and data from existing NWRM experiences in Europe.

Task 1 specifically aimed at building the integrated NWRM knowledge platform including:

- a taxonomy and glossary for key concepts, acting as a discovery tool;
- a catalogue of well-structured and organised NWRM;
- a set of case studies including “good practice” examples (60 examples proposed)⁵.

The knowledge base is the set of technical tools to gather (input part), store (databases part) and retrieve (outputs part) data and information on NWRM.

Task 1 was closely connected to Task 2 (developing a network of NWRM experts and practitioners feeding the knowledge base) and Task 3 (developing the practical guide mobilising the knowledge platform and presenting key messages on the policy relevance, the design and implementation challenges of NWRM).

The NWRM project relied on an integrated knowledge management process that comprised on (i) the mobilisation of European networks of experts and NWRM consortium partners and (ii) the development and maintenance of a set of integrated web based tools (named here the “knowledge base”). Both parts and their interrelations are presented as detailed in the figure below.

⁵ Note that the term « good practice » specified in the terms of reference of the study is replaced by the simple reference to « practice », recognising the contextual differences in applications, pre-conditions and impacts of potential NWRM measures.

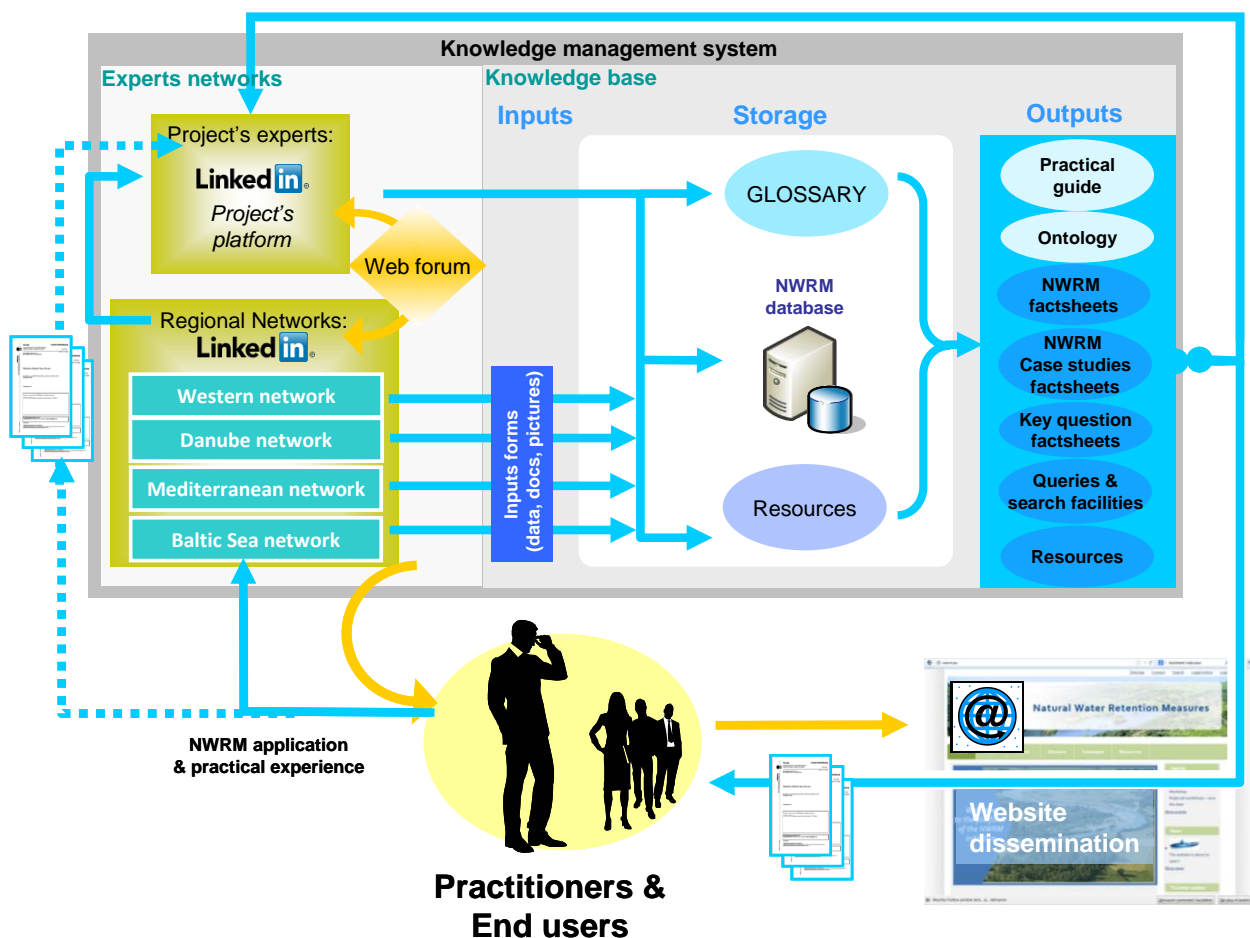


Figure 2: description of the knowledge management system to gather the NWRM knowledge

Task 1 included:

The development of the required computer/internet-based infrastructure; and

The collation of relevant information on NWRM applications through the mobilisation of a wide range of up-to-date data and information from existing literature and from existing practical NWRM experiences throughout Europe.

The knowledge base which is publicly available and provides **facilities for accessing to, and extracting knowledge** (e.g. giving access to summarised information on a given NWRM, a specific case study or a key question) as well as **input facilities** for feeding in new case studies and information.

A fully integrated system was progressively implemented to store all data and information in a single system. Considering the complexity of the data collection and consolidation exercise, and the need to progress on individual components of the system by mobilising individual thematic and sector experts, it was proposed to split the system in two key parts: (1) the catalogue of NWRM and the catalogue of case studies; and (2) a set of structured functions including the taxonomy/glossary, a section dedicated to resources and "News". Further web pages were dedicated to the dissemination of information linked to the regional workshops: presentations, syntheses, and the synthesis documents but also other documents like the sources of information used, some pictures and photo galleries.

III.1 Sub-task 1a: Building a catalogue of measures

The catalogue of measures is a web-based tool structured based on a collectively elaborated and structured taxonomy. It presents all identified NWRM classified in 4 different sectors, with emphasis not just on a typology of measures but rather on criteria and conceptual clarity to organize the set of available measures.

III.1.1 Initial List of measures

At the onset of the project, a first concept NWRM note was elaborated to raise awareness on the focus and scope of the pilot project. This note included first discussions on key issues linked to NWRM, along with a first definition of what NWRM are and what they are not.

Based on the existing EU working definition of NWRM⁶, the Blueprint to Safeguard Europe's Water Resources (COM (2012) 673), and the Stella Consulting report (2012) summarizing earlier initiatives on NWRM, some distinctive characteristics of NWRM were drawn. Not every measure that increases the water stored in water bodies or soils is a NWRM, as some measures might be efficiency improvement measures or measures aimed at accessing alternative water supply sources. NWRM are interventions on water related (eco)systems that maintain their potential to provide water-related ecosystem services (including services such as flood-risk reduction or drought resilience), using natural processes (i.e. functions commonly performed by nature). Water retention itself is not the end but the means that make NWRMs relevant for water resource efficiency and sustainability, as retaining water in the environment is essential for the production of different flows of services. Last, NWRM are not simply means to restore assets modified by human actions to their original natural conditions. They can adapt existing developments to enhance or recover their water regulation functions.

The criteria used to classify NWRM emphasized the interest in specific measures seen as relevant to (water) policy. The first approach to classify NWRMs was to distinguish between alternatives addressed directly to restore or adapt **water bodies** ("Type 1") from those focused on **land use** ("Type 2"). The former included actions to repair or restore the potential to store water in **rivers and their wetlands** ("Class 1.1"), **lakes and their wetlands** ("Class 1.2"), and **aquifers** ("Class 1.3")⁷. The latter included modifying and adapting **forest, meadows and pastures** ("Class 2.2"), **agricultural lands** ("Class 2.1") and **urban practices** ("Class 2.3"). This allowed streamlining the typology of NWRM initially proposed in the context of the Blueprint Impact Assessment⁸.

All measures considered could then be classified according to these two basic criteria.

The discussion on **this first classification emphasized the importance of defining criteria that made a measure a NWRM** rather than providing long lists of potential measures that could be considered as NWRM. This ensured that new measures considered in case studies (or NWRM applications) selected for further analysis could progressively be

⁶ <http://ec.europa.eu/environment/water/adaptation/ecosystemstorage.htm>

⁷ This is aligned with the classification proposed by Stella Consulting (2012).

⁸ In Stella Consulting (2012)

added to a list that would be regularly updated. The following table presents the classification proposed .

Table 2: Initial classification of NWRM

Type 1, on water bodies		Type 2, on land use	
Restoration measures – partial recovery of functions or the structure of modified ecosystems by intervening directly over...		Change or adaptation of land-use practices (partial recovery of functions or the structure of modified ecosystems by changing or adapting land-use practices such as...	
...Rivers and their wetlands	N1. Basins and ponds N2. Wetland restoration and creation N3. Floodplain reconnection and restoration N4. Re-meandering N5. Revitalisation of flowing waters N6. Restoration of the flows of temporary tributaries N7. Reconnection of hydraulic annexes N8. Restoration of the riverbed (alluvial mattress) N9. Levelling of dams/longitudinal barriers N10. Natural bank stabilisation N11. Elimination of riverbank protection	...Agriculture	A1. Restoring and maintaining meadows and pastures A2. Buffer strips A3. Field margins and headlands A4. Soil conservation crop practices: crop rotation A5. Soil conservation crop practices: strip cropping A6. Soil conservation crop practices: intercropping A7. No tillage A8. Reduced/conservation tillage A9. Green cover A10. Early sowing A11. Traditional terracing A12. Beetle banks A13. Hedgerows A14. Controlled traffic farming
...Lakes and their wetlands	N12. Restoration of lakes.	...Forestry and pastures	F1. Afforestation of riparian areas F2. Afforestation of montane areas F3. Afforestation of reservoir catchments F4. Targeted planting in Mediterranean areas for "catching" precipitation F5. Forests as large-scale water pumps F6. Land use conversion for water quality improvement F7. Continuous Cover forestry F8. "Water sensitive" driving F9. Maintenance of riparian buffers F10. Appropriate design of roads and stream crossings F11. Sediment capture ponds F12. Coarse woody debris F13. Re-meandering of forestry-affected rivers F14. Urban forests F15. Riparian trees in agricultural landscape
...Aquifers	N13. Artificial groundwater recharge (AGR)	...Urban development	U1. Green Roofs U2. Rainwater Harvesting U3. Permeable Paving U4. Other Permeable Surfaces U5. Swales U6. Channels and Rills U7. Filter Strips

Type 1, on water bodies	Type 2, on land use
	U8. Filter Trenches U9. Bioretention Areas U10. Soakaways U11. Infiltration Trenches U12. Infiltration Basins U13. Rain Gardens U14. Detention Basins U15. Retention Ponds U16. Wetlands U17. Urban channel restoration U18. Floodplain restoration U19. Managed Aquifer Recharge

III.1.2 Methodology to improve this list and create a catalogue of NWRM

After the first round of regional workshops organised by the project, the knowledge base on NWRM was progressively developed using a simple classification of measures into four sectors (agriculture, forestry, nature⁹, and urban).

Overall, 61 measures equally spread between the four sectors were identified. It was recognised that the allocation of measures to individual sectors was more a practical classification than a strict allocation between sectors clearly overlapping.

The sectors are in fact covering more the typical dedicated areas where such measure can be applied in the landscape and the core technics the main economic actor in charge of this space are using regularly and mastering, than the sole area where the measure can be implemented. Most measures can in fact be applied in more than one sector and the sectors most relevant for each NWRM were then specified in the catalogue of measures.

The following table, taken from the **Background note to the WG PoM – Implementing the NWRM Pilot Project: progress, feedbacks and next steps** written in March 2014, gives an overview of what needed to be improved. It summarises the main issues raised during the first round of comments on the catalogue of NWRM that was included in the concept note.

Table 3: Summary of comments related to the NWRM Catalogue received from members of the WG PoM, the EEA and DG ENV

Main issue of the NWRM catalogue	What?	The main lines of development
General	The proposed list of measures is seen as too long. The codes that are used for specific measures should be harmonized with the measure codes used in the STELLA Report. Additional information should be provided for better grasping what the measure is / what it entails.	The list is currently under revision to propose some types of grouping along different criteria. This process will include some simplification but also addition of some measures not already included. A mapping towards Stella report measure codes will

⁹ 'Subsequently recategorised as hydromorphology'

Main issue of the NWRM catalogue	What?	The main lines of development
		be added. Beyond the number of individual measures the more important aspect is that each NWRM project will develop for each measure an individual factsheet providing more details for better grasping the measure.
Relation of the NWRM to the different Directives	<p>It would be helpful to include a qualitative indication of the (possible) contribution (effectiveness) of each individual measure to the achievement of the objectives of the WFD and FD (i.e. how do NWRM help reducing flood risks) in particular, but also of other more general EU policies (including the Habitat Directive that has not been specifically referred to). Clearer indications of the link between NWRM and individual WFD pressures (or the relevance of individual NWRM to specific pressures / impacts situations) should be indicated. A hierarchy could be made explicit between the contribution to well-defined existing "legal requirements" (seen as a priority) and contributions to wider "general objectives" like the provision of ecosystem services, improving soil quality, etc.</p> <p>Experiences of implementing NWRM for WFD purposes (in particular as part of the first PoM / RBMP cycle) could be shared among EU MS even if this exercise mainly serves the 3rd WFD RBM planning cycle.</p>	<p>Although the link to individual WFD pressures can be explored, a qualitative indication of the effectiveness of each measure to the WFD and FD and other policies objectives is a more challenging exercise in which the WG PoM should provide a key support, in particular in the listing of legal requirements and general objectives. If relevant experiences of NWRM implementation in the first RBMP cycle exist, they should be shared with NWRM project as it will serve the data collection process as regards case studies.</p>
Proposal for additional measures to be considered as NWRM	<p>Additional measures that could be considered include:</p> <p>Spontaneous or sown inter row grass / green covering on tree or shrub crops during wet season (fall-winter);</p> <p>Adequate crops and agricultural practices to land slope;</p> <p>Rural SuDS;</p> <p>Small ponds and wetland areas in agricultural land (only mentioned under the natural area category);</p> <p>Artificial (and temporal) watering of forests and peat land and run-off regulation of the same areas;</p> <p>Specific measures for addressing "snow issues" (in particular in rural areas) in the Northern European Member States;</p>	<p>A complete revision of the list and the grouping criteria is under way to cover also such kind of measures proposed. In addition a specific exercise of collecting synonyms will allow completing the current list by providing alternative wording to allow people /end users enter the system with their own wording.</p>

Main issue of the NWRM catalogue	What?	The main lines of development
	<p>Improving water course regulation practices;</p> <p>Flexible gabion weirs for river training.</p> <p>Feedbacks also stressed the need to carefully check the description of individual measures, as: (1) different measures (e.g. "buffer strips and field margins/headlands", "infiltration trenches and infiltration basins" or "soakaways and Managed Aquifer Recharge") have the same definition or significantly overlap each other (thus implying that this could be a single measure type in the database); (2) additional measures similar to green cover crops (but with a different main function – e.g. catch crops that prevent nutrient losses to water and cover soils) could be added to the list. In the case of Managed Aquifer Recharge (and also Artificial Groundwater Recharge), the mechanisms used to undertake the recharge could be further highlighted, by differentiating between: (i) surface structures to facilitate / increase recharge (such as soakaways and infiltration basins); (ii) subsurface indirect recharge -artificial recharge is undertaken through wells drilled within the unsaturated zone; and (iii) subsurface direct recharge - artificial recharge is undertaken through wells reaching the saturated zone.</p>	

The issues raised led to an update of the NWRM list. Harmonizing definitions and eliminating duplications helped reduce the list from 61 to 51 measures. At the interim meeting, a template for gathering the key information on each individual measure was discussed and progressively updated with the experience gained from testing it with first examples of NWRM. The final template version was circulated to all partners before the summer 2014 and then systematically used to develop individual NWRM factsheets.

After the second round of regional workshops, the list of NWRMs was stabilized at 53 measures classified under the following four sectors: Agriculture, Forest, Hydro morphology and Urban. All definitions of individual NWRM were specifically checked to ensure consistency between the title of the measure and what the measure is.

Work was also carried out to establish the link(s) between measures and their corresponding biophysical impacts, ecosystem services delivered and likely contributions to EU policy objectives. Different matrices presenting qualitative ratings were developed and are made available at the project website (<http://www.nwrm.eu/catalogue-nwrm/benefit-tables>). They are further detailed in the respective synthesis documents with a detailed description, for each biophysical impact, each ecosystem service and each policy objective.

To structure the knowledge for each NWRM, a detailed knowledge base template was developed together with a first set of qualitative rating matrixes.

To keep it manageable and understandable, qualitative rating for each biophysical impact, each ecosystem service and each policy objective was defined with 4 categories: no effect of the measure, low effect, medium effect or high effect. The choice between these categories is based on expert judgement supported by the information found with the literature review but also collected for the case studies and the support of the project and external experts involved for example in the Workshops. The purpose of this qualitative category is to provide a useful comparative assessment between the different biophysical impacts, ecosystem services and policy objectives respectively. During the elaboration and quality review of each NWRM factsheet, these ratings were thoroughly reviewed and revised where necessary. At the end of the project, they provide a robust tool to help managers to choose among the possible NWRM. The addition of new case studies, new pieces of literature and more generally new knowledge, should help refine this and progressively add quantitative rating, the quantitative values being currently mainly found in individual factsheets, case studies and Workshop presentations.

III.1.3 List of NWRM at the end of the project

The following table presents the final list of NWRM that was investigated by the project.

Table 4: NWRM list at the end of the project

AGRICULTURE		URBAN	
A1	Meadows and pastures	U1	Green roofs
A2	Buffer strips and hedges	U2	Rainwater harvesting
A3	Crop rotation	U3	Permeable surfaces
A4	Strip cropping along contours	U4	Swales
A5	Intercropping	U5	Channels and rills
A6	No till agriculture	U6	Filter strips
A7	Low till agriculture	U7	Soakaways
A8	Green cover	U8	Infiltration trenches
A9	Early sowing	U9	Rain gardens
A10	Traditional terracing	U10	Detention basins
A11	Controlled traffic farming	U11	Retention ponds
A12	Reduced stocking density	U12	Infiltration basins
A13	Mulching		
HYDROMORPHOLOGY		FOREST	
N1	Basins and ponds	F1	Forest riparian Buffers
N2	Wetland restoration and management	F2	Maintenance of forest cover in headwater areas
N3	Floodplain restoration and management	F3	Afforestation of reservoir catchments
N4	Re-Meandering	F4	Targeted planting for "catching" precipitation
N5	Stream bed re-naturalization	F5	Land use conversion
N6	Restoration and reconnection of seasonal streams	F6	Continuous cover forestry

N7	Reconnection of oxbow lakes and similar features	F7	'Water sensitive' driving
N8	Riverbed material re-naturalisation	F8	Appropriate design of roads and stream crossings
N9	Removal of dams and other longitudinal barriers	F9	Sediment capture ponds
N10	Natural bank stabilisation	F10	Coarse woody debris
N11	Elimination of riverbank protection	F11	Urban forest parks
N12	Lake restoration	F12	Trees in urban areas
N13	Restoration of natural infiltration to groundwater	F13	Peak flow control structures
N14	Re-naturalisation of polder areas	F14	Overland flow areas in peatland forests

For each NWRM, an individual factsheet providing the basic characteristics of the measure along with its biophysical impacts, expected benefits and pre-conditions for implementation was produced. All factsheets are available on the website of the project (<http://www.nwrm.eu/measures-catalogue>).

An illustrated version of the catalogue of NWRM is also available on the website (<http://nwrm.eu/sites/default/files/documents-docs/53-nwrm-illustrated.pdf>).

It is important to stress that the NWRM list could still be adapted as new evidence is produced on the application of measures. The aim of the current list was to gather existing information in a structured manner. The goal of the NWRM website will be to support the progressive development of the existing knowledge base as new evidence and case studies are developed.

III.2 Sub-task 1a: Building a catalogue of case studies

According to the terms of reference, 60 best practice case studies on NWRMs should be provided by the project. The concept of best practices was quite difficult to apply as NWRMs definition took some time to be finalised (in relation with WG PoM) and the information on NWRMs' implementation and demonstration was fragmented. Instead of best practices, the concept of case studies was preferred. Associated to it, differentiation of "in-depth" and "light" case studies was introduced to include less developed case studies that can provide very relevant information and illustrations. A common database template was developed for all case studies to facilitate the structuring of information collected on NWRM applications. For in-depth case studies, an additional case study factsheet was also used. The latter gives space for additional textual information. And it provides the possibility to elaborate storylines on case studies that are particularly interesting and well documented.

Given the clear demand to provide quantitative information on NWRMs (in particular on their biophysical impact), the availability of (quantitative) information has been one of the primary selection criteria for the case studies. Furthermore, efforts were made to represent all regions (or countries) and to cover as many NWRMs as possible. Particular attention was also paid to case studies proposed by experts who attended regional workshops.

The following steps have been implemented towards the development of a database of Case Studies (i.e. NWRM applications):

- Identification of end-user needs;
- Development of the case study data fields with the sectoral and thematic leaders;

- Development of the data collection template (in .xls);
- First round of data collection and feedback;
- Refinement and updates of the data fields and data collection templates (.xls);
- Diversification between “in-depth” and “light” case studies on the basis of the availability of information;
- Development of Case Study Factsheets (in addition to the.xls templates) with additional text and storyline (addressing implementation, performance, lessons from implementation, implications for policy, etc.) for all in-depth case studies

III.2.1 Initial List of fields

The first step in developing the case study data fields was the identification of end-user needs (design practitioners, policy makers, JRC).

The initial selection of the data fields to be collected for each case study was defined in agreement with the thematic and sectoral leaders within the consortium. An .xls template was developed for guiding the data collection process. A first round of data gathering was launched, focused on the assessment of the selected parameters in every category and their structure.

The different data fields/ parameters have been classified under 6 main groups:

Reference conditions: An application can be an actual test site, case study information, a modelled/simulated example, a prototype/lab application. Each Application relates to a specific NWRM (NWRM codes as assigned in the Look-up table) or to a combination of NWRM. Basic information on the case study is collated under this reference field (application name, type, scale, location, references, etc.)

Design Parameters: These fields store the parameters associated with the specific design of the NWRM(s). Specific information is requested on the general characteristics of the treated area (land use, climate zone, etc.), the installation date, or the lifespan and age of the implemented NWRM. Furthermore, the design specifications of the NWRM are reported, as well as the methods used to monitor the impacts and the preconditions identified as factors of success to the design & implementation phases.

Input data: These fields store the parameters that help understanding of the basic conditions under which the NWRM is installed and operated (info on land use and soil, climate and hydrology, inflows & outflows, etc.)

Biophysical Impacts: This group contains basic data that help assess the performance of the NWRMs. Impacts are grouped into 3 main categories: Hydrological Effects (volume of water retained, runoff reduction, increased infiltration, etc.), Water & Soil Quality (water quality improvements, etc.), and Ecosystem Services delivered (improved biodiversity, flood control, etc.).

Socio-Economic info: This group contains the parameters associated with the socio-economic costs and benefits (in monetary terms) of the NWRM implementation. It includes information on financial costs of NWRMs, compensations costs, administrative costs, wider economic costs and benefits, etc.

Governance: This group addresses issues linked to the governance of NWRM (general governance, implementation barriers, success factors, financing, etc.).

In order to address general data quality issues, a web application was developed for the validation of the NWRM data. It helped checking the data for potential quality issues related to the following categories: (a) invalid data types, (b) missing mandatory and conditional mandatory values, (c) detection of extreme values, (d) exceeding maximum length of text.

III.2.2 Methodology to improve this list and create collection templates

The initial list of parameters as well as the database structure were presented to several stakeholders in order to collect their feedback (CIS WG PoM, EEA, DG ENV, JRC). From the feedback and respective consortium analyses, several issues were identified:

- a) The scope of the case studies should be clarified. Information from scientific articles should be systematically collected and included into the knowledge base.
- b) The dataset should be simple and easily understood. Specific attention was given to the unit of measurement of individual parameters, or the number of parameters (to avoid complexity),
- c) Harmonization and streamlining with EU infrastructure, e.g. linking with WISE, using WFD WB codes or the codes of other databases such as ECRINS and CORINE.

More specifically, the main feedback from stakeholders on the structure of the case study database is listed below:

- Further clarifications by the COM is required on the role and on the future management of the database of case studies (*Nota: transfer to JRC will allow maintenance of this and regular update with new case studies but also potential adaptations of the database*);
- The parameters and issues considered in the database (DB) are very complete. However, it will be challenging to collect information on all fields. Simplification in the structure of the database can increase the applicability and usefulness of the DB. It is recognised that collecting detailed and quantitative data/information for each single field will be challenging and impossible. It is therefore important to clearly distinguish between necessary data and data that will be “nice to have”.
- Specific comments on improvements on the structure of the xls input data file (e.g. to simplify the governance sections, to link LU classes to CORINE, to link the spatial reference data with the EEA data base, to remove ESA from the biophysical impact assessment section, to link quality parameters to the WFD parameters, etc.)

The first round of data collection and entry into the database led to the following conclusions:

- It is very challenging to fill the requested parameters (769 editable fields; 130 mandatory fields) with a sufficient level of detail. Additional input from the expert or practitioner directly involved in implementation activities is always required to achieve a sufficient level of details.
- Simplification of the DB structure is necessary, in particular with regards to the “design parameters”, “inputs”, “and governance” fields. Simplification in the basic descriptive information is also required.
- The NWRM case studies often involve multiple measures from multiple sectors – as it might be expected from the type of integrated management the choice of NWRM

reflects. There may be difficulties in attributing outcomes and costs to individual measures/sectors.

- Not all mandatory parameters are relevant to all NWRM types.
- Some parameter definitions need further refinement and clarification from thematic leaders.

Accounting for the above feedback and results, a second round of data collection was launched following an update of the data collection fields and of the case study DB.

Recognizing further the need to present the DB information in a more consolidated and “storyline-telling” format, where issues around quick-wins, constraints, lessons learned, etc., could be immediately unpicked by end-users (e.g. design practitioners), it was decided to further develop Factsheets for the CS which were the most documented and considered as of “particular interest”. These CS were categorised as “in-depth” CS and factsheets were developed for each of them (an output product able to reflect on a coherent storyline and targeting mostly design practitioners). These have been linked to the DB via specific queries that extract relevant information. Factsheets contain descriptive information on the specific NWRM application (i.e. the implementation of an individual NWRM or of a bundle of NWRM), technical information on key design parameters and monitoring requirements (to allow practitioners to identify similarities and/or discrepancies as compared to their “candidate” site/environment), quantifiable indicators (especially with regards to biophysical and economic impacts, along with possible performance metrics). These can help to grasp the range of benefits and costs and the overall performance/effectiveness of the NWRM(s) implemented, along with key lessons learned on main risks, additional outcomes, enabling factors and preconditions for implementation and effectiveness.

III.2.3 Building the NWRM case studies database

The database has been developed based on a conceptual data model able of storing information related to NWRM case studies. One main goal of its design was to allow for possible expansion of the database with new fields without changing the DB structure. The files from which the database has been populated are stored as well as the original sources of the data. Numerous parameters have been categorized and grouped in tables. The types of the fields have been selected with care so that one can find a number of important quantifiable parameters (integer/real numbers, boolean values, enumerated values) based on which the database can be queried. Other fields store free text with limited (varchar) or unlimited length (text/memo), providing flexibility to add unstructured descriptive information relevant to specific issues. In the next paragraphs, the main entity classes of the NWRM conceptual data model are described, as shown in the E-R diagram in Figure 3. Reference (lookup) tables have the suffix **_ref** and usually they share the same structure.

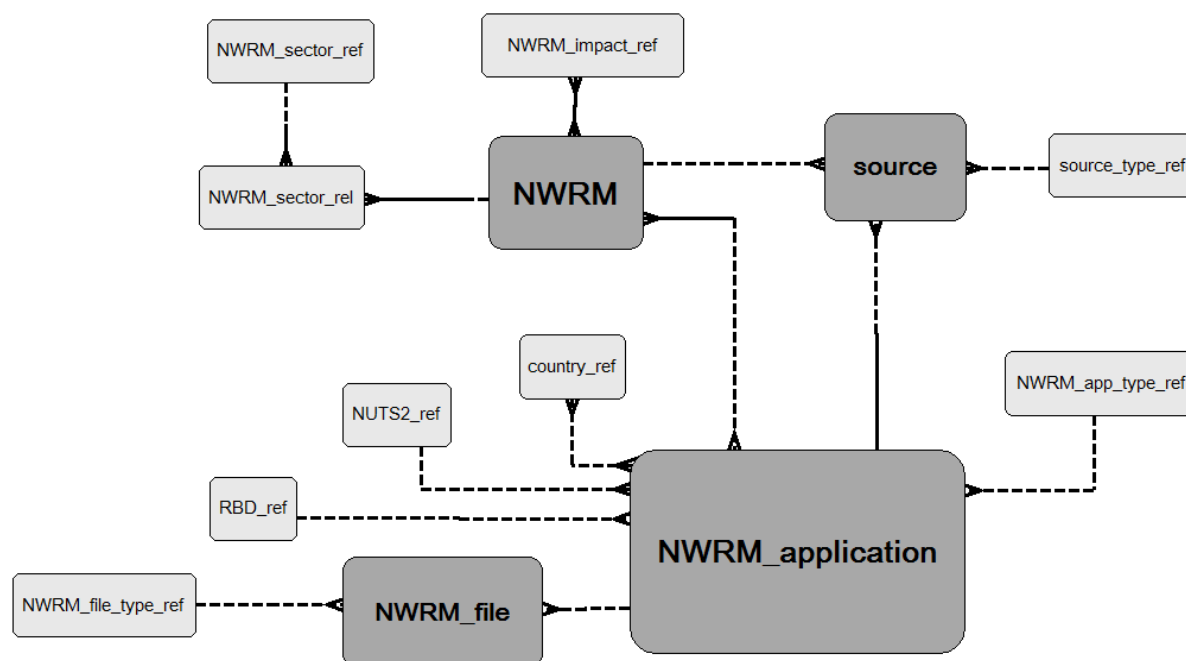


Figure 3: E-R diagram of the basic entities in the conceptual data model

NWRM

This class represents **NWRM**. Entities of this class are not applications of a NWRM (see below for this) but rather a reference list (catalogue) for known and commonly used NWRM types. NWRM are grouped in more general categories like forest, urban, agricultural and hydromorphological measures (see **NWRM_sector_ref**). A NWRM may belong to different sectors. The intended impacts of the NWRM are in general documented by the n:m relation to the class **NWRM_impact_ref**. A field providing a short description/definition of the NWRM (definition) is also available.

NWRM Applications

NWRM which have been implemented (applied) are central to the data model (entity **NWRM_application**). An application has always a geographical reference and may refer to a test site, a case study or modelled results documented in research studies (see **NWRM_app_type_ref**). All entities from this class must have at least one or more references to the sources (see below), from which all information has been retrieved. The reference of an application to one or more countries (in the case of transboundary NWRM application), NUTS II and RBD is documented. A NWRM application must include at least one measure from the reference list of known NWRM, but may as well apply measures from more than one categories (mix of measures defined as “composite NWRM”). The class **NWRM_application** has attributes/properties that refer to the site or case study as a whole. Typical examples are basic information related with the specific location of a site or the name of the facilities. Files related to specific NWRM applications such as the files from which data have been imported into the database, are documented in table **NWRM_file**.

References

The class **source** includes all kind of references that have been used to document NWRM applications or NWRM types, such as journal articles, books, conference proceedings, project reports, websites etc. The attributes of the class are typical for bibliographical references. Known source types are stored in the table **source_type_ref**, while additional information is stored on the attributes source title, source authors, source website (URL), etc. A source may refer to one application of NWRM or one NWRM type.

Parameters

There are several parameters to be considered in order to describe the attributes of a NWRM and assess its applicability and effectiveness. Such parameters refer to the design specification of the NWRM, the inputs, the biophysical impacts, the socio-economic costs and benefits and the governance related aspects. Many of these parameters are common to all measures, whereas others are specific to one NWRM or to a group of NWRM. Parameters are organized in tables covering the following thematic areas:

- Site Characteristics (table app_site),
- Design & Implementation Parameters (table app_design),
- Policy Context, General governance and Design Targets (table app_policy),
- Socio-Economic Information (table app_socioecon),
- Biophysical Impacts (table app_biophys),
- Performance metrics and assessment criteria (table app_performance),
- Monitoring & maintenance requirements (table app_monitoring),
- Key lessons, main risks, implications, enabling factors, preconditions and financing related information (table app_lessons),
- Parameter tables have a 1:1 relationship with NWRM_application tables with a parent-child relationship so parameter tables inherit characteristics from the parent table.

III.3 Sub-task 1b: Collect information to feed the main products: catalogue of NWRM, catalogue of case studies, synthesis documents, glossary

When the project developed, the collection of information and data was conducted by all the experts of the team. The split of countries for the case studies was based on the language abilities of the respective partners, and the team was apportioned between the three key disciplines and the 4 clusters to insure an effective data collection and assessment (see also VII.4).

III.3.1 Collect information on individual NWRM

With the progressive delineation of the individual NWRM, data and information were collected in the different case studies but also in the literature review so as to gather and provide relevant elements in the pre-defined structured template. As indicated above, the template itself was also progressively matured towards its final version and therefore enriched with additional information collected throughout the project duration.

III.3.1.1 Agriculture cluster

Information on the agricultural measures was collected largely from peer reviewed scientific literature and grey literature (reports, trade publications)) including reports synthesising existing water related research and evidence (see for example Somma et al, 2013).

Whenever possible, the evidence used European applications of NWRM to reflect environmental and agricultural conditions. However, in some instances, non-European studies have also been cited. Applications of agricultural measures have in many instances been for reasons that are not directly linked to their NWRM potential (e.g. soil management, pollution mitigation or biodiversity and landscape amenity). The extent to which different agricultural measures can achieve specific objectives of NWRM (water quality, natural flood management or alleviating water stress) will vary across measures. The geographical applicability of measures was determined from data including land cover (European Environmental Agency) and agricultural practices (Eurostat).

A consequence of the multiple objectives that can be addressed by agricultural measures is that the available evidence is often not focussed on the NWRM benefits. Instead the available literature tends to consider one or more of the non-NWRM co-benefits. This has the disadvantage of providing often context specific evidence for a sub-set of benefits that makes evaluating measures for their NWRM potential problematic. Conversely, when the benefits of NWRMs are largely public in nature but the implementation costs are private (although potentially compensated through Rural Development Payments) it is important to have evidence of potential private co-benefits such as improved crop yields, improved soil condition and reduced soil erosion. Evidence of these co-benefits together with implementation costs was identified for a number of agricultural measures and is presented in the associated factsheets. Evidence of wider public co-benefits (e.g. carbon sequestration, nutrient management, biodiversity) is also useful in identifying potential sources of funding and advocacy, for example under Rural Development Programmes and alignment with the activities of environmental NGOs. Uptake of NWRM measures by farmers also depends on a wider range of economic, social and other factors reflecting farm and farmer characteristics (see for example Holstead et al, 2012)

References:

- Holstead, K., Kenyon, W. & Rouillard, J. (2012) Factors that affect uptake of natural flood management features by farmers in Scotland: A review, The James Hutton Institute on behalf of CREW – Scotland's Centre of Expertise for Waters
<http://www.crew.ac.uk/files/publications/Farmers%20NFM%20review.pdf>
- Somma, F. et al (2013) River Basin Network on Water Framework Directive and Agriculture: Practical Experiences and Knowledge Exchange in Support of the WFD Implementation (2010-2012), JRC Scientific and Policy Reports, EUR – Scientific and Technical Research series ISBN 978-92-79-29940-7
<https://ec.europa.eu/jrc/sites/default/files/lb-na-25978-en-n.pdf>

III.3.1.2 Urban cluster

The NWRM that have been classified as 'urban' for the purposes of this assessment are essentially those that also fall under the category of 'Sustainable Drainage Systems' (SuDS). However it is important to recognise that other NWRM can often be relevant to urban areas (for example river and floodplain restoration). And SuDS can be equally relevant in non-urban areas (for example for farm drainage).

The collection of data for 'urban NWRM' therefore focused on the SuDS literature, drawing also information from 'rural SuDS' sources. There is considerable literature on the use and effectiveness of SuDS. The most comprehensive source of information about SuDS remains the CIRIA SuDS manual (Woods-Ballard et al., 2007), which details design, implementation and maintenance requirements for a wide range of SuDS. Information was drawn from the SuDS manual to add to the measures knowledge base. But the manual itself (along with other CIRIA guidance available) still represents the reference for detailed implementation information.

Other recent reports that have collated literature and evidence about SuDS include (amongst others): Blanc, Arthur and Wright (2012) for the Centre of Expertise For Waters (focussing on effectiveness for runoff detention and retention), and the Rural SuDS guidance of the Environment Agency for England & Wales (2012), providing in particular a review of water quality benefits. Further to this, there are a number of organisations and public authorities that seek to encourage the practical implementation of SuDS (in some cases for individual homeowners, as well as developers and town planners) and have produced user-friendly guides in support. Such guides, for example the Cambridge Design and Adoption Guide (Wilson et al., 2009), are often produced at the local level and are relevant to local areas and policies. It is likely that many more local guidance exist than those reviewed during the project.

Additional literature was sourced where there were specific data gaps or to provide more details. And information was drawn from relevant 'urban' case studies that had been developed during the course of the project. Expertise was sought from consortium members (and workshop participants) across Europe to ensure that the suitability and effectiveness of each measure in different climatic and geographic locations was accounted for.

References:

- Blanc, J, Arthur, S and Wright, G (2012) Natural flood management (NFM) knowledge system: Part 1- Sustainable urban drainage systems (SUDS) and flood management in urban areas.
- Environment Agency (2012) Rural Sustainable Drainage Systems (RSuDS).
- Wilson, S, Bray, B, Neesam, S, Bunn, S and Flanagan, E (2009) Sustainable Drainage: Cambridge Design and Adoption Guide.
- Woods-Ballard, B, Kellagher, R, Martin, P, Jefferies, C, Bray, R and Shaffer, P (CIRIA) (2007) The SuDS Manual, CIRIA C697.

III.3.1.3 Hydro morphology cluster

"The field of hydromorphology deals with the structure, evolution, and dynamic morphology of hydrologic systems over time (e.g., years, decades, and centuries)." NWRM entering the Hydromorphology cluster mostly have effects on rivers and associated natural structures like lakes and groundwater tables. The benefits of hydromorphological actions are already known across Europe. But different names, such as Natural Flood Management measures for example, are often used. Although a large number of case studies corresponding natural flood management measures exist, information on the impact, effectiveness and long-term effects of such measures are not well documented.

Information on the Hydromorphology sector and measures was mostly collected from relevant case studies developed during the course of the project. Expertise was sought from

consortium members (and workshop participants) across Europe to ensure that the suitability and effectiveness of each measure in different climatic and geographic locations was accounted for.

References:

Vogel R M, (ASCE library), (2011) Hydromorphology (Journal of Water Resources Planning and Management © ASCE)

III.3.1.4 Forestry cluster

Forest and forestry measures include a wide range of rural and urban NWRM. The measures fall into two broad groups: those that aim to preserve or enhance forest functioning and measures which aim to reduce the potential negative consequences of forest harvesting. Many of the forestry measures have water retention as an ancillary benefit. Control of diffuse pollution and minimizing the negative effects of aquatic biodiversity are the main focus of many NWRM related to forest harvesting (Neary et al. 2009). Amenity values, improvements to air quality and maintenance of biodiversity are the main focus of most urban forestry NWRM (Konijnendijk, 2003). Large-scale green infrastructure measures related to afforestation of forest maintenance can play an important role in upstream flood control by keeping the rain where it falls, or potentially affecting precipitation patterns (Ellison et al. 2012).

Information on the measures was collected mostly from the peer-reviewed and grey literature. The literature searches were complemented by discussions with staff at forest research institutes in the Nordic Baltic countries and flood management professionals working in central Europe and the UK. Information on forestry-related NWRM is available from studies in Europe, Asia and North America. Whenever possible, European information was used.

Forestry sector actors generally respond favorably to guidance on NWRM and urban forests are highly appreciated by city planners and residents. However, there are several challenges with the implementation of forestry NWRM. The wide range of climatic conditions across Europe mean that measures can be geographically localized in their application. There is a lack of awareness of the NWRM co-benefits of some forestry measures and measures are not well integrated into European forest policy. Finally, the large range of scales, from individual trees in urban locations to regional afforestation measures with a spatial extent of thousands of hectares makes it difficult to develop an overview of the range of benefits delivered by forestry related NWRM.

Ellison, D., N Futter, M., & Bishop, K. (2012). On the forest cover–water yield debate: from demand- to supply- side thinking. *Global Change Biology*, 18(3), 806-820.

Konijnendijk, C. C. (2003). A decade of urban forestry in Europe. *Forest policy and Economics*, 5(2), 173-186.

Neary, D. G., Ice, G. G., & Jackson, C. R. (2009). Linkages between forest soils and water quality and quantity. *Forest Ecology and Management*, 258(10), 2269-2281.

III.3.2 Collect information on case studies

The different case studies cover nearly all NWRMs of the catalogue of measures. An overview of all case studies and of the NWRMs covered in each is given in Annex 4. Despite the efforts of the project team, it was not possible to identify case studies for all agricultural or forestry related NWRMs. Whereas for example many NWRMs which affect hydro morphological aspects are carried out in the form of larger projects, measures applied in the agricultural or forestry sector are often individual, small scale applications. For the latter, monitoring of biophysical effects is hardly done. And governance issues to be documented in the case study factsheet are often not applicable at this scale. This information, however, is covered in the individual NWRM factsheets, which fall back on different literature sources to inform the different impact categories (e.g. biophysical, ecosystem service, policy and economic).

With regards to the light case studies, a target of at least two per country was proposed. However, it was not possible to reach this target for all countries as a result of the (small) size of some countries, the current state of implementation of NWRMs, missing monitoring programmes or also the biophysical characteristics of the country (e.g. limestone being the dominant soil type/geology in Malta). However, this missing number of light case studies for some countries was compensated by a higher number of light case studies in other countries (see Table 5), in particular from the Danube region.

In total, 42 in-depth and 83 light case studies have been entered into the project database. At least one in-depth case study is available for each of the 28 EU member states, as well as for Norway and Switzerland. The number of available in-depth and light case studies per country is shown in the following Table 5.

Table 5: Number of light and in-depth case studies per country

Country	In-depth case studies	Light case studies
Austria	2	2
Belgium	2	2
Bulgaria	1	10
Croatia	1	1
Cyprus	1	2
Czech Republic	1	4
Denmark	1	1
Estonia	1	2
Finland	1	2
France	2	5
Germany	4	2
Greece	1	1
Hungary	2	3
Ireland	1	1
Italy	2	2
Latvia	1	2
Lithuania	1	2
Luxembourg	1	2
Malta	1	1
The Netherlands	1	1

Country	In-depth case studies	Light case studies
Norway	1	0
Poland	1	2
Portugal	1	2
Romania	1	10
Slovakia	1	7
Slovenia	1	8
Spain	2	2
Sweden	1	1
Switzerland	1	2
United Kingdom	4	1
Total	42	83

As explained in the section VII.3, case studies can be accessed on the website either through an alphabetical list or through a map geo-referencing them.

III.3.3 Literature review and policy questions

In order to provide information on key questions linked to the implementation of NWRM, 11 Synthesis Documents (SD) were developed, each being attached to one of the disciplinary areas covered by the project (Biophysical Impacts, Socio-Economic aspects, and Governance, Implementation and Financing). They rely on the detailed delineation of what NWRM cover as described in the introducing Synthesis Document n°0, and in structured benefit tables. Evidences included into these synthesis documents come from the literature review, combining references provided in the tender document, additional references identified by project partners, and information collated from case studies (see the <http://www.nwrm.eu/list-of-all-case-studies>) and from the individual NWRM factsheets (see [catalogue of measures](#)). The thorough literature review also helped thematic/disciplinary leaders and experts to feed documents with references to Directives, from relevant reports related to the respective legislation implementation and named in their respective bibliographies. All disciplinary groups are presented below:

Table 1: discipline groups

Discipline Group	Led by	Partner	Name of person to contribute
Technical & Biophysical	Benoît Fribourg-blanc (OIEau)	IMDEA AMEC REC	Carlos M. Gómez Heather Williams Jovanka Ignjatovic
Socio-economics	Carlos M. Gómez and Gonzalo Delacámara (IMDEA)	Enveco SRUC SLU	Mats Ivarsson Alistair McVittie Dennis Collentine
Governance & implementation	Pierre Strosser and Verena Mattheiß (ACTEON)	IMDEA REKK IACO BEF	Gonzalo Delacámara Gábor Ungvári Ayis Iacovides, Maggie Kossida Heidrun Fammler Kristina Veidemane

III.3.3.1 “Biophysical impacts” discipline

Three synthesis documents are dedicated to the biophysical impacts’ dimension of the NWRM providing each a specific angle of understanding. The first one deals with “what are NWRM main biophysical impacts and how are they influenced by basin characteristics?”, the second explain the potential links between NWRM (multiple effects) and achievement of EU policy objectives and the last one presents the methods and tools used to assess NWRM effectiveness

a. Introducing NWRM (available here)

The synthesis document n°1 (What are NWRM?) focuses on the definition of NWRM.

Natural Water Retention Measures (NWRM) are a key contributor to reducing the vulnerability of EU waters and in particular negative effects of floods and droughts (Blueprint 2012). During the past ten years, a set of devastating flood and drought events have occurred. In response to these, many projects and studies on flood protection and mitigation have been carried out (Stella Consulting for DG ENV inter alia). These projects have clearly shown that grey infrastructure solutions alone cannot provide 100% protection as they target most often a single function, and, as stated by the English Environment Agency, “working with natural processes is becoming increasingly accepted”, above all in “flood and coastal erosion risk management policy.”

Several flood mitigation strategies and many River Basin Management Plans (RBMPs) have thus introduced a mix of NWRM with other approaches including hard-engineering works, and it has been increasingly recognised that NWRM provide a wide range of benefits not only for flood control but also for the provision of a set of Ecosystem Services (ES). This is all the more relevant in an environment where the space is becoming rare.

NWRM are a set of measures which can be applied in the RBMP framework under the Water Framework Directive (WFD) or the Flood Risk Management Plans (FRMP) under the Floods Directive (FD). Both instruments target the restoration of aquatic ecosystems and NWRM can play a key role in this. Restoration refers to a large variety of ecological, physical, spatial and management measures and practices which are aimed at restoring the natural state and functioning of an ecosystem to support biodiversity, recreation, flood management and landscape development.

The NWRM concept embraces a complex reality extending beyond floods and droughts. It also embraces a wide set of measures, many of which are already in use, but that were not addressed in an integrated way in the past. Agriculture measures were, for instance, developed to improve productivity of soil or management of water as a key production factor. Urban measures were developed to better manage run off to avoid flooding of lower-lying parts of cities and other disturbances of the urban space.

This synthesis document provides key elements to understand where the concept comes from, what are the alternative names that cover at least in part NWRM and the key characteristics of such measures as compared to structural measures.

- b. *NWRM Synthesis document n° 2 – What are NWRM main biophysical impacts and how are they influenced by basin characteristics? (available [here](#).)*

Biophysical impacts cover all factors that have an influence on living organisms. When narrowed down to the aquatic environment, and particularly in the context of the Water Framework Directive, these are often referred to as water quality, water quantity and hydromorphology. According to their definition, biophysical impacts of NWRM could be understood as the positive consequences over biophysical environment (its structure and functions) resulting from well designed and properly implemented measures (that modify water balances in order to make nature work better). It does not mean they do not have negative impacts but by essence, implementing measures is done with as core objective to have positive impacts.

Nonetheless, many NWRM are relevant beyond the aquatic environment, for example potentially being relevant to terrestrial ecology, soils and, in some cases, air quality. Narrowing down further to Natural Water Retention Measure (NWRM), and “Retention” being the core function targeted, biophysics would mean in the first instance the factors related to the water balance. This first set of impacts is called Direct biophysical impacts: Mechanisms of Water Retention. In the second instance it means all other factors that are enabled or improved by this retention and that can be monitored in or near the aquatic environment, i.e. Indirect Biophysical Impacts resulting from Water Retention (which, as noted above, may include impacts to air and terrestrial habitats as well as the aquatic environment). This document proposes a framework to organise the key NWRM biophysical mechanisms and impacts and link them to their associated Ecosystem Services and to Policy Objectives.

A large part of NWRM biophysical impacts cover the policy objectives of the EU legislation. Addressing the way NWRM biophysical impacts are linked to EU policy objectives is important to understand how they can help policy implementation. While the broader scope is detailed in Synthesis document n°10, the link to the key environmental EU legislation is crucial to convince the targeted end-users of the benefits of applying NWRM. A single NWRM cannot overcome all expectations, i.e. reduction of nutrient inputs or of high waters using NWRM cannot be reached efficiently with one NWRM. Therefore the combination of a set of NWRM is a key factor for good effectiveness. NWRM are by nature measures with multiple benefits, and hence implemented with a set of objectives. It is therefore important to consider some objectives may be covered to a lesser extent than an alternative option. This document focuses on demonstrating all these points.

- c. *NWRM Synthesis document n°3: assessment methods for NWRM (available [here](#)).*

As the previous questions have discussed, increased uptake of NWRM aims to improve and restore the natural hydrological functioning and related biophysical processes of catchments. Here, the document focuses on approaches for understanding how effective NWRM are at achieving individual biophysical impacts including:

- Mechanisms of water retention: slowing and storing runoff and/or river flows;
- Resulting biophysical impacts: predominantly water quality. Other impacts including soil conservation, habitat creation and climate influences are also given some

consideration, but span wide extents of natural sciences and cannot be covered here in full.

Many existing examples of NWRM, and indeed other environmental improvement projects, suffer from lack of quantitative evidence as to their effectiveness. Where post-implementation monitoring is carried out, it is often only for a short period which, in some cases, may be insufficient to allow a measure to become fully effective (for example, woodland development, which will take many years to mature). For example, Feld et al. (2011) note that “Virtually all restoration project evaluations are restricted to a few years after restoration (e.g., 3-5 years), and significant uncertainties remain surrounding the long-term effects and sustainability of restoration measures.” Lack of evidence can make it harder to justify their value and their continued use in future. Therefore, approaches to establishing the effectiveness of a new measure (preferably by monitoring) should be incorporated as an integral part of implementation, not as an ‘added extra’.

It is also extremely important not to limit assessments of effectiveness solely to a single parameter. Considering that one of the main attractions of NWRM is their potential ability to provide a range of benefits, monitoring of only a single parameter is likely to underplay its overall effectiveness and may make it appear less cost-effective in comparison to some other measures, when a full assessment across a range of impacts would show NWRM in a more favourable light.

To add to the complexity, it is not solely the effectiveness of an individual measure at its location that we are interested in. In many cases it will be the contribution of that measure to influencing catchment-scale processes, or even the potential for that measure to be incorporated in to a wider network of measures which overall (but not necessarily individually) influences catchment-scale processes.

It is beyond the scope of this assessment to consider the details of specific monitoring and modelling approaches/techniques, particularly considering how many different types of impact come in to play in relation to NWRM. The focus here is on determining the principles that should be applied in an assessment of effectiveness, which can be transferable across many different parameters and situations.

III.3.3.2 “Socio-economics” discipline

a. *NWRM Synthesis document n° 4 – What are the benefits of NWRM? (available [here](#))*

The document discusses about basic concepts of the benefits of NWRM, illustrated with examples from relevant scientific literature. Benefits of NWRM can be defined as the advantages in terms of human wellbeing obtained from their successful implementation and the achievement of their particular objectives. Benefits can be direct and indirect and its difference is mainly instrumental to integrate in the assessment all the benefits derived from the way the economy adapts to a certain policy strategy. Changes due to the chosen course of action will modify production levels, employment and prices in different areas of the economy. These changes will lead to indirect benefits that can be both private (or financial) and social (or collective) and affect water management as well as other policy areas. However, indirect effects of restoration measures are insufficiently studied and can only be captured through complex macroeconomic models (i.e. general equilibrium and input-output analysis). Still their relevance for policymaking is to be proved.

Nature restoration and protection provide not only primary benefits but also ancillary ones related to the choice of natural means when pursuing their objectives. The former are those directly derived from pursuing the policy's primary aim, while the later are the side benefits of water policy. Primary benefits include improving the water bodies' status, controlling flood risks, reducing scarcity and droughts, etc., and ancillary benefits would then refer to the positive outcomes on climate change mitigation, biodiversity levels, energy savings and all private and social benefits that are not the main intended purpose of water policy. These ancillary benefits (also referred in the scientific literature as secondary benefits and co-benefits) are those derived from the measures but not from the induced improvement in the status of water bodies. Primary and ancillary benefits are important as both might be considered as part of the distinctive character of NWRM. For example, since river NWRMs are multifunctional, whilst contributing to the same objective, they also serve many different policy purposes. This is why ancillary benefits can be defined as the advantages associated to choosing a particular course of action, for example adopting nature-based measures instead of equally effective ones to get to the same purpose (for example, reducing pollution). The widely neglected ancillary benefits provide ground for taking advantage of synergies between different objectives of water policy, as well as opening the ground for advantageous cooperation between different areas of public policy such as water management, spatial planning, rural development, and climate change adaptation and disaster risk reduction.

b. *NWRM Synthesis document n° 5 – What are the costs of NWRM? (available [here](#))*

The document discusses about basic concepts of NWRM's costs, illustrated with examples from relevant scientific literature. The overall economic cost linked to the implementation of NWRMs is not just its financial cost, but also the so-called opportunity costs and sunk costs. Self-evidence of advantages of nature-based measures tends to ignore the opportunity cost of the resources implied and the existence of alternatives that may serve the same purpose. A basic distinction should be made between economic and financial costs, which are often presented as synonyms. Economic costs of implementing a given measure include all the resources, foregone opportunities and other sacrifices required, so that any economic cost is an opportunity cost in itself. Financial costs, on the other hand, include all the cash outflows required to set up all the infrastructures and other features required for the operation once the measure is in place. Despite the relevance of financial costs, others should be considered: opportunity costs and trade-offs are crucial regarding the implementation of river restoration measures. The opportunity cost of these measures refers to the benefits foregone for not pursuing the baseline course of action or for not choosing the best alternative available to a certain measure. Individuals bearing those costs should be identified before implementing the measure, as its performance is highly dependent on its social acceptance. The opportunity costs associated with changes in land use, while rarely explored so far, might have important effects over the social adequacy of NWRM and might result, for example, in local contest, mainly from farmers concerned about the loss of agricultural production and associated tax revenues. Sunk costs, in turn, are those expenditures that, once incurred, cannot be (easily) recovered, since they arise from activities requiring specialized assets that cannot be easily diverted to other uses. These costs include all expenditure applied to research and development, consultancy, project designs, stakeholder involvement, public consultation, negotiation, agreement, etc. These costs are highly relevant to innovative alternatives.

Special emphasis was put on the challenges associated to the quantification of financial and opportunity costs of NWRM. In this regard, though financial costs of NWRMs follow standard and well-established methodologies, comparisons between data from projects (and scientific literature) are still challenging due to the lack of yardsticks as per the assumptions used to estimate costs indicators (such as unitary costs), and in particular the difference between nominal and real prices, the discount rate, the base year, the time span considered, or often the lack of clear distinction of cost and benefits. Additional challenges emerge when assessing a single measure, a combination of them, or when cost estimates need to be transferred to other locations.

c. *NWRM Synthesis document n° 6 – What is the cost-effectiveness of NWRM? (available [here](#))*

The document discusses limitations of the conventional cost-effectiveness analysis (CEA) when applied to NWRMs, suggests an assessment approach and additional relevant information to be taken into account when carrying out this kind of analysis. CEA is an essential methodology to combine the information about the costs, benefits and effectiveness of the different options available (and currently used as to support identifying the least cost PoM within the framework of WFD).

There are a number of drawbacks that may make NWRMs look less attractive than they really are such as: limiting the analysis to a single purpose/effect (thus leading to ignore the multiple co-benefits of the NWRMs); considering only those costs that are measurable in an undisputable way (this is what happens when only financial costs are used for the comparison); and limiting evidence on effectiveness to design conditions (thus ignoring NWRM contributions to multiple water policy objectives). Building a strong evidence base on NWRM performance and, especially, on their cost-effectiveness, is perceived as a crucial step to induce a change in the policy processes and in public awareness. However, the ideal cost-effectiveness indicators are generally easier to build for traditional measures than for NWRMs. NWRMs often contribute to many different objectives at the same time and therefore require to be characterized by different CE analysis, one per each objective (i.e. by a set of cost-effective indicators).

A practical alternative to complete the limited information delivered by CEA consist in complementing the analysis with the opposite indicator as the one used by cost-effectiveness analysis. In addition to identify at what cost can a particular target be reached (a cost-effectiveness indicator), it is possible to gather information about what can be obtained by one euro invested in a particular measure (the value for money). While the first indicator may favour conventional single-purpose measures, the second will shed light information about multiple benefits.

Additional information to take into account when carrying out this kind of analysis is the dependence on local conditions, the relevance of transaction costs and the role of NWRM in delivering other benefits different than water retention.

d. *NWRM Synthesis document n° 7 – Economic assessment methods for the costs and benefits of NWRM (available [here](#))*

The document reflects on the how to assess cost and benefits of NWRM. Assessing financial cost might be straightforward and based upon a transparent, accountable and well-established method, but the identification of other costs (i.e. opportunity costs) and multiple benefits is a more demanding task. A quick survey of the literature and different experiences

covered in the project reveals that the strategies applied to classify, identify and assess the different advantages and disadvantages are as varied as the nature of these benefits and costs themselves. Additionally, methods used must be adapted to available information, and site-specific characteristics.

Usually there are many alternatives to measure the value of any opportunity cost or benefits. In practice, the method is selected through the use of practical considerations such as production losses or the cost of defensive and replacement measures. Thus it is important to explore the reasons that led to the adoption of any particular measure implemented so far.

For practical reasons related with policy relevance and cost of information effectiveness, the most frequently used valuation approaches rely in proxy measures that make extensive use of market information to value changes in welfare due to avoided costs and foregone benefits. These methods are less sophisticated than preference revelation alternatives (such as contingent valuation, stated preferences, hedonic or travel cost methods), but given the state of the art they provide reliable information, easy to communicate to stakeholders and adaptable to local circumstances. These methods are also better suited to consider the marginal and incremental changes characteristic of NWRMs. Valuation of non-market benefits is always a complex issue. NWRMs add a new complexity layer as each of the multiple benefits of particular measures is subject to different and specific valuation strategies depending on data availability and the possibility of building robust connections between the measures, the flow of the benefits obtained from its implementation and the monetary value of these benefits. (Examples of valuation methods applied to assess the social benefits of green roofs: dose-response functions, avoided cost, valuation of indirect benefits, avoided replacement costs, hedonic valuation....)

III.3.3.3 Governance and implementation

With regards to governance and implementation, the following main questions had been further investigated in the synthesis documents:

- a. *NWRM synthesis document no. 8 – Windows of opportunities for Natural Water Retention Measures (available [here](#))*

This synthesis document provides information about the (policy) context in which NWRMs are currently applied and points at the “windows of opportunities” to introduce them in management processes of the different policy areas concerned. The document is structured around sector specific focuses (NWRMs linked to nature restoration, agriculture, forestry or urban development). A focus lies on the European context, and (potential) links to the WFD and FD are made explicit. This is complemented by examples of opportunities created and used at national, regional or local level.

- b. *NWRM synthesis document no. 9 – Barriers and success factors for Natural Water Retention Measures (available [here](#))*

This synthesis document seeks to answer the following question: what are the preconditions to success for an effective implementation of NWRMs by river basin managers and practitioners? In particular, the document is based on:

- Examples from the project's case studies of measures that were implemented across Europe;
- Conclusions and illustrations based on the experience of participants to the project's regional workshops that were shared during presentations and discussions;

- The project's measures factsheets and other synthesis documents;
- An extensive literature review (academic and institutional sources at different levels).

The objective is double: a) to see what worked, what didn't and the reasons that may explain such situations, as well as the ways forward in case a project meets difficulties; b) to come up with operational recommendations for river basin managers and practitioners when implementing such measures.

- c. *NWRM synthesis document no. 10 – Policy coordination linked to Natural Water Retention Measures – Which integration with different European Directives? (available [here](#))*

This synthesis document points out possibilities for policy coordination linked to NWRMs and present examples on how decision makers managed to address related governance issues in an integrated manner by implementing NWRMs. Furthermore, existing methods and tools to select NWRMs relevant for several policy objectives are mentioned. The document provides furthermore evidence on the role (policy) coordination can play for implementing NWRMs. A focus is laid on the WFD and the FD, although it is acknowledged that NWRMs can have a positive impact on several other EU Directives (e.g. Habitats Directive, Drinking Water Directive, Groundwater Directive, Urban Wastewater Directive).

- d. *NWRM synthesis document no. 11 – Financing NWRMs – How can NWRMs be financed? (available [here](#))*

This synthesis document aims at identifying available sources and new opportunities opening up to finance NWRM implementation. This is achieved by:

- Providing an overview of how measures have been financed so far: this includes both a review of the in-depth case studies and an overview of how EU funding sources have contributed so far to NWRM implementation;
- A critical review of the main challenges to financing encountered so far;
- An overview of funding opportunities opening up in the current EU programming period, as well as a short review of promising innovative financing mechanisms involving the private sector.

For detailed information, please refer to the individual synthesis documents <http://nwrn.eu/implementing-nwrn/synthesis-documents>.

III.3.4 Collect information for the glossary

Each partner of the consortium was provided with an account on the knowledge platform so it could complement the glossary on a regular basis. The glossary was therefore enriched throughout the project duration with additions or improvements of definitions, and the completion of links to other terms of the glossary or to external terms. The ontology was progressively developed and enriched to reach a set of more than 100 terms that can be exported as an excel file.

III.4 Sub-task 1c: Handover of the platform

The objective at the beginning of the project was to transfer the platform in the Water Information System for Europe (WISE). As WISE is managed by the EEA, specific

discussions were conducted in December 2013 and February 2014 for identifying the process that would lead to the transfer of the project knowledge base to the EEA.

It became rapidly clear that the EEA could not host the knowledge platform in WISE, as they cannot currently modify the existing WISE infrastructure to accommodate for such type of information. WISE is mostly targeting information on the state of waters and WFD reporting. The focus on the NWRM knowledge base on measures and Case Studies could not be easily integrated.

In Spring 2015, the possibility to link the NWRM knowledge base to the platform gathering case studies and information on adaptation to climate change (Climate-ADAPT) hosted by the EEA was discussed. However the specificities of the NWRM platform (i.e. NWRM factsheets, information from networks, the practical guide, etc.) make it difficult to integrate it into the Climate-ADAPT platform. The EEA therefore proposed to reference the website as a key source of information and to include a sub set of NWRM case studies, particularly relevant to climate change adaptation into the Climate-ADAPT platform.

At the final SC in December 2014, the JRC offered to host the NWRM knowledge platform on its water portal (once the water portal is finalised). The JRC consider the NWRM site as “a very good product and may be the first of (and the role model for) a set of tools designed specifically to assist river basin managers”. At the beginning of July 2015, a webconference was organised to discuss all technicalities necessary to allow for the transfer of the NWRM knowledge platform to JRC. The technical details will be further explored over the summer and the transfer will occur before the end of 2015. This will include: buying the domain name; performing the physical transfer; updating the management and administration rights; slightly adjusting the content of the knowledge base; and redirecting web links to the new platform.

Short documentation will also be provided to allow for an easy maintenance of the system. If human and financial resources are available, a technical meeting and assistance on the platform will be proposed for an interim period.

On the IT aspects, the choice was to use only open source software to avoid part of the difficulties that can occur when transferring such a tool. More specifically the platform uses:

- Server with Linux or windows operating system,
- 2gBytes RAM,
- Hard disk drive 20 GBytes (complete system, split between DB and the rest possible. The DB is around 1Gbytes but the size depends on indexation which speed up access to the data),
- At least two processors but 4 is better,
- Website drupal CMS,
- Search engine server based on SOLR,
- Database developed under Postgres ,
- The server at OIEau is virtualized and uses VMware system but can also use virtualbox software

The transfer will allow the platform to continue to evolve with updating of the content and addition of case studies. It will be necessary to implement a quality control system with a review process for the added content so as to ensure a homogeneous content and its sustainable evolution.

IV Task 2: Launching of a European NWRM community

IV.1 The regional processes

A major objective of the NWRM initiative is to build a European NWRM “community of practice” by bringing together all parties interested in the design and implementation of NWRM, facilitating the creation of partnerships and information exchange.

Four European regions were identified as part of NWRM initiative: the Danube river basin, the Mediterranean Sea region, Northern Europe/the Baltic Sea and Western Europe. These regions were defined for the similarities they can have in bioclimatic, hydromorphological and water management conditions, but they do not have strict geographic boundaries and can overlap.

To achieve this, two main activities have been carried out:

The creation of EU-level and regional NWRM networks through web-based discussion forum, to gather experts and practitioners across Europe. The networks’ objectives were to facilitate sharing of practical experiences, to identify and discuss specific issues and solutions related to regional contexts, and to help build or consolidate partnerships. Practitioners, managers, representatives from the economic sector, experts, researchers and other professionals are welcomed to get involved in the regional networks;

The Regional workshops, an occasion for experts, practitioners and NWRM project experts to meet and discuss about the most relevant features of NWRM implementation in each region.

The paragraphs below provide a description of activities carried out; the following chapter will focus on stakeholders’ interactions within the networks, and the main messages and lessons learnt.

IV.1.1 The regional fora

A **web-based NWRM discussion forum** was created to host the NWRM community and build networks of experts and practitioners. On this platform, group members can exchange ideas and experiences on NWRM, as well as discuss about specific challenges and priorities specific to different regional contexts.

At the EU level, the forum aimed to bring together existing initiatives and research projects on NWRM. However, NWRM implementation faces different challenges in different European regions, depending on factors like for example bioclimatic and hydro-morphologic conditions. For this reason, four regional networks were created as sub-groups of the main group: Baltic Sea network, Danube network, Mediterranean network and Western network. Discussions on the regional groups can focus on these regional characteristics, challenges and priorities, and can allow the identification of best practices as well as practical solutions to common issues.

On a practical level, five dedicated discussion groups were created on LinkedIn, a widely used professional social network: an EU-level NWRM Group, collecting all members and discussion topics across the four regions, and four regional sub-groups. The LinkedIn Groups are managed by regional coordinators. When establishing the networks, potential

participants were identified and personally invited in all 28 European countries. The main features of the five groups are summarized in the table below.

Table 6. Main features of the regional discussion fora

Group	Discussion topics	Members	Link
NWRM Group	The Group collects all discussion topics initiated in the four groups, as well as cross-cutting discussion topics. Thirty-two topics have been posted so far, ranging from project-related announcements (e.g. workshops) and requests for feedback, to members' posts highlighting NWRM practices and events, new relevant publications, training courses.	298	http://www.linkedin.com/groups?gid=7410406&trk=groups_member_s-h-dsc&goback=%2Eanp_7410406_1393493064943_1
Mediterranean network	Five discussion topics including project-related announcements (workshop) and a post on the use of NWRM in arid Mediterranean river basin.	72	http://www.linkedin.com/groups?gid=7424029&trk=my_groups-b-grp-v
Western network	Eight discussion topics including project-related announcements (workshop) and posts on "NWRM in the news" –recent press articles on flooding issues in the area and the need for NWRM.	30	http://www.linkedin.com/groups?gid=7418108&trk=my_groups-b-grp-v
Baltic network	Three discussion topics including the workshop announcement and a reflection on the NWRM concept and definition.	54	http://www.linkedin.com/groups?gid=7423083&trk=my_groups-b-grp-v
Danube network	Eleven discussion topics including the workshop announcements, feedback from the workshops, information on case studies selected for the project, examples of good practices.	47	http://www.linkedin.com/groups?gid=7424028&trk=my_groups-b-grp-v

Beyond activities going on within the LinkedIn groups, the networks played a crucial role in providing a "meeting place" for NWRM experts and practitioners, especially those participating in the regional workshops and willing to keep in touch with project activities and the project team.

The question now is how to ensure that these groups of people continue to live and exist after the end of the NWRM initiative. Solutions for following-up groups' activities can differ from one region to the other, depending on existing networks and on-going activities related to river basin management. Some first suggestions include:

- Having a dedicated group of Water Supply and Sanitation Technology Platform (WssTP);
- A poster session including the NWRM PowerPoint presentation, a computer to access the platform and the distribution of the leaflet and some printed copies of the guide at Euro INBO after the end of the project;
- Danube network: transfer of contacts to ICPDR;

- Baltic network: partners responsible for developing and maintaining the regional network have developed a EU LIFE proposal (WFD and FD implementation at urban areas in Hamburg) which includes practical applications of NWRM among project activities. The proposal was submitted to the call of 2014. The project was not awarded. But, the partners are preparing a revised proposal for re-submission by 7 October. The project concept was developed also based on the case study data base and the Baltic Regional network. Project activities will, among other things, include: (i) a new, wide pilot NWRM case integrating WFD, FD and quality of life (The project area in Hamburg (sites where NWRM shall be implemented) is densely populated, also used for recreation of local inhabitants. The project aims at addressing flood management issues and at the same time to keep areas accessible and attractive for local inhabitants); and (ii) a socio-economic impact assessment. The proposal includes an international exchange action with 4 thematic workshops, to which members of the Baltic regional NWRM network will be invited.

Furthermore, the consortium acknowledges and welcomes the inclusions of NWRM as priority thematic focus of the new EU environmental funding programmes and its water policy section (LIFE MAW 2014-2020). The outcome of the current project, its stakeholder networks as well as the case data base, will be a very good basis to develop future LIFE projects and keep the networks vital by including their actors into project proposals on national and transnational level.

The regional discussion fora are still active on LinkedIn. Both discussion fora and the Regional Workshop (described below) have been an occasion for research and practitioners to get to know each other and establish new relationship and collaborations.

In the autumn of 2015, a further small collection of case studies will be conducted and will be used to further interact with the dedicated LinkedIn groups. The future of these groups will be as well addressed with DG ENV to define the handover of the groups either directly to JRC or to DG ENV, or else how to keep them alive.

IV.1.2 The Regional Workshops

Two rounds of Regional Workshops were organized in each region, in January and over the summer 2014. The two rounds of workshops were held in different stages of the project and had different objectives.

In the first round, the four workshops had common objectives, and their agendas were built around common building blocks –this ensured coherence and comparability among activities in the four workshops. The overall objectives of the first round of Regional Workshops were to:

- Update participants on activities within the NWRM initiative and collect their feedback;
- Consolidate the exchange of experiences and knowledge initiated in the regional networks and web fora, ultimately strengthening the regional networks.

The 1st Regional Workshops were very effective in providing a shared **overview of NWRM definition and implementation in the four regions**, in terms of main water management issues to be addressed, main features of NWRMs and implementation challenges. The

workshops also proved to be very effective in bringing people together and stimulating exchanges on NWRMs, and ultimately they had a crucial role in consolidating the networks.

The 2nd Regional Workshops were then the opportunity for moving one step ahead and gaining a deeper insight on the **core water management issues and related NWRM applications** in the four regions – or, in other words, on core themes.

Overall, the **main focus** of the 2nd workshops was on ‘real world’ applications of NWRMs and the **practical aspects of their implementation**. A great space was given to **contents and discussions about NWRM implementation experiences** in the different MS, to match the knowledge gathered during the project with the operational needs of water stakeholders. The knowledge provided by the case studies collected by the NWRM initiative fed the discussion of the practitioners, as it was felt that this type of approach would provide a deeper insight on NWRMs and a valuable input to the NWRM project. The **links with other project outputs** (i.e. the knowledge base and the guidance) were ensured through different mechanisms in each workshop.

A key objective of the second workshop was to **stimulate participation and discussions**, and this can only be achieved by developing an **effective format**. Examples of format that were developed in the four regions include, among other things, interactive sessions based on one or more case studies, on which participants and NWRM team members could work together on the objectives to be achieved, challenges and issues to be addressed and possible solutions.

The **target audience** of the four workshops was tailored on the core theme of each workshop. Similarly, the focus theme and approach varied across the four regions, to account for the specific regional characteristics and features of NWRM implementation.

The main features of the two Regional Workshops held in each Region are summarized in the table below, and further discussed in the following paragraphs.

Table 7. Key information on the Mediterranean Region Workshops

Mediterranean Region

	First Workshop	Second Workshop
Date and venue	January 28-29, Madrid (ES)	September 11-12, Torino (IT)
Main theme(s) and objective(s)	<p>The workshop agenda included the following themes:</p> <p>Presentation of project activities;</p> <p>NWRM: main concepts and issues in the Mediterranean area;</p> <p>NWRM: case studies on forestry, agriculture and urban measures;</p> <p>Biophysical and socio-economic impacts of NWRMs;</p> <p>Getting feedback on project activities: the knowledge base and the Practical Guidance.</p>	<p>This workshop has been designed both to link NWRM to different policy challenges (including those framed by the Water Framework Directive and the Floods Directive) and also to emphasise on the multi-benefits of these measures, as linked to different policy aims (natural flood management, drought risk mitigation, biodiversity conservation, climate change adaptation, etc.).</p> <p>The workshop agenda included the following themes:</p> <p>The multiple benefits of NWRM – Water retention: a means to different ends</p> <p>NWRM as part of ecosystem-based management approaches</p> <p>Facilitated role playing in break-out groups: implementing NWRMs....in practice;</p> <p>Supporting NWRM design and implementation: the knowledge base and the Practical Guidance;</p> <p>Breakout groups on: (i) NWRM within the context of climate change adaptation; (ii) NWRM within the context of disaster risk reduction; and (iii) NWRM as a catalyst for policy co-ordination;</p> <p>Inputs for the WFD CIS process – Panel of policy makers and practitioners.</p>
Format	Plenary and break-out groups presentations/ discussions	Interactive format - Plenary and break-out groups' presentations/ discussions, the panel of policy makers and practitioners and the role play on one 'real-life' case study.
Participants	39 participants	33 Participants

Table 8. Key information on the Western Region Workshops

Western Region

	First Workshop	Second Workshop
Date and venue	January 22-23, Brussels (BE)	July 1-2, Strasbourg (FR)
Main theme(s) and objective(s)	<p>The workshop agenda included the following items:</p> <p>Presentation of project activities;</p> <p>Practical applications of NWRMs in the Western Region – most of the case studies were about Natural Flood Management, clearly indicating which is the main feature of NWRM implementation in the region and which are the main issues to be addressed by NWRMs;</p> <p>Breakout group session on understanding NWRM and what this project should seek to contribute;</p> <p>Breakout group session on main thematic areas: nature, forestry, agriculture and urban.</p>	<p>The Workshop was dedicated to discussions on how to adapt catchment management for widening the potential of NWRMs. The main discussion topics will include:</p> <p>Current policy and planning frameworks for NWRM implementation;</p> <p>Existing links between NWRM implementation and the WFD;</p> <p>Experiences with NWRMs implementation in biodiversity management and climate change adaptation;</p> <p>Financing: current financing frameworks; opportunities and challenges for diversifying financing sources in an integrated catchment-wide perspective;</p> <p>Integrated (interconnected) planning at the catchment level: opportunities and challenges for strengthening integration;</p> <p>Opportunities and challenges for strengthening the links between NWRM implementation and implementation of the relevant EU Directives (WFD, FD, Habitats/Bird Directives, Climate Change Adaptation Strategy).</p>
Format	Plenary presentation/ discussions and breakout group discussions	Highly interactive format, plenary presentations and discussions, round table discussions with water policy makers, role play on three 'real-life' case studies
Participants	<p>32 participants</p> <p>Researchers, public authorities (EC, ministries, local administrations), practitioners</p>	<p>46 participants</p> <p>Main target: water catchment managers. Other participants included national and local policy makers, NGO' involved in catchment management, NWRM practitioners.</p>

Table 9. Key information on the Baltic Region Workshops

Baltic Region

	First Workshop	Second Workshop
Date and venue	January 30-31, Riga (LV)	June 10-11, Gimo (SE)
Main theme(s) and objective(s)	<p>Main theme: Integration of natural water retention measures (NWRM) into river basin management in the Baltic Sea Region</p> <p>The workshop agenda included the following items:</p> <p>Presentation of project activities;</p> <p>Benefits of NWRMs; how NWRMs relate to RBMPs;</p> <p>Work group session: how to implement NWRM in programme of measures of RBMP?</p> <p>Breakout group presentation on practical NWRM applications in three thematic areas: agriculture, forestry, urban environment;</p> <p>Building common understanding on NWRMs.</p>	<p>Main theme: Urban-rural trade-offs as a solution for urban flooding</p> <p>The following key questions were addressed during the workshop:</p> <p>What are the key issues and challenges faced when implementing NWRM for flood risk management?</p> <p>What additional green infrastructure solutions could act as NWRM? From a flood risk management perspective, what features do they share?</p> <p>What knowledge should be produced by this pilot project for supporting the design and implementation of flood risk related NWRM across Europe?</p> <p>Which issues should receive specific attention in the practical guide that will be developed as an outcome of the project?</p> <p>What is the best way to mobilize stakeholders and other actors in the networks and workshops organized in the different regions?</p>
Format	Plenary and breakout group presentations/ discussion, working group discussions.	Plenary presentations and discussions, presentations of 3-4 exemplary case studies and discussions in working groups.
Participants	<p>45 participants</p> <p>Researchers, public authorities (EC, ministries, local administrations), practitioners</p>	<p>32 participants</p> <p>Municipalities that have some flood problem; Expertise on regulated drainage in agriculture & forestry, wetland restoration, general water retention; National/regional agencies: Flood Directive and/or WFD</p>

Table 10. Key information on the Danube Region Workshops

Danube Region

	First Workshop	Second Workshop
Date and venue	January 28-29, Szentendre (HU)	June 23-24, Bucharest (RO)
Main theme(s) and objective(s)	<p>The workshop agenda included the following items:</p> <p>Presentation of project activities;</p> <p>General concepts on NWRMs;</p> <p>Linking to the CIS process in the Danube RBD;</p> <p>Practical applications of NWRMs in the Danube region and elsewhere in Europe;</p> <p>Thematic group sessions with presentation on NWRM applications in agriculture & Forestry, Urban areas, Natural areas;</p> <p>Building common understanding on NWRMs.</p>	<p>The workshop focused on:</p> <p>Multi-benefits of NWRM concerning water harvesting water and flood protection</p> <p>Ecosystem protection and NWRM and the wider use of NWRM in reaching a wide range of water objectives</p> <p>Needs in policy integration in support to implementation of the NWRMs</p> <p>The contribution of <i>Blue Water and Green Water</i> to the multifunctional character of agriculture and land in the Danube Region</p> <p>Socio-Economic aspects.</p> <p>The idea is to support countries in their preparation for the 2nd round of RBMPs in general and in integrating implementation of the NWRM in the forthcoming RBMPs and FRMPs, with an analysis of their cost-effectiveness and alternatives.</p>
Format	Plenary and breakout group presentations/ discussions; site visit	Plenary presentations and discussions; thematic group discussions (agriculture & forestry, urban, nature) structured around key questions.
Participants	<p>43 participants</p> <p>Public authorities (ministries, water agencies, local administrations), researchers; some practitioners and NGO's representatives</p>	<p>39 participants</p> <p>Authorities, practitioners, researchers and other stakeholders from the Danube region</p>

IV.1.2.1 Mediterranean Region

The objective was both ambitious and exciting: to catalyse a community of practice on NWRM in the Mediterranean that could take over the study's outcomes once the project itself is completed. Conditions have been created for network members to enhance their understanding of the functioning, intended benefits and effectiveness of the NWRM, to pool expertise on the design, selection and application of NWRM, to build or consolidate partnerships, to foster the use of NWRM in the new water planning cycle starting in 2015 (or even better in the third planning cycle, given the timing of the project), and to promote a

policy agenda tackling main challenges related to implementation (financing, co-ordination of water and land-use policies, etc.).

The Mediterranean network on NWRM, as above, has covered Portugal (despite being an Atlantic country), Spain, (southern) France, Italy, Malta, Greece, Cyprus, and Croatia (which is also part of the Danube regional network). Mediterranean relevant contributions were taken into account from EU candidate countries such as Turkey.

The web-based discussion forum was set based on Linked-In (<https://www.linkedin.com/groups?gid=7410406>). The Mediterranean Network sub-group (or sub-forum) gathers 72 members (the highest number amongst NWRM Regional Networks) not only from the countries involved in the network, but also from other Member States, of the European Commission and beyond. The forum has been used to liaise with members, to post announcements of forthcoming events, to send invitations to specific practitioners and to share relevant information linked with the initiative. Besides, The Mediterranean Network has been contributing to the general discussion forum, where members from other networks also shared relevant information.

The Mediterranean Network has managed to engage experts that have been actively contributing to the initiatives, not only attending to the workshops, but also providing meaningful insights on case studies, and helping us understand the specificities of each particular case or national context. Some of these experts have been key to reach a deeper understanding of the measures and their implementation.

Furthermore, the network has served to create links for further researches linked to the topic among members of the academia, and to help water-planning officers to better understand NWRM so that they can foster their implementation at a catchment scale.

In addition to the web-based community of practice described above, two 2-day regional workshops were held in 2014 and the above table summarises key aspects. The first one was held in Madrid (Spain), on January 28th-29th. The second one took place after the summer break, on September 11th-12th, in Turin (Italy) benefiting from the sway of the activities of the Presidency of the Council of the European Union – Italy is currently the incumbent country. The workshops were designed and actively facilitated to tackle key knowledge gaps and barriers, as well as to review practical implementations of NWRM, and to foster knowledge and experience sharing among participants.

The **first workshop** aimed at introducing NWRM and shedding light on what was commonly understood under that notion, as well as presenting the NWRM initiative and regional process to the invitees, who were also part of the community of practice. The workshop was also designed to create a discussion floor where participants could share their views on pre-conditions, constraints, difficulties, transaction costs, success factors, etc., that were relevant to the design and implementation of NWRM, emphasising on the practical relevance of these measures for the next planning cycles within the WFD (mostly the third one, taking into the account the timing of this pilot project) and other EU directives. Finally it was meant to be an opportunity to collect views on the structure of the knowledge base, and its functionality to extract information, to identify expectations vis-à-vis practitioners on the aims of the practical guide, and to agree on follow-up steps for the regional network, while encouraging active contribution to the case studies.

The **second workshop** was designed (based on lessons learnt from the previous workshop and also distilling the key elements for analysis in the project) both to link NWRM to different

policy challenges (including those framed by the Water Framework Directive and the Floods Directive) and also to emphasise on the multiple benefits of these measures, as linked to different policy aims (natural flood management, drought risk mitigation, biodiversity conservation, climate change adaptation, etc.). Furthermore, the focus placed emphasis on the assessment of NWRM from a technical (biophysical) perspective and also from a financial and economic one.

Participants in both workshops were invited according to the main topics to be discussed during the workshops, their expertise on NWRM, and their involvement in the NWRM initiative. Also, the selection was based on reaching a balanced representation of different stakeholders and a wide geographical distribution. Participants were mainly river basin managers (from water planning units), local practitioners dealing with NWRM implementation on the field, researchers and academics working on related issues, environmental protection organizations, international organizations with activity in the Mediterranean region, and other sectoral managers.

During the two regional workshops organised within the Mediterranean and throughout the whole projects, stable contacts were made with:

- Research institutions: IAS-CSIC (Spain), CEDEX (Spain), Croatian Forest Research Institute (Croatia), Water Research Institute (IRSA-CNR, Italy).
- Academic institutions: Ege University (Turkey), Dokuz Eylul University (Turkey), Universidade de Trás-os-Montes e Alto Douro (UTAD, Portugal), CESAM / Universidade de Aveiro (Portugal), Universidade do Porto (Portugal), Universidad de Córdoba (Spain).
- Technical experts (SMEs): Bio3, SuDS S.L., IRIDRA Srl. (Italy)
- Water and regional authorities: Regione Lombardia (Italy), Regione Piemonte (Italy) Segura RBA (Spain), Duero RBA (Spain), Miño-Sil RBA (Spain), and Tagus RBA (Spain).
- National authorities: Ministry of the Environment (Italy), Ministry of the Environment, Energy and Climate Change (Greece), Hellenic Agricultural Organization “Demeter” (Greece), Ministry of Agriculture, Food and the Environment (Spain), Ministry of Agriculture, Natural Resources and Environment - Water Development Department (Cyprus).
- Associations or other public services: Malta Water Association (Malta), Lonjsko Polje Nature Park Public Service (Croatia)
- International organizations: IUCN, Plan Bleu, Union for the Mediterranean.

IV.1.2.2 Western Region

The two workshops formed the focal point of developing an NWRM community for the Western region. Both workshops were interesting and informative sessions, and represented an evolution in the understanding and awareness of NWRM.

The **first workshop** provided an opportunity for the project team to understand the level of awareness and interest in NWRM. The workshop participants were mainly in regulatory and academic roles, and this was valuable for developing understanding of a concept that, at

least under the name of NWRM, is relatively in its infancy. Hence the input of academics (to provide detailed studies and evidence) and regulatory authorities (to establish a consistent basis and awareness for the use of NWRM) was particularly appropriate.

The **second workshop**, focused on how to adapt catchment management for widening the potential of NWRMs –the main theme was developed across highly interactive sessions. Thus, participants were mainly selected among water catchment managers across the Western Region; however, participants also included national/local policy makers, NGOs and practitioners, to ensure a representation of all relevant stakeholders. The involvement of water catchment managers and practitioners also ensured that project deliverables are appropriately focussed and designed to be of practical use.

Good feedback was received from participants after the workshops, and some practitioners are now in regular contact to form working groups and share experiences (for example participants in the second workshop from UK and Ireland).

IV.1.2.3 Baltic Region

A wide group of stakeholders participated at the two workshops (30-31 January in Riga, Latvia and 10-11 June in Gimo, Sweden): in January the participants were invited having in mind the four thematic focusses of the project when discussing NWRM: agriculture/rural and riparian areas, forestry/commercial forest management areas, protected areas/(mostly) wetlands and urban areas/heavily modified water bodies at local level. 45 stakeholders from Finland, Sweden, Estonia, Latvia, Lithuania, Poland, Germany and Denmark gathered representing national competent authorities (ministries and their sub-ordinate structures), scientific institutions (researching on technical solutions for optimum NWRM), advisory services and NGOs and guests from the NWRM project consortium representing Western European Region. At the second workshop in June the participants were invited according to the thematic focus of urban/rural trade-off as one of the most significant issues for the Nordic-Baltic regions for successful NWRM. 33 participants from the same countries' national competent authorities, municipalities, regional river basin management authorities, experts on economics, eco-system services and cost-benefits of measures as well as guests from the Mediterranean and Western regions presenting practical cases of urban/rural interlinks.

While at the first workshop the regional coordinators tried to reach an overall understanding with the group on the meaning of NWRM for the Nordic-Baltic region coming to the conclusions as indicated above, the second workshops aimed at an in-depth discussion on solutions for a thematic focus found the most relevant for the region (the urban/rural interlink and trade-off potential).

Both workshops received a very positive feedback from the participants on the actuality of the topic and a commitment to further participate in the regional network respectively an expression of interest to receive further information materials, documentation and stay connected via the project platform.

IV.1.2.4 Danube Region

To improve communication between project team, partners and stakeholders, and to raise awareness and knowledge improving common understanding of effectiveness, costs and benefits of the Natural Water Retention Measures in the Danube region, the discussion forum was created in the LinkedIn Social Network. This group complemented the CIS

process in the creation of a NWRM community Europe wide, linked the different regional networks creating synergies and improved collaboration with the International Commission for the Protection of the Danube Region (ICPDR) and its technical experts, participating in on going activities as the assess of the 1st River Basin Management Plan (RBMP) and the preparation of the 2nd one.

Since December 2013, after the beginning of the project, the Danube regional forum was placed online as sub-group of the Natural Water Retention Measures (NWRM) group. The Danube regional forum comprises all EU countries sharing the Danube River Basin – Germany, Austria, Check Republic, Slovakia, Hungary, Slovenia, Croatia, Romania and Bulgaria. In addition, stakeholders from Bosnia and Herzegovina, Serbia, Montenegro, Ukraine and Moldova have been also invited to participate in the Danube Network.

It is at date been followed by 45 members, including project team members from the other networks, regional and local experts, lecturers, researchers, decision makers, NGOs representatives and other stakeholders from the Danube River Basin region and other European countries.

The web-based discussion forum fostered regional presence and served as an interactive tool which let participants to share related information on NWRM with a wide EU audience, thus promoting the measures that use natural process with direct impacts on the hydrological regime, water quality and quantity management and ecosystems protection. The users are also updated with the last news and activities within the project and the region, and invited to publish any relevant information, case studies, share experiences and knowledge, think together and be part of the NWRM community of practice.

With the main participation of our leader partners, Jovanka Ignjatovic and [Gábor Ungvári](#) comments were posted in the forum giving information about the progress and activities of the project, as well and other news and studies on the topic and information about the 1st and 2nd Workshops in the Danube region like process, key messages, outcomes, publications, and case studies.

The two regional workshops were organised, the first one in Szentendre (Hungary) in January and the second one in Bucharest (Romania) in June 2014. The general aim of both workshops was to establish regional NWRM network of practitioners and interested parties within the Danube River Basin, to raise awareness on the potential role NWRM can play in future WFD, FD or adaptation plans and to exchange experiences related to the NWRMs.

For the first workshop, the targeted groups were mainly decision makers and authorities, as well as International organizations (the ICPDR, ISRBC, UN FAO, etc) and other actors at regional level (WWF, IAD, etc). The main results were expected concerning national plans and actions related to the Common Implementation Strategy (CIS) process, identification of good practices and experiences in implementing NWRM at national level, as well as identification of needs regarding the preparation of the second WFD management cycle and the development of the 2nd DRBM Plan and the Flood Risk Management Plans. For the second workshop, focus was brought further, involving more academia, planners and business sector with the intention of emphasizing further benefits from NWRM, their favourable impacts on environment and economy. In addition, existing financial mechanisms for investments have been discussed.

Good feedback was received from participants after the workshops. The Danube Region Network highlighted its appreciation for the activities of the project and suggested that they

support the follow up of the current project and continuation after the lifetime of the project. Furthermore, they stated satisfaction with the information communicated during the workshop and its outcomes.

Concerning expectations from the project, participants highlighted a need to develop a practical guide for implementation of NWRM and tools to promote innovative and cheap solutions. More support is expected from the EC for these kind of measures and to simplify funding mechanisms in order to speed up the uptake and implementation of innovative technologies.

V Task 2 – Implementing NWRMs in the four Regions: a view from the regional processes

V.1 Introduction

The regional processes were not only successful in bringing together NWRMs communities in the four regions, but they were also able to unlock a wealth of information and knowledge on NWRM implementation “on the ground”, through the contributions of experts, practitioners and policy makers from the four regions. The workshops provided the ideal ground for these exchanges: presentations, discussions, policy panels and role games allowed to highlight the key features of NWRM implementation in the four regions, as well as major opportunities for and challenges to implementation.

The following sections highlight, region by region, the following aspects:

- General overview and geographic features;
- Main NWRMs implemented in the region;
- Key messages from the workshop;
- Interactions and synergies with regional stakeholders.

The work on regional processes was conducted in very different regions of Europe so, although a basic common approach was outlined at the beginning, the approaches to regional workshops and discussions were different in the four regions, to adapt to the specific characteristics of each of them. This is also reflected in the way the work on regional processes is reported in the following sections: although there is an attempt to follow a common structure, the contents of each section reflect the differences among the four regions.

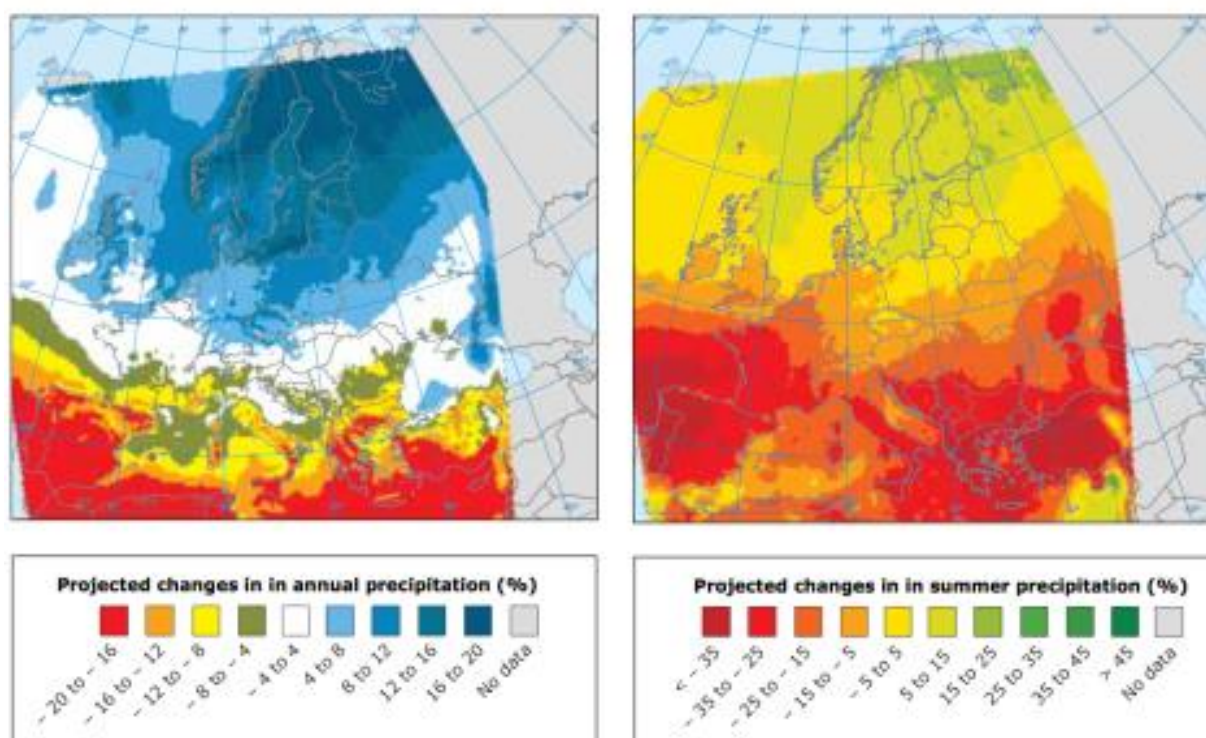
The last sections of this chapter will then attempt to identify common trends as well as differences in NWRM implementation, with a particular focus on implementation challenges and opportunities.

V.2 Mediterranean Region

V.2.1 Introduction to the region

Some specific features of Mediterranean basins point out at the relevance of adequate incentives for water retention in an area where flood management is increasingly relevant but building resilience to water scarcity and drought is still a critical water policy challenge.

The spatiotemporal rainfall and runoff variability, particularly pronounced in some areas of the region, shapes the particularities of the Mediterranean basins in terms of water resources availability and distribution. Mediterranean rivers have large periodic floods, transporting significant amounts of sediments, shaping braided channels, while many streams are intermittent or ephemeral.



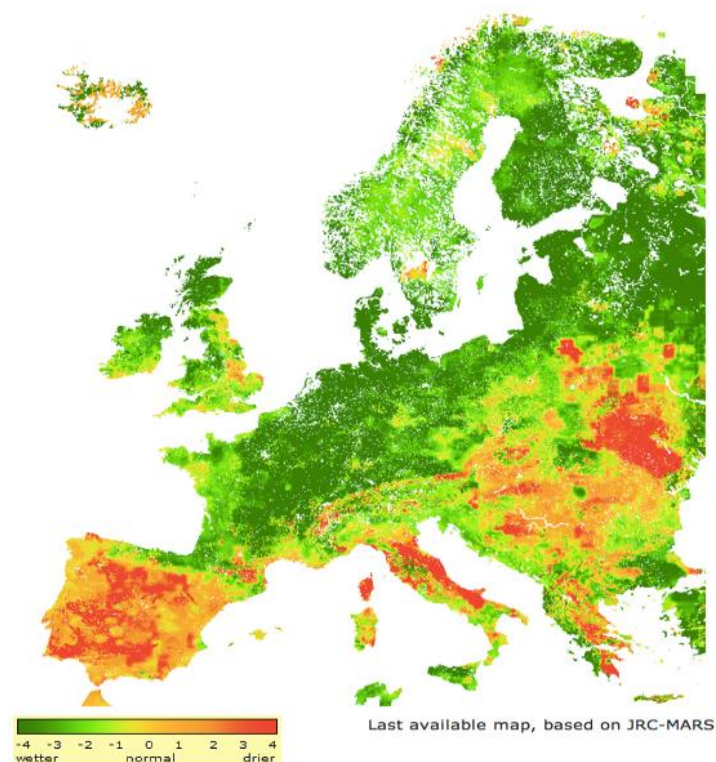
(Source: EEA (2012))

Figure 4: Projected changes in annual (left) and summer (right) precipitation (%) between 1961-1990 and 2071 – 2100

Overall, these rainfall and runoff patterns concur with the intensive use of water resources, mostly in agriculture, in some cases due to a quite complex system of storage and regulation infrastructures (dams, reservoirs, and other impoundment structures), part of which have induced significant hydro morphological alterations. Downstream reaches are commonly deprived of high flows, which carry sediments, modify channel morphology, and maintain habitat complexity.

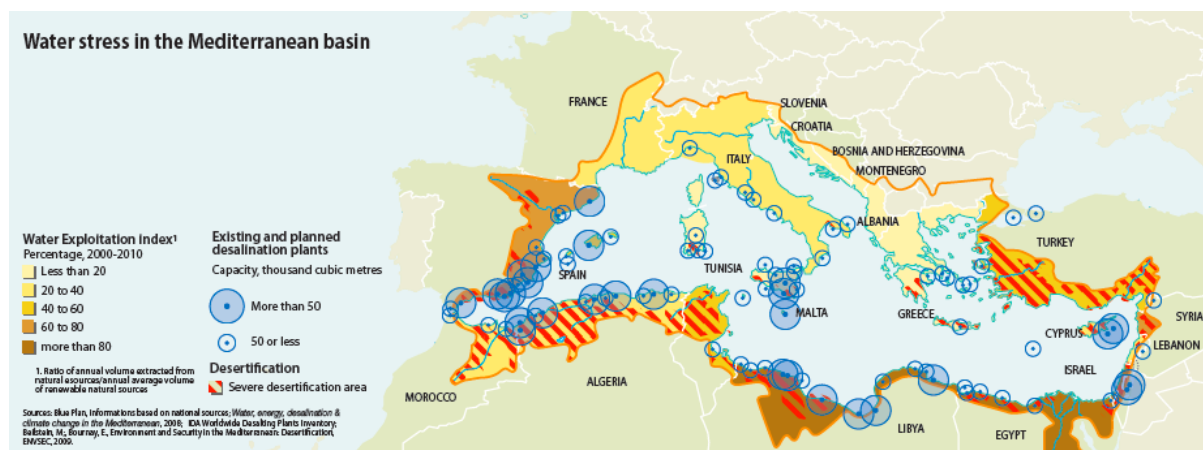
Given the limited decoupling between water use and economic growth trends, growing water demand has led to increasing water scarcity and related risk and vulnerability. In some cases, this is also the result of the lack of coordination of sectoral policies that, in some Mediterranean countries, has led to oversized infrastructures and increasingly idle (and sometimes derelict) facilities. Additionally, it is common to find flawed enforcement (and inadequate structure) of water use rights, mostly regarding groundwater resources, and over-allocation of surface water use rights, leading to potential (often also actual) overexploitation.

The fact that drought events are becoming more frequent in the Mediterranean basins, where average annual demand of water is already higher than long-term renewable resources (i.e. availability), has led to an increased uncertainty about the reliability of water supply exacerbated by climate change. These critical issues call for improved adaptation mechanisms and strengthened resilience, both in terms of demand reduction and increase on the supply side.



(Source: JRC-MARS, 2013)

Figure 5: Increasing drought exposure



(Source: GRID-Arendal (2013))

Figure 6: Overview of water stress in the Mediterranean basin, highlighting water exploitation as well as existing and planned desalination plants

In most water scarce areas, competitiveness of both the urban and rural economy is heavily dependent on the availability of a sufficient and reliable provision of water services in particular for agriculture, agro-food industries, and tourism. Opportunities can be identified to reduce water use (e.g. by increasing water use efficiency in irrigation) or to enhance availability. Increasing the water stored in aquifers through natural recharge facilities such as ponds, temporary attenuation of runoff by low retention dykes etc., provides infiltration

opportunities (including infiltration of treated effluent into aquifers for pumping in the summer and re-use for irrigation), which contribute to increasing water availability (or reallocating it in time). This makes these measures of particular interest in the area, although just if linked to the enhancement, protection or restoration of a natural function (i.e. if linked to positive environmental outcomes). After all, it is not about retaining water per se but doing it for environmental purposes.

Yet, not everything is about scarcity and droughts in the Mediterranean at all. Torrential rains are common in Mediterranean catchments, which lead to hazards of flash floods, stream flooding, and landslides. The technical analysis of Mediterranean ephemeral streams and mountain torrent floods is quite different to that of flood events in other European rivers (notably due to the sediment load) and opportunities to use the excess floodwater do arise anyway.

V.2.2 NWRMs in the Mediterranean region: a view from the workshops

Experiences in **Portugal** are less abundant than in other countries and frequently not defined as NWRM. However, there are some good examples of characteristic Mediterranean intermittent rivers where the qualities of a holistic approach (including restoration measures, bioengineering, NWRM, monitoring, reporting, stakeholder involvement, etc.) are highlighted. Natural engineering and riparian afforestation measures at local spatial scale are seen as means to restore facets of the river functions in the Iberian Peninsula. They are implemented to promote or preserve biodiversity, and not directly aimed at NWRM per se. NWRM are an indirect consequence of these actions but they have not been quantified; this emphasises the need to include quantifiable NWRM in programmes. In Portugal, massive changes in land use have occurred, mostly caused by climate change as the main driving force.

Examples in **Spain** are diverse. In northern areas implemented NWRM target flood risk management through river restoration and the recovery of floodplains. As it has been pointed out above, these measures improve hydrological connectivity, enhance the role of natural habitats to trap sediments and water, and improve the functionality of the flow to reach a good status of floodplains and rivers. In the southern areas, where agriculture is a major economic activity, soil conservation practices (i.e. cover crops) have become a way to control erosion, increase infiltration, reduce runoff, and improve the topsoil, leading to an enhanced resilience to other impacts and a greater biological activity. Managed aquifer recharge can be also found in Spain. Groundwater is in many places overexploited due to agriculture, thus managed aquifer recharge via natural means aims at recovering groundwater sources and their functions.

Most cases in what has been considered the Mediterranean **France** are also related to reduce flood risk and improve the ecological status of rivers. Measures are on the one hand aimed at slowing down water flows (i.e. hedges) and to spread out the peak-flows, therefore mitigating potential flood damages and erosion. On the other hand, they aim at recovering a more natural status of the river, the floodplain and the riverbanks (i.e. re-meandering, revitalization of river flows, natural bank stabilization, etc.). Dealing with private owners is one of the main difficulties when implementing these measures on their properties.

In **Italy** there is a long tradition of river restoration that has created a fertile space for NWRM implementation. As a matter of fact, applications are mainly related to complex river

restoration projects to shed light on key challenges in relation to flood risk management for joint WFD and FD implementation. Italian members of the network expressed that too much emphasis is placed on reducing flood hazard when reducing vulnerability and increasing resilience would actually be more meaningful. In Italy, as in other MS, a critical aspect has to do with soil sealing, which amplifies the impact of flooding events and leads to a number of difficulties in terms of wastewater management. In fact, in Italy there are some relevant examples on the use of SuDS for stormwater management and on-site treatment. Mixed sewers represent the most adopted solution for the collection of untreated wastewater: the high flux of water eases the transport of solids and the washout of sediments at every rain event. Green infrastructure is especially relevant within that context to increase water quality in the receiving water bodies, to take account of public health concerns, and to mitigate flood risk. Additional experiences on aquifer recharge were collected for the Mediterranean, such as the adaptive strategy to the climate changes for the sustainable governance of the upper Vicenza's plain groundwater resources (Italy), in which infiltration wells, infiltration trenches, forested infiltration areas, infiltration brooks (basin) and (sub) infiltration fields were implemented.

Malta also has relevant experiences in SuDS; the Maltese traditional and legal requirement for each building to have its own rainwater storage facility has been key for stormwater management. The neglect of the compliance with this rule in recent times has had an impact on recent floods, raising the consequences of bad planning, weak compliance and disjointed water management.

Greece's experience on post-fire water retention management showed that the direct objective of the implemented measures was not water retention using natural means but rather to tackle wildfire negative effects (increases in surface runoff, severe soil erosion, decrease in the soil infiltration capacity, or the occurrence of critical flooding problems as a result of some of the above). Water retention here is clearly a result of the targeted increase in the infiltration capacity and the reduction of surface runoff but overall these applications of NWRM are mostly intended to prevent further soil erosion. Additionally, in Greece there are some examples on water retention in agricultural lands with the application of sewage sludge. This, as it occurs with artificial water recharge with treated water poses some critical doubts on quality effects.

Cyprus, as in the case of Malta, has a relevant experience in SuDS implementation. The institutional dimensions of the practical implementation of SuDS in Limassol are worth mentioning: compliance with the law, close co-operation between the Sewerage Board of Limassol – Amathus (SBLA) and local authorities during the process of approval of building permits and new projects of land development, a new set of requirements or restrictions imposed on new building licenses in order to use SuDS and minimize overflow of rainwater into public roads, etc. Cyprus also has significant experience on artificial aquifer recharge with treated water, where the potential adverse effects in water quality are critical, as most Waste water treatment plants (WWTP) are not prepared to treat emergent pollutants. Nowadays in Cyprus, RBMPs are reviewing the measures included in the PoM, and identifying those that may have a water retention component. Further analysis of the identified NWRM is carried out to single out the water retention component, to describe recognized benefits but also those that have been missed, and to coordinate involved bodies. As a result a better insight in NWRM and its gaps is reached and the identification of priority areas for future action is possible. However, during the process it was highlighted that NWRM awareness and knowledge exists only in relation to (urban) stormwater management,

that the multiple benefits of measures for riparian zones have not yet been recognized, that measures for WFD and FD did not recognise mutual benefits and synergies, and that identified gaps in stakeholders participation were limited.

Croatia has some examples of NWRM related to the conservation of protected natural areas (i.e. wetlands) through traditional practices and on forest management for climate change adaptation. Forests, due to their higher infiltration rates and soil water consumption, produce lower levels of storm flow and greater soil stability than any other vegetation type, forest soils also provide purification of water. However, adaptive potential of the NWRM of the Mediterranean forests and scrublands should be assessed against multiple functions and services that they provide such as biodiversity conservation, erosion control, and carbon sequestration, timber production together with societal and recreational services.

V.2.3 Key messages from the Mediterranean region

V.2.3.1 When language matters... but so do concepts

Firstly, there should be an explicit acknowledgement of the fact that NWRM might mean different things to different people. Mediterranean practitioners and other experts during the workshops actually referred to runoff attenuation features, sustainable drainage systems (either rural or urban), green infrastructures, bioengineering practices, natural flood management, soil and water conservation practices, river restoration, renaturation, ecosystem-based management approaches, etc.

NWRM appeal to a single purpose: (i.e. restoring and maintaining aquatic ecosystems) and to a particular set of means (i.e. by natural means). As a result of this, it should be clear that not every measure that increases the water stored in any particular place is a NWRM. NWRM are interventions over aquatic ecosystems and should therefore be explicitly linked to an environmental objective. Yet, NWRM are not simply means to rebuild a functioning aquatic ecosystem modified by human action, since this is often not an affordable (if at all possible) endeavour, but to adapt current developments in order to enhance or recover water regulation functions and services delivered.

NWRM are measures intended to improve the water storage potential of both natural and modified systems: they may consist in creating new green infrastructures or in maximizing the potential of grey infrastructures to contribute to natural recharge. For that purpose they rely on functions usually performed by natural ecosystems (infiltration, natural runoff, soil and biomass retention, etc.) to increase the ability of those systems to emulate the usual functions of natural systems. What is of paramount importance is that NWRM are aimed at delivering critical ecosystem services people and the economy depend upon.

As stated all along the NWRM project and in particular in the concept note, the definition of NWRM appeals both to a single purpose (i.e. to safeguard and enhance water storage potential of ecosystems) and to a particular set of means (i.e. restoring or enhancing ecosystems by using **natural** processes). Regarding the former, NWRM may contribute to attain different environmental policy objectives besides its outstanding potential for water management. Yet, what actually distinguishes NWRM seems to be the particular means used to pursue this set of aims. In the Mediterranean, oft-claimed “natural” water retention measures are sometimes not natural, which actually provided a very insightful context for discussion to identify potential improvements in practice and to single out the actual role to be played by NWRM within programmes of measures (PoM). This is due to the fact that in

many RBDs there's lack of clarity regarding what NWRM are but, in others, where this is clear, it is unclear how NWRM could be used both as a complement of conventional flood (and flood risk) management measures and in combination with other measures of the PoM.

V.2.3.2 The need to factor in trade-offs

Restoring and protecting the natural water storage capacity is a source of many different and simultaneous beneficial effects. In addition to their contribution to the purposes of water management NWRM are associated to significant co-benefits in many relevant policy domains. Further, the choice of the adequate means to restore and protect natural water storage capacity requires dealing with significant trade-offs (as in JRC, 2012), such as for instance: afforestation of mountainous areas is an effective way to attenuate peak flows but may increase water stress in the soil and reduce groundwater recharge; improved crop practices reduce water stress in the soil but increase evapotranspiration and might reduce groundwater recharge; buffer strips may be beneficial for water management but might also reduce crop areas and yields; reduced or no tillage improves soil structure and reduces the exposure of agriculture to flood risk and drought vulnerability but increases pest infestation risks and the use of agrochemicals.

Trade-offs should thus not be neglected. Changing land-use practices entails opportunity costs. Not only benefits are characteristic of NWRM; specific costs could also be relevant. What should then be financed and what not? Who should pay? The assessment of trade-offs allows to identify who wins and who loses and to figure out the required incentives to make NWRM acceptable and implementable.

V.2.3.3 Let's be fair, let's be accurate – the relevance of sound assessment

In other words, NWRM represent an opportunity to design better programmes of measures for water management, because they are measures to more than one pressure, but their adequate assessment requires considering their pros and cons, their additional benefits and opportunity costs, as entailed in any land-use change.

NWRM may be good on their own (if appraised individually, which does not make much sense) because they help restore the environment and ecosystem functions and services. Yet, self-evidence of advantages tends to ignore the existence of alternatives that may serve the same purpose and to overlook the opportunity cost of resources. Therefore, besides their rationality for nature restoration, NWRM need to be judged against their potential contribution to other policy objectives (WFD, FD, EU 2020 Biodiversity Strategy, CCA strategy, CAP reform, Habitats Directive, Birds Directive, etc.). At the end of the day, NWRM advantages are better captured within integrated programmes of measures, such as those that are designed and implemented as part of the planning cycles of the WFD and the FD.

As part of 'successful stories', sometimes purely financial reasons would suffice. NWRM might be cost-effective alternatives to attain particular objectives (improving the status of water bodies, mitigating flood risks, etc.). Yet, costs other than purely financial ones may be more relevant in most cases (notably in upstream-downstream relationships). Thus, as important as putting the right incentive in place is also to avoid prevailing ones (and environmentally harmful subsidies).

V.2.3.4 Successful implementation of NWRM demands a wider perspective and better information

On institutional grounds, the implementation of NWRM requires breaking up the institutional silos at all levels (EU, National and sub-national levels). Besides the purposes of water management NWRMs are outstanding opportunities for a better coordination of different sectoral policies including land planning, spatial development, rural development, agricultural policy, climate change adaptation and disaster risk reduction, etc. As it is clear in many examples in the Mediterranean, cooperation between the private, the public sector and the civil society is not only a pre-condition to make NWRM happen but also rather a logical need.

Furthermore, some information gaps need to be bridged: evidence on actual technical effectiveness mostly refers to design conditions; few projects have been assessed in terms of its contribution to water policy objectives (many river restoration projects have also found no or minor ecological improvements; virtually all restoration project evaluations are restricted to a few years after restoration (e.g., 3-5 years), and significant uncertainties remain as per the long-term effects and sustainability of restoration measures. Furthermore, the watershed and river system conditions must be more strongly considered.

Biophysical impacts are the central evidence component – mechanisms to show how benefits and policy objectives are realized should thus be better understood. Without the biophysical benefits the link between the measures implemented and the contribution to policy objectives cannot be made. If there is no measurement of those benefits it is almost a leap of faith to believe that they actually have positive benefits. Evidence of some NWRM effectiveness in the Mediterranean is very often based on experimental tests and upscaling would be required.

V.2.3.5 NWRM as nature-based approaches

As above, it is critical to recognize that NWRM are multipurpose. Natural water retention, especially if part of complex river and floodplain restoration projects, does contribute to multiple benefits, and to combined outcomes: natural flood risk management, improved eco-hydrological connectivity, and recovery of priority river habitats, just to mention critical examples.

A pervasive idea is that to build the case for NWRM an explicit link with the WFD (and RBMP) needs to be made, as well as recognising the multi-dimensional feature of these measures, which are essential to fully integrate the WFD, the FD, Nature Directives (Birds, Habitats) and other related Directives. All Directives need to be taken into account at the same time, meaning a more complex (though not necessarily more complicated) approach. Good ecological status (GES), ecosystems services (ESS), and other relevant concepts are all progressing in parallel paths, but have to be adequately interconnected through NWRM. As a matter of fact, Mediterranean basins need NWRM to avoid collapse (desertification, climate change, anthropogenic impacts).

River and floodplain restoration in the Mediterranean contribute to natural water retention in different ways: improving (3D) eco-hydrological connectivity, increasing the heterogeneity of river environments, enhancing the role of natural habitats as traps for water and sediments, improving the functionality of the flow regime to contribute to good status of rivers and floodplains, and supporting public awareness about the vital role of natural water retention for people.

It's not that NWRM must be based on an ecosystemic perspective; their implementation is an ecosystem-based management approach itself. Only ecosystem-based measures will sustainably fulfil the expected goals in the medium and long term. Besides, the complexity of river systems make artificial measures prone to failure, and non-working measures can be an obstacle for future planning and management. Also, inefficient measures can promote (social, economic and environmental) unexpected inconveniences. Furthermore, uncertainties and knowledge gaps in river functioning recommend a precautionary approach, as close as possible to the natural river dynamics. Ecosystemic approach can be applied from very different perspectives, but should always be inherent to NWRMs.

Design of measures must target long-lasting solutions for multi-pressured and changing systems, and it is key to discuss the outcomes of alternatives and finding one different solution for each site and condition. Monitoring and learning from results is necessary to any further implementation of these measures.

V.2.4 Developing an NWRM community within and beyond the Mediterranean region

The Mediterranean regional process intended to take into account Mediterranean-specific issues around the design and implementation of NWRM, providing case studies of NWRM applications in Mediterranean basins, as well as creating a Mediterranean network on NWRM, a community of practice involving practitioners, other experts, and stakeholders as explained in section IV.1.

The process focused on the required characteristics of NWRM in order to best deliver their intended benefits, and sought to promote the discussion about Mediterranean specific challenges and priorities, having in mind the specificities of hydromorphological features and main pressures on water resources in Mediterranean river basin districts. Some NWRMs applicable elsewhere in the EU were discussed accordingly for Mediterranean conditions and NWRMs specifically applicable to the region were highlighted.

With the aim of building on previous knowledge on the field of NWRM, the Mediterranean Network has encouraged synergies with other related projects and specialized research centres. It has also facilitated the inclusion of water planners, water related authorities, expert practitioners and researchers to foster NWRM implementation.

For river restoration experiences in Europe, the MED network first contacted partners involved in Life+ RESTORE partnership whose main objective was to share knowledge and promoting best practice on river restoration in Europe. Linked to this initiative the CIRF (Centro Italiano per la Riqualificazione Fluviale) has been very proactive in the MED network through its Director Andrea Goltara, who actually cooperated with the organization of the second Mediterranean Workshop in Turin. There has also been exchange with REFORM (EU FP7 project) consortium partners whose work is based on providing a framework for improving the success of hydro-morphological restoration measures to reach, in a cost-effective manner, and targeting at the same time the ecological status or potential of rivers.

In line with the above-mentioned links, Gonzalo Delacámara, the Coordinator for the Mediterranean co-organised a parallel session (#2, Vienna, October 27th, 2014) at the 6th European River Restoration Conference (ERRC2014) and delivered a presentation on the evidence on multiple benefits of NWRM from the project. The 2014 Conference focused on

capacity building aspects of cross-sectoral river management and took ecological river restoration as the linking point with Green Infrastructure, NWRM and Contemporary River Corridor Management.

Due to the collaboration established with the Spanish CEDEX (Centro de Experimentación y Obras Públicas, Spain), Fernando Magdaleno participated in the WFD CIS WG Programme of Measures (March 26th, 2014) as an expert in river restoration measures presenting the case study of Arga-Aragón River. The regional coordinator has also participated in the last WG PoM meeting organized in October 14th, 2014 presenting on economic costs and benefits of NWRM.

There was also major cooperation with water authorities regarding the workshops organization and participation. The Regione Piemonte (the Regional Government of Piedmont) kindly hosted the second Mediterranean Workshop. Piedmont Region plays a remarkable role leading Italian Regional Governments in environmental issues. Paolo Mancin, responsible for water management issues in the DG Environment of the Regional Government, represented the Piedmont Region and acted as host of the event.

The NWRM initiative has enabled (through the organization of the Mediterranean workshops and the web based discussion forum) the establishment of new working relationships among participants of the network. This has been particularly relevant in Portugal, where the involvement of Samantha Hughes (UTAD), Ruth Pereira (Universidade do Porto) and Ana Lillebø (Universidade de Aveiro) during the whole process (specially providing case study information and attending the workshops) has ended up in future collaboration in the field of bioengineering, river restoration and water quality.

Furthermore, from discussions during the workshops a new opportunity has arisen to organize conferences on NWRM at national level, which would ensure the continuity of the project and the further inclusion of NWRM in water planning, studies and projects. National authorities, river basin authorities, experts and stakeholders have expressed their interest in such initiative.

V.3 Western Network

V.3.1 Introduction to the region

The Western region (as defined for the purposes of this project) encompasses the Rhine basin (including parts of Switzerland, Germany, France and the Netherlands), northern France, Belgium, the United Kingdom and Ireland. With the exception of the upper Rhine catchment, the region represents a predominantly temperate climate, with high rainfall particularly in the west. At higher altitudes in Switzerland and France, snow can comprise a significant proportion of annual precipitation, and in those regions some similarities to the Baltic region may be seen in terms of the influence of freezing and snowmelt on NWRM selection and effectiveness. Elsewhere, many areas are very low-lying, including the Netherlands, Belgium and parts of the eastern UK, and include widespread drained areas with intensive water management. There are areas of high population density and irrigated agriculture across the region, where there is high water demand.

This climatic and topographic definition influences the major water management concerns of the region. Flood risk management is a significant concern, with considerable investment

requirements, particularly due to the extent of urban development in the floodplains of the Rhine, Thames and other large and small rivers. At the other extreme, water scarcity is a realistic concern, particularly in the southern parts of the region. The balancing of water and land requirements for agricultural and urban areas is a potential source of conflict.

Within this context, NWRM has a very relevant role to play in effective water management in Western Europe. As discussed further below, awareness of NWRM in the region relates largely to flood management. But a long history in the region of land use changes, drainage, intensive agriculture and increasing urbanisation, coupled with the threat of climate change, means that the pressures on water, as seen through the River Basin Management Plans, are considerable. NWRM have the potential to help restore more natural functioning of catchments across the region, contributing to more natural flow regimes in rivers (jointly addressing concerns of both floods and droughts), improved water quality, and new or improved habitats.

V.3.2 NWRMs in Western Europe: a view from the workshops

The workshops showed that there is already a good level of awareness about measures linked to NWRM in Western Europe, although generally known by a different name and often dominated by Natural Flood Management (NFM). Incorporation of NWRM into River Basin Planning is in its infancy, but there are good examples of existing case studies that deliver benefits clearly of relevance to WFD. The range of case studies presented between the two workshops gave an informative and engaging overview of the issues and interests in the region, and are summarised below under some key themes¹⁰.

V.3.2.1 Expanding on Natural Flood Management

The concept of NWRM is most familiar in the Western Region to people working in NFM. NFM itself seeks to develop alternative solutions for flood management by making space for water, and as part of this process, considers the other benefits that may be achieved beyond flood risk reduction. The climatic and geographic conditions in Western Europe mean that NFM can often be synonymous with NWRM, although the primary aim will not always be driven by flood risk. Many of the presentations during the workshops focussed on measures implemented primarily for their flood risk benefits, but they all showed the desire and the challenges to look more widely and seek to develop holistic solutions. These included:

- Maarten Jans, W&Z: Sigmaplan. Sigmaplan is the national programme for flood protection on the River Scheldt and its tributaries. Earlier stages of the plan have been in progress since the 1970s, but a revamp in 2005 has broadened the aims to bring a strong focus on biodiversity, with Habitats Directive aims now being integral to the plan.
- Ulrike Pfarr, Freiburg Regional Council: Polder Altenheim. Participants in the July workshop were lucky to have the opportunity to visit the Polder Altenheim, which is used for flood storage for the River Rhine. Rather than being a single-use basin, a forest ecosystem has been developed in the polder. This has necessitated changes

¹⁰ All of these presentations can be found in full on the project website

to the water management, with small 'ecological flooding' events managed to maintain the habitat and condition it to withstand larger flooding events.

- Peter Close, NEIA: Sustainable Drainage Systems in Northern Ireland. Peter introduced a pilot study for the implementation of sustainable stormwater management in the town of Ballyclare, Northern Ireland, as well as aspirations for a similar approach in the city of Belfast. Examples were provided of retrofit schemes as well as the introduction of planning restrictions to enforce stringent runoff management for new developments. The aim of the studies is to re-direct stormwater out of the sewerage network and waste water treatment plant, not only for local flood risk benefits, but also to improve the water quality of the European designated sites downstream.

V.3.2.2 The value of coordination and opportunity mapping

The multidisciplinary nature of NFM and wider NWRM means that participants from multiple sectors and organisations may, and should, be interested in their implementation. This means that many factors have to be taken in to account, and the best opportunities identified to provide benefits to all parties. NWRM should be considered at a strategic level, not only when site-specific opportunities are happened upon. Opportunity mapping, whether at a catchment scale or national scale, may be an important tool for encouraging and enabling widespread implementation of NWRM. Some organisations are already taking this approach, as illustrated during the workshops by a number of speakers including:

- Roy Richardson, SEPA: Natural Flood Management in Scotland. This presentation described the approach being taken to Floods Directive implementation in Scotland. A full review of flood risk management was undertaken, and an integrated catchment-based approach, based on Natural Flood Management (NFM), is being implemented. National 'opportunity maps' have been produced, showing areas with potential for runoff reduction, floodplain storage and sediment management, and will be used nationally for development planning.
- Stephanie Natho, BfN: Floodplain restoration in Germany. In Germany, a broader view of the WFD and integrated water management has led to the development of national mapping of floodplain status, focussing on the extent of modification. Although these are not directly incorporated in to waterbody status for RBMPs, they are classified and reported in a similar manner.
- Prof. Dr Gebhard Schueler, Research Institute for Forest Ecology and Forestry, Rheinland-Pfalz: Flood mitigation by forestry. A test catchment in southern Germany was presented, where investigations have been carried out in to the effectiveness of forestry measures for controlling runoff. A GIS-based system was used to identify hotspots for runoff generation, along with an inventory of linear structures that could accelerate runoff. These allow prioritisation of appropriate locations and types of measures.

V.3.2.3 Applying NWRM at the catchment scale

Opportunity mapping (as introduced above) is valuable not only for selecting individual locations for NWRM, but as the basis for a network of measures. Commonly NWRM are most effective not in isolation but when a large number of similar measures are distributed around a catchment. This may be particularly noticeable for measures that individually are

very small scale. Ideally, an NWRM scheme should be both developed and monitored at the catchment scale. Two examples discussed during the workshops illustrated a catchment-based approach to NWRM implementation:

- Mark Wilkinson, James Hutton Institute: Natural Flood Management in Belford catchment. A natural flood management scheme was implemented as a cost-effective solution for addressing flooding problems in a small town downstream. The scheme considered the full catchment area upstream of the village, incorporating a network of runoff attenuation features, with a nested monitoring network to assess the effectiveness of the measures. Adoption of this approach, rather than a hard engineering solution in the village, has allowed wider benefits including sediment management and water quality to be incorporated.
- Prof. Chris Spray, University of Dundee: Eddleston Water pilot project. This is a detailed pilot study linked to NFM implementation in Scotland. Eddleston Water is a small catchment with a straightened and embanked river, where a detailed monitoring network has been installed to look at flows throughout the catchment, and surface flood modelling and groundwater modelling have both been used. The monitoring and modelling have allowed effective and appropriate measures to be identified and located, including re-introduction of meanders to the river, improvements in the riparian zone, changes to land use, and introduction of wetland features.

V.3.2.4 The importance of engagement

The vast majority of presentations during the workshops highlighted the importance of engagement. The reasons for this are manifold, but central is the understanding that implementing a measure in one location may provide benefit elsewhere and to other people. Hence without engagement, it would be extremely challenging to act on the multi-disciplinary and spatially distributed nature of NWRM and to achieve those benefits. Furthermore, NWRM do not only act within the river, but throughout the catchment, potentially requiring changes in land use. In such cases, there is clearly a direct need for engagement with land owners and occupiers (beyond what may be the case for 'traditional' engineering solutions). Many of the examples already discussed above highlighted the engagement requirements of their projects, as well as:

- Thomas Borchers, BMU: Dyke relocation on the River Elbe. The main aim of this project on the Elbe was to restore the floodplain habitats, which was brought together with a more comprehensive plan incorporating flood benefits. The dykes containing the River Elbe were relocated to allow flooding of the floodplain, which required an extensive land consolidation process. This process involved negotiation with many landowners, and defined the full extent of the scheme that was ultimately implemented.
- Marie Pénélope Guillet, SYMASOL: Renaturation of the Hermance River. Two river restoration schemes were undertaken as part of this project: and enhancement scheme on the Hermance within the town, with retention zones created upstream. These schemes were planned and implemented over a number of years, involving a very dedicated process of engagement with local communities.
- David Webb, Environment Agency: The River Quaggy. The River Quaggy in London lost much of its floodplain in the 20th century due to channelisation and urbanisation, and in some reaches was culverted underground. A major scheme successfully

restored reaches of the river, creating areas of floodplain storage within urban parkland, sports fields and private property. Public consultation commenced at a very early stage in the project, and was key to successful implementation, not least in the agreement of a whole street of private houses to allow set-back flood defences to be incorporated in to their gardens.

All in all, the discussions during the Western region workshops were greatly illustrative of these key considerations for NWRM implementation in the region.

V.3.3 Key messages from the Western region

As indicated by the case studies summarised above, key messages and questions from the Western region workshops included:

- The importance of being able to demonstrate the physical effectiveness of measures and their costs and benefits. Whilst the 'multiple benefits' of NWRM are a key selling point, a realistic view must be taken, without unfeasible expectations that a wide range of benefits will automatically be achieved.
- Related to this, while NWRM are clearly multi-functional, how can this be used to make them an appealing proposition? Particular problems are that: a. schemes tend to be initiated for a specific purpose, which creates a tendency for the measure that is most effective for a single purpose to be selected, with lower priority placed on 'other' benefits; b. Those who receive the benefits are not necessarily the same as those who incur the costs, e.g. improvements to water quality or a reduction in flood risk downstream, not at the location of the measure.
- Taking a catchment-scale approach is key. This allows an integrated assessment of which combination of measures and locations will provide the most effective solution for the catchment as a whole.
- The need for community engagement and acceptance should not be underestimated. This needs to include communities throughout the catchment, not only at the location at which measures will be implemented, and must set out a clear and realistic vision.
- Support and coordination from authorities (from local to national levels) is likely to be important for successful and effective implementation, for example through opportunity mapping, planning policy and financial support.
- It is necessary to move beyond water management to overall spatial planning and land management. The concept of NWRM is widely encompassing, covering land use practices as well as direct water management, and includes a wide range of measures, led by different sectors (e.g. agriculture) that already exist but are not usually classified as NWRM. Making the most of NWRM therefore requires moving beyond water management to overall spatial planning and land management.

Development of the western network, as an integral part of the Europe-wide community, has added greatly to the project's understanding of the needs of member states and local practitioners in the uptake of NWRM. More than that, it has initiated a community of practice who are enthusiastic about the use and promotion of NWRM.

V.3.4 Developing an NWRM community within and beyond the Western region

The project team engaged widely with stakeholders involved in NWRM or related subjects. Individual contacts were made in all Member States, to identify and discuss case studies of NWRM, encourage discussion (including via the LinkedIn site) and invite attendance at the regional workshops. Interested parties joined the LinkedIn site, with the majority joining the main NWRM group rather than a specific 'Western Region' group. This perhaps reflects the diversity within the region and a European-wide interest, and indeed during the first workshop many participants expressed their desire to share experiences between countries, not necessarily only restricted to Western Europe, since there are many synergies with other regions. The workshops and other discussion fora have allowed practitioners to make new links and share experiences, with some now continuing to work together.

As has been discussed above, the concept of NWRM is relatively well recognised in Western Europe, particularly in relation to Natural Flood Management, and existing vehicles for implementation should be taken advantage of. For example, the Sigmaplan programme in Belgium and Room for the River programme in the Netherlands both promote approaches to 'making space for water' similar to NWRM, while in Scotland SEPA is advocating a Natural Flood Management approach to Floods Directive implementation. This type of approach should be adopted more widely, i.e. not necessarily with flood management as the primary aim. In particular, the value of NWRM in direct relation to the Water Framework Directive must continue to be promoted, for example as may be possible through the 'Catchment-Based Approach' to river basin planning in England. The project team has continued to promote NWRM and the project outputs at conferences, including presentations at the UK Flood Defence Expo and at CIWEM events examining synergies between the WFD and Floods Directive, highlighting the potential multiple benefits of NWRM within a catchment-based approach to management of the water environment. We will continue to seek opportunities to continue to promote NWRM beyond the completion of the project.

V.4 Baltic Network

V.4.1 Introduction to the region

It is important to recognize that the beneficial functions of Natural Water Retention Measures (NWRM) are very context specific. The same measure can have very different effects, depending where in Europe it is implemented. The range of environmental conditions across Europe means that measures with positive net benefits for the Nordic Baltic region may not be appropriate in other parts of Europe and that appropriate measures for hot, dry conditions may not be applicable in cool, wet regions. Furthermore, a process that is seen as beneficial to ecosystem health may be harmful elsewhere. One good example of this are measures for sediment retention, which are seen as beneficial NWRM for Nordic Baltic forestry, but would most likely have negative effects on biodiversity if applied in mountainous regions.

The Nordic-Baltic region is characterized by cool temperatures and abundant precipitation. In some parts of the region, a significant fraction of precipitation falls as snow, meaning that NWRM appropriate for Nordic-Baltic conditions should be adapted to below freezing temperatures and high flows during spring snowmelt. Droughts are rare in the region but flooding is common, especially during snowmelt and intense summer rains. In the Nordic

Baltic states, most agricultural and forest water management is devoted to getting water off the land, not for water retention. While there have been a number of NWRM successfully implemented in urban, agricultural and forest water management in the Nordic Baltic region, the water retention function of NWRM is often seen as an ancillary benefit and the primary purpose of measures is often related to biodiversity or water quality improvement. Hydro-morphological NWRMs for water quality protection are widely used in the Nordic-Baltic region. Flood plain reconnection and river restoration have also been practiced.

The general features of flood risk are similar in most Nordic Baltic and northern European states. Large floods are most common during spring snowmelt and flash floods can occur during periods of heavy summer rain. Risk is often defined as the probability of an event multiplied by its consequences. There are many changes in the biophysical environment which continue to increase the probability of flooding related to land use change (urbanization, deforestation and agricultural intensification) as well as river regulation, channelization and construction of embankments. Furthermore, climate change may alter precipitation patterns and further increase the probability of floods. Changes in socio-economic systems are increasing the potential consequences of flooding through flood plain development, and greater investment in infrastructure in flood prone areas.

V.4.2 NWRMs in the Baltic region: a view from the workshops

V.4.2.1 Overview

Throughout the project, there have been ongoing discussions as to what is meant by “Natural”, what qualifies as an NWRM and their relevance in the water-rich Nordic Baltic region. These discussions are especially relevant given the plans to use the measures identified in this project in compensation schemes and in the separation of “grey” and “green” infrastructure. NWRM are green infrastructure which use natural processes materials to enhance or emulate functions commonly performed by nature including slowing down of water flows, soil infiltration, aquifer recharge and evapotranspiration. The boundary between green NWRM and grey infrastructure is not clear as many grey infrastructures also use natural processes. Mixed grey/green sustainable urban drainage systems (SUDS) are used in a number of Nordic-Baltic cities. These SUDS are well integrated into the urban planning process and are believed to be more resilient to a changing climate than traditional urban drainage systems.

For the Nordic-Baltic region NWRM have a clear role in urban flood prevention. However, this role is inadequately appreciated and not well incorporated into national or EU policy. It may be that MS implementation of the Floods Directive (FD) is too focused in this region on flood risk and flood hazard in urban areas and on protection of these areas with construction of grey infrastructure, and does not take sufficient consideration of flood prevention or the source of water in the upstream catchment. This suggests a role for NWRM in landscape-scale spatial planning, specifically, identifying and capitalizing on upstream-downstream linkages, an approach which the Nordic-Baltic working group of the project suggests as the most important task for the future.

V.4.2.2 Urban-rural trade-offs as a solution to urban flooding

While droughts are rarely a problem in the Nordic-Baltic region, floods are a significant concern. Urban flooding associated with snowmelt, marine storm surges and heavy summer rainfall are a significant risk for many cities in the Nordic-Baltic region. Flood risk assessment

in rural areas is generally lower, primarily because economic consequences are less than those for floods in urban areas. NWRM in rural areas may contribute to sustainable flood management in the Nordic-Baltic region. However, there are tradeoffs associated with rural NWRM and urban flood prevention. The cost of urban flood damage mitigation is generally very high. Grey infrastructure defensive measures are expensive with high maintenance costs and high opportunity costs. NWRM in urban areas can help limit local flooding but are not likely to have an appreciable impact on larger floods. The costs of NWRM in rural areas are generally low. Rural NWRM that lower urban flood risk often have low opportunity costs and little or no maintenance cost. Urban and rural benefits differ. Urban areas typically receive high benefits from reduced flood damage and some ancillary benefits related to biodiversity and recreation. Rural areas receive low but locally important benefits from reduced flood damage and significant ancillary benefits related to improved water quality, enhanced biodiversity and improved amenity services. Deciding whether to site flood risk prevention measures in urban or rural locations involves an assessment of the cost-benefit ratio. The most efficient measures have high (urban) benefits and low (rural) costs.

NWRM can also be embedded into a framework of Sustainable Flood Management (SFM). There are three pillars to SFM: Preparation, Protection and Prevention. The FD adequately takes into account of first two of these pillars while NWRM have a role to play in the third. From a hydrological perspective, the goal of NWRM is to reduce the frequency of high-flow events. Broadly speaking, there are two ways of reducing the frequency of high flow events: making room for the river, and keeping the rain where it falls. Making room for the river involves rural measures downstream of a city while keeping the rain where it falls involves rural measures upstream of an urban area.

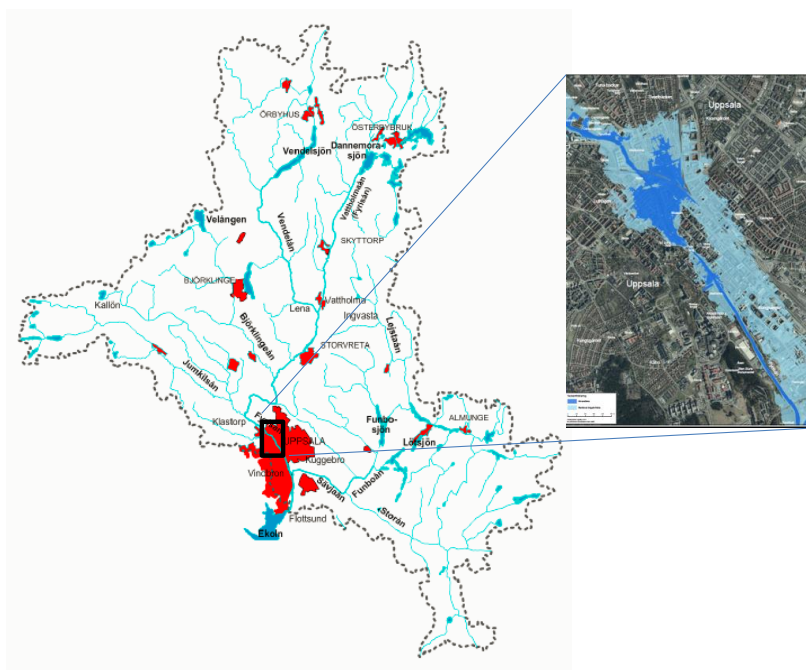


Figure 7: urban areas at risk of flood damage in Uppsala

The above figure illustrates urban areas (inset) are at most risk of flood damage but successful flood risk management requires the linking of the catchment to the city. Areas upstream of a city are suitable locations for NWRM that help to keep the rain where it falls while downstream areas are potential locations for measures that make room for the river.

Both “making room for the river” and “keeping rain where it falls” have a role to play in flood prevention in the Nordic Baltic region. Broadly speaking, there are three kinds of floods in the Nordic Baltic countries: predictable high flows associated with snowmelt every spring, less predictable summer flash floods associated with heavy rains and storm surges or high tides in areas near the sea. Each of these kinds of floods can cause significant damage and inconvenience in urban areas. While the effects of spring flooding or storm surges are often more spectacular and therefore the subject of media attention, overloading of sewage treatment plants and localized flooding can mean that summer floods are actually more costly. Cities near the sea can be flooded by high tides or storm surges. While there is limited scope for managing sea water, “keeping the rain where it falls” may have a role to play in preventing urban flooding related to seawater intrusion by giving the storm surge more room to dissipate upstream of a flood vulnerable area.

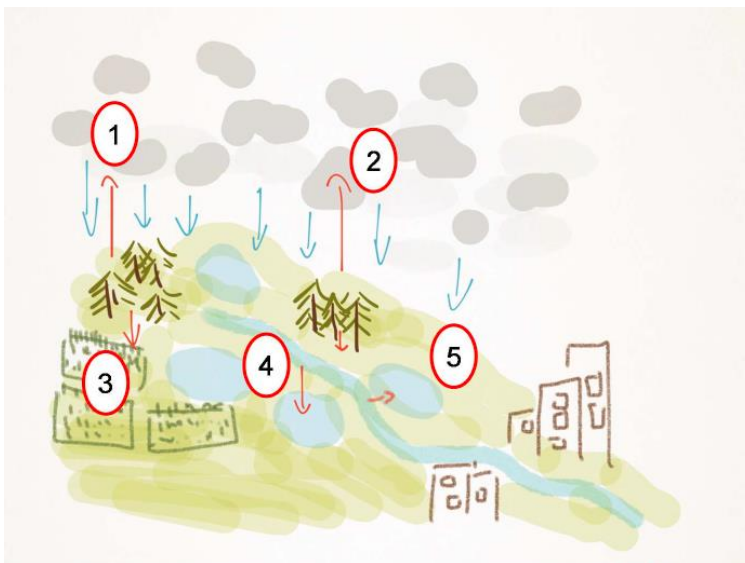


Figure 8: illustration of how to keep the rain where it falls

The above figure on “Keeping the rain where it falls” can involve (1) afforestation measures to improve canopy interception and return of precipitation to the atmosphere; (2) targeted planting of tree species including conifers and short rotation willow with high transpiration potential; (3) agricultural and land management practices contributing to improved infiltration; (4) creation or refurbishing of ponds and wetlands and (5) reconnection of rivers to their floodplains.

Many NWRM help to “keep the rain where it falls”: Afforestation, for example, can have multiple benefits as it leads to increased interception, more transpiration and improved infiltration. In Sweden and Finland, there is limited opportunity for further afforestation but land conversion may be possible in Norway, Denmark and the Baltic states. Urban measures such as permeable pavements, swales and green roofs can serve similar functions and work well in cities throughout the Nordic-Baltic region. Unlike hydro-morphological measures such as making room for the river, which can contribute to preventing even the largest floods; keeping rain where it falls only helps to reduce small to medium size floods .

Throughout Europe, traditional engineering approaches to flood prevention have focused on what happens in the river channel, and how to keep the river in the channel, while spatial planning takes a whole catchment approach. “Making room for the river” takes a more holistic approach as it involves re-connection of the river to its floodplain and may also

involve artificial channels and floodways downstream of at-risk urban areas. When implemented correctly, measures that make room for the river are able to reduce the frequency of even the highest flow events.

V.4.3 Key messages from the Baltic region

NWRM are an important part of the emerging paradigm shift in water management. This pilot project and the Nordic Baltic region can play an important role in their implementation and acceptance. While NWRM are multi-functional, they have an important role to play in urban flood prevention. Successful incorporation of NWRM into spatial planning for urban flood prevention will require a number of shifts in thinking. There are six key areas where further thought is needed:

- Landscape vs. Lawscape
- Grey vs. Green
- City vs. Catchment
- Reductionism vs. Holism
- Winners vs. Losers
- Multi-functional vs. Flood Control

Landscape vs. lawscape contrasts the biophysical versus the social environment. We have a good, but inadequate, understanding of the hydrology of floods and NWRM but we lack understanding of the institutional and regulatory framework, or lawscape. It was clear from this workshop that the paradigm shift in water governance requires shifts in institutional activities and attitudes if it is to succeed.

There is a role for both grey and green infrastructure in sustainable flood management. NWRM cannot solve all problems but they are an important, under-appreciated and cost-effective complement to grey infrastructure solutions. More pilot scale and demonstration NWRM are needed to build the knowledge base and increase the societal acceptance of NWRM for sustainable flood management.

The FD and WFD planning cycles are linked and share many similarities. However, the FD could be even more effective if it focused on catchment scale water retention measures as well as urban flood risk management. Problems associated with floods occur mainly in cities. Flood prevention solutions can only occur in the catchment.

The change in paradigm from flood protection to water management involves a shift from reductionist to holistic thinking. Many institutions and other actors are ill-prepared to deal with this shift as it entails greater uncertainty, more decision making and balancing competing views and interests.

Implementing measures to prevent urban flooding, whether they are related to “making room for the river” or “keeping the rain where it falls” will have both winners and losers. On a simplistic level, the winners will be those urban residents who avoid flooding while the losers will be rural land owners. Adequate mechanisms must be developed to compensate losers and charge winners for catchment scale water retention services.

NWRM are the decathletes of water management. Decathletes do not get the same attention as sprinters but they can do many things extremely well. NWRM are multi-functional: they

have a clear role to play in flood prevention, but they also fill many other important roles for human wellbeing and environmental sustainability.

V.4.3.1 Institutional challenges to a catchment-wide approach

FRMP fall within the remit of spatial planning as they should take a holistic whole-catchment approach to water management. Spatial planning which incorporates “keeping the rain where it falls” and “making room for the river” can lead to institutional challenges. Traditional engineering approaches are often embedded in a top-down “command and control” organizational structure while spatial planning involves balancing and negotiating the competing needs and demands of multiple stakeholders. In a similar manner, traditional engineering approaches make a one-dimensional evaluation of success while multipurpose solutions such as NWRM must be evaluated using multiple criteria.

Institutional obstacles also have a spatial component. Local knowledge is often inadequately appreciated by regional or national competent authorities. This lack of consideration of local knowledge damages the credibility of national and regional competent authorities. Fortunately, there is an increasing awareness of the need for local knowledge in the spatial planning process.

NWRM are an important part of the emerging paradigm shift in water management. The opportunities for NWRM implementation are starting to be recognized in the Nordic Baltic region but there is not yet a sustainable balance between grey infrastructure engineering and a more holistic green infrastructure approach to sustainable flood management. This pilot project and the Nordic Baltic region can play an important role in the implementation and acceptance of NWRM. There is a widespread interest in NWRM throughout the Nordic-Baltic region but there are many questions that still must be addressed including how to evaluate and aggregate the benefits of multi-functional measures.

V.4.3.2 The role of NWRM in WFD River Basin Management Plans

On merits of cost-efficiency, a number of NWRM (e.g. riparian buffer zones, wetlands etc.) have frequently been proposed in WFD programs of measures by competent authorities to achieve Good Ecological status of inland water bodies. The average unit costs for reduction of e.g. nutrients are often low for these measures compared to more traditional grey-/engineering approaches, a fact that has made NWRM attractive tools for River Basin Management planners. In the WFD context, the positive effects from NWRM on water quality and biodiversity are thus considered to be the direct benefits, while restoring natural hydrological functioning is an ancillary benefit.

From a Floods Directive point of view, the direct benefits from the NWRM can relatively easily be valued in terms of avoided costs for flooding, or reduced risk for flooding events. In this context, the benefits from a strengthened supply of ecosystem services (e.g. water quality, biodiversity, amenities and opportunities for recreation) are considered ancillary benefits.

The relationship between direct and indirect benefits in the two directives indicates a potential for significant efficiency improvements in both Water- and Flood risk management. Including the value of “FD-ancillary benefits” in cost-efficiency analysis of measures in the WFD context might overturn the result from previous ranking exercises resulting in new cost efficient bundles of measures. Monetary valuation of ecosystem services is however often challenging, sometimes even impossible. Monetary valuation is however not always

necessary, a qualitative or quantitative approach to including the ecosystem services in the analysis is often sufficient to describe the importance of these welfare gains. This type of approach is used by planners in different contexts more and more frequently by application of multi-criteria analysis tools.

Achieving these efficiency improvements requires a more holistic approach by spatial planners where multiple objectives are considered simultaneously and at the appropriate scale. In many cases this will mean spatial planning for the whole catchment.

V.4.4 Developing an NWRM community within and beyond the Baltic Region

The two workshops were a unique occasion to engage with stakeholders involved in NWRM or related subjects. Individual contacts were made in all Baltic Member States to identify and discuss case studies, identify potential speakers and invite stakeholders to the workshops.

Discussions during the workshops highlighted that regional stakeholders are aware of the existence of measures for restoring the natural water retention capacity of the landscape, and for the use of natural materials to limit flood risk. However, before this project they were often not familiar with the term NWRM. Therefore, participants to both the workshop and the discussion forum were glad to be involved in the network, and they recognized the need for an ongoing dialogue on this subject.

Furthermore, the workshops were also useful to clarify participants' expectations on the NWRM initiative, and namely: (i) To clarify terminology related to NWRM; (ii) To implement NWRM (and to clarify costs); (iii) To raise awareness about benefits of NWRM of different stakeholders (including the general public); (iv) to present more data on implemented case studies in our own countries, (v) to provide an evidence base with the catalogue of ideas/case studies/recommendations.

V.5 Danube Network

V.5.1 Introduction to the region

The Danube region covers the Danube River Basin that is the second largest river basin of Europe covering territories of 18 states including EU-Member States, Accession countries and other states (Table 11). At the time of reporting, eleven Danube countries are the EU-Member States, while four other Danube countries are candidates for the process of accession and are preparing to fulfil the complete body of EU legislation in order to become EU Members. Due to a large number of states and geographic coverage close links have been established with other regional networks and initiatives. Furthermore, coordination requirements defined by the "Convention on Cooperation for the Protection and Sustainable Use of the Danube River" (Danube River Protection Convention, DRPC), Memorandum of Understanding between the International Commission for the Protection of the Danube River (ICPDR) and the Black Sea Commission and existing multi and bi-lateral agreements in the field of water management concerning the entire Danube River Basin District (DRBD) have been considered.

The International Commission for the Protection of the Danube River (ICPDR) comprises 15 Contracting Parties (14 countries and the European Union) who have committed themselves to implement the DRPC. The final goals are to co-operate on fundamental water

management issues and to take all appropriate legal, administrative and technical measures to maintain and improve the quality of the Danube River and its environment.

Table 11. States in the Danube River Basin District

State	ISO-Code	Status in the European Union*	Status in the DRPC	Share of the DRBD ¹¹ (%)	Percentage of state within the DRBD ¹ (%)
Albania	AL	Candidate		< 0.1	0.01
Austria	AT	Member State	Contracting Party	10.0	96.1
Bosnia and Herzegovina	BA	Potential candidate	Contracting Party	4.7	74.9
Bulgaria	BG	Member State	Contracting Party	5.8	42.6
Croatia	HR	Member State	Contracting Party	4.3	61.9
Czech Republic	CZ	Member State	Contracting Party	2.7	27.3
Germany	DE	Member State	Contracting Party	7.0	16.0
Hungary	HU	Member State	Contracting Party	11.5	100
Italy	IT	Member State		<0.1	0.2
Macedonia	MK	Candidate		<0.1	0.2
Moldova	MD	-	Contracting Party	1.5	36.2
Montenegro	MN	Candidate	Contracting Party	0.9	55.0
Poland	PL	Member State		<0.1	0.1
Romania	RO	Member State	Contracting Party	29.6	100
Serbia	RS	Candidate	Contracting Party	10.1	92.8
Slovak Republic	SK	Member State	Contracting Party	5.8	96.0
Slovenia	SI	Member State	Contracting Party	2.0	81.1
Switzerland	CH	-		0.2	4.3
Ukraine	UA	-	Contracting Party	4.5	6.0

* The table reflects the situation at October 2014.

¹¹ Source: Danube River Basin District Management Plan, ICPDR 2009

The ICPDR is the implementing body under the DRPC and serves as the platform for coordination to develop the Danube River Basin Management Plans (DRBMPs) and the Flood Risk Management Plans. The Contracting Parties have committed themselves to the development of the co-ordinated international River Basin Management Plan for the Danube River Basin as requested by the EU Water Framework Directive.

The Danube River Basin is the second largest river basin in Europe after the Volga covering 801,463 km². It lies to the west of the Black Sea in Central and South-eastern Europe. To the west and northwest the Danube River Basin borders on the Rhine River Basin, in the north on the Weser, Elbe, Odra and Vistula River Basins, in the north-east on the Dnjestr, and in the south on the catchments of the rivers flowing into the Adriatic Sea and the Aegean. Due to its geologic and geographic conditions, the Danube River Basin can be divided into 3 main parts:

- The Upper Danube Basin reaches from the sources in the Black Forest Mountains to the Gate of Devín, to the east of Vienna, where the foothills of the Alps, the Small Carpathians and the Leitha Mountains meet. The area covers in the north the Swabian and Frankonian Alb, parts of the Oberpfälzer, the Bavarian and the Bohemian Forests, the Austrian Mühl- and Waldviertel, and the Bohemian-Moravian Uplands. South of the Danube lie the Swabian- Bavarian-Austrian Alpine Foothills as well as large parts of the Alps up to the water divide in the crystalline Central Alps.
- The Middle Danube Basin covers a large area reaching from the Gate of Devín to the impressive gorge of the Danube at the Iron Gate, which divides the Southern Carpathian Mountains in the north and the Balkan Mountains in the south. The Middle Danube Basin is confined by the Carpathians in the north and the east, and Karnic Alps and the Karawankas, the Julian Alps and the Dinaric Mountains in the west and south. This circle of mountains embraces the Pannonian Plains and the Transylvanian Uplands.
- The Lower Danube Basin covers the Romanian-Bulgarian Danube sub-basin downstream of Cazane Gorge and the sub-basins of the Siret and Prut River. It is confined by the Carpathians in the north, by the Bessarabian Upland Plateau in the east, and by the Dobrogea and Balkan Mountains in the south. Due to this richness in landscape the Danube River Basin shows a tremendous diversity of habitats through which rivers and stream flow including glaciated high-gradient mountains, forested midland mountains and hills, upland plateaus and through plains and wet lowlands near sea level.

Due to its large extension from west to east, and diverse relief, the Danube River Basin also shows great differences in climate. The upper regions in the west show strong influence from the Atlantic climate with high precipitation, whereas the eastern regions are affected by Continental climate with lower precipitation and typical cold winters. In the area of the Drava and Sava, influences from the Mediterranean climate, can also be detected. The heterogeneity of the relief, especially the differences in the extent of exposure to the predominantly westerly winds, as well as the differences in altitude diversify this general climate pattern. This leads to distinct landscape regions showing differences in climatic conditions and in the biota, e.g. the vegetation. The precipitation ranges from less than 500 mm to more than 2000 mm based on differences in the regions. This in turn has strong effects on the surface run-off and the discharge in the streams.

The hydrologic regime of the Danube River, in particular the discharge regime, is distinctly influenced by the regional precipitation patterns. The surface water contribution from each country to the cumulative discharge of the Danube is highly different between countries. Austria shows by far the largest contribution (22.1 %) followed by Romania (17.6 %) and other countries. This reflects the high precipitation in the Alps and in the Carpathian mountains. In the upper part of the Danube, the Inn contributes the main water volume adding more water to the Danube than it has itself at the point of confluence of the two. In the middle reach it is the Drava, Tisza and Sava, which together contribute almost half of the total discharge that finally reaches the Black Sea.

Floodplain forests, marshlands, deltas, floodplain corridors, lake shores and other wetlands are essential components in the Danube River Basin's biodiversity and hydrology. The Danube River Basin extends into five of the eight Biogeographical Regions of Europe: the Alpine, the Continental, the Pannonic, the Steppic and the Black Sea Region. Each of these shows characteristic wetlands, some of them are protected, others not. Many of the larger wetland areas are transboundary in nature. The wetlands in the Alps and Carpathians also represent valuable drinking water reserves for millions of people. The current extent of wetlands in the DRB is only a remnant of the former wetland systems.

The Danube River Basin contains a large number of wetlands offering unique habitats for a rich and diverse aquatic community. Many of these areas have high protection status such as the large wetland complexes protected under international conventions, others still deserve to be designated as protected areas, but have not been granted such status. 80 % of the historical floodplain on the large rivers has been lost during the last 150 years mainly from significant hydromorphological alterations, and many already protected areas deteriorate due to new human interventions. Still today, many wetlands and natural retentions are under pressure from navigation, hydropower plants, intensive agriculture and forestry as well as from new infrastructure projects. Implementation of NWRM, including wetland restoration can bring many benefits, in particular for flood and water quality protection¹².

V.5.2 NWRM in the Danube Region: a view from the workshops

Wetlands play an important role in the Danube River Basin and many of them are transboundary and under international protection. At the same time, the protected areas for drinking water abstraction, for economically significant aquatic species, for recreational waters and the nutrient sensitive areas (including vulnerable zones) are generally not of transboundary importance. Therefore, actions are needed at all levels, local, national and regional/international in order to maintain and improve status of water resources and protect species and habitats.

To determine the implementation steps for restoration and reconnection of lost floodplains and wetlands along the Danube River and its tributaries, a priority ranking needs to be developed and introduced taking flood retention, nutrient reduction and wetland/floodplain reconnection into account. At regional level, guidance and/or other tools are needed in regard

¹² Source: Danube Basin Analysis (WFD Roof Report 2004)" ICPDR Document IC/084, 18 March 2005

to the implementation of NWRM concerning hydromorphology and addressing hydromorphological pressures.

NWRM may significantly contribute to the Green Infrastructure initiative and enrichment of Europe's natural wealth. Promotion of smart, sustainable and inclusive growth can be further ensured by positive experience on NWRM gained in the Danube region that achieved to control sources, helped to mitigate natural disaster/damages and improve the ecosystem performance. Development of customized tools for specific environmental, economic and cultural conditions could empower societies and support them to accept innovative concepts, including NWRMs.

Synergies between EU Directives should be improved by multifunctional solutions and NWRMs should be considered as cross-compliance solutions. Relevant legal framework should be upgraded at different levels (local, regional, national), planning adjusted to the new reality, and incentives for implementing NWRM measures should be put in place.

For increasing the implementation and acceptance of NWRMs it is crucial to increase awareness of decision-makers concerning benefits of NWRMs as a resource for cost recovery (future strategic planning), as well as acceptance and supporting attitude of citizens.

In addition, implementation of NWRMs could be stimulated by financial and other social incentives, improvement/development of guidelines (technical) and capacity building. Promotion activities could start with young people and social networks, followed by development of convincing projects, pilot studies, and dissemination of success stories. Important precondition is open access to multi-funding sources for application of NWRM in various sectors. With this respect, the EU funds represent a big opportunity, but also the World Bank, the European Bank for Reconstruction and Development (EBRD), etc. and other potential bilateral donors.

During this process, there is a need to keep in mind what is feasible for the Danube Region. Priorities are given to "green" infrastructures that are still to be built and implement the latest technologies that are more adapted to the climate changes. To do that in a possible and cheaper way there is a necessity to reduce a gap between potential and feasibility in the region.

The two Workshops gave the opportunity to show concrete examples of NWRM implemented and the following set of case studies were presented:

A. The 1st Danube Region Workshop, 28-29 January 2014, REC Conference Centre, Szentendre, Hungary:

- (1) Case study from Netherlands: the Dommel area in Brabant
- (2) Case studies from Austria: restructuring Ybbsmündung, Danube; south of Vienna and & Upper Drava
- (3) Case study from Slovakia: Landscape restoration program and integrated river basin management in Bratislava region, Horny Hricov, high Tatras, Tichy Potok and Kosice)
- (4) Case study from Hungary: The Szentendre-Pomáz-plain; NWRM in Flood Management: New Vásárhelyi Plan (room for rivers);

- (5) Case studies from Croatia: Agriculture and Land Use in Lonja Field; CONTRIBUTED WETLANDS in Istria and Adriatic Coast (camping purposes Glavotok; island Krk;; Zagreb's landfill and artificial lake Butoniga
- (6) Case study from Croatia & Slovenia: the reservoir vonarje/sutla lake
- (7) Case study from Czech Republic: Drainage Area Study of the city of Hradec Kralove
- (8) Case study from Romania: Practical case in green Infrastructure - Danube Flood Plain
- (9) WWF - Danube basin floodplain restoration: Liberty Island and side-arm restoration – HU
- (10) Case study from Bulgaria: Osam River near Obnova village; Restoration of meander of Vesselina river, Reconnection between the Danube River and the wetlands of Persin Island; Restoration of Russenski Lom River near Ivanovo Rock Monasteries; Restoration, protection and sustainable development of Zlato pole; Atanasovsko lake; Constructed Wetlands for wastewater treatment.

B. The 2nd Danube Region Workshop, 23-24 June 2014, Bucharest, Romania

- (1) Case study from Romania: Ecological restauration in Comana wetlands; NWRs and torrent management
- (2) Case study from WWF Romania: Danube floodplain restoration projects in Romania
- (3) Case study from DHI: Ecological restoration for Lower Danube; Flood mitigation and Wetland restoration in Danube River Basin
- (4) Case study from UK: Blue-Green innovations in future cities' spatial planning
- (5) Case study from Danube River Basin: Natural water retention measures and sustainable agriculture practices

V.5.3 Key messages from the Danube region

Main challenges identified with regard to NWRM implementation in the Danube region are:

- Overcoming administrative and legal constraints
- Overcoming lack of relevant knowledge and interest
- Taking into consideration local characteristics and limitations (e.g. demographic, geographical)
- Securing sufficient financing and investment
- Re-establishing economic balance following changes in land-use that favour green infrastructure
- Establishing and maintaining relevant institutions and organisations tasked with development, implementation, monitoring and enforcement
- Drafting health and safety measures

Benefits of NWRM implementation and good practises are:

- Lessened pressure on ecosystems

- Water and nutrient recycling in constructed wetlands
- Improved visual aesthetics
- Lower flood risk
- Local water retention (especially beneficial during dry periods)
- Enhanced water quality and quality protection
- Sustainability of urban development and drainage systems

Recognising that good practises need to be in place to reap NWRM benefits, several were mentioned, namely:

- Preliminary information on any measure should include an indication of the level of contribution to primary objectives. Will the benefits be minor (short term), fairly significant (medium term) or significant (long term)?
- Any contribution that a measure makes to legal or policy obligations should be highlighted, as this will provide added incentives to implement the measure.
- Relevant terms need to be clearly and carefully defined, so that all stakeholders are clear about the terminology used in relevant measures. One term of particular importance and demanding clarity is that of 'ecosystem services'.
- Furthermore, the economic value of ecosystem services should be included if it applies to the measure in question. It is important that the positive economic impacts of NWRMs are indicated.
- It is imperative that measures strengthen the local environment's resilience to the effects of climate change.

Instruments to promote NWRM:

- Appropriate financial incentives need to be in place to motivate as many stakeholders as possible.
- It is essential that legal standards and requirements are comprehensive and up to date.
- Current obstacles need to be assessed in order to identify which legal instruments are in need of review.

During the new programming period for the next RBMPs, explore creative possibilities to mobilise existing funds and to allocate them directly for NWRMs.

- Fundraising efforts are made easier when preliminary studies are carried out to help determine a hierarchy of priorities.
- Present clear arguments and persuasive studies when trying to win political commitment to implementing measures that promote and secure sustainability.
- Promote a basic understanding of the retention capacity of catchment areas and stretches of river, and keep existing retention areas open.
- It is crucial to continually exchange knowledge and information; otherwise, even the best instruments may not work.
- Present information to decision makers in a clear, understandable way.

- Communicate and raise awareness as much as possible concerning all possible options.
- When attempting to develop and implement river basin management plans (RBMPs) or flood risk management plans (FRMPs), stress the importance of the solidarity principle and the transboundary aspect of NWRMs.
- A partnership or bilateral agreement between countries on bilateral issues provides a solid foundation for further planning and implementation efforts.

Concerning Agriculture and Forestry, NWRM as multi-functional measure can contribute to foster recovery of biodiversity and reduce nutrient load. With the main focus to enhance the retention capacity of soils, wetlands and other water-dependent ecosystems these measures can reduce soil erosion, needs for water retention during flood events, as well as increase availability of water for use in agriculture.

In relation to the policy relevance of NWRMs, participants stressed in order to achieve the Green-Blue European infrastructure in the future, it is necessary to reach policy coherence and integration considering requirements of the WFD and FD in agriculture and forestry. Incorporation of NWRM into 2nd RBMPs and FRMP is essential. There is a constant need to increase capacities of authorities and all practitioners in general and in mobilizing existing funds, as well as to increase the acceptance and awareness of NWRMs in agriculture and forestry.

The initiative of the NWRM project to build network of experts and practitioners that can meet and communicate experiences through the Danube Region and beyond was assessed as one of the most important mechanisms to stimulate implementation of the NWRMs in agriculture and forestry. This should not stop with the end of the project but the project team shall try to find a way to keep it in the future. There is also a need to improve mechanisms to deal with land ownership and associated property rights when implementing NWRMs.

Urban liveability could be improved by applying NWRM in terms of standard, health, longevity, economics, policy relevance; as well as water quality, hydrology, hydromorphology / natural design – biodiversity. They can help to mitigation of floods, droughts, damage and enrich ecosystem performance and services. Keeping as much water as possible by multi-functionality of NWRMs we ensure source control of precious storm runoff by using, recycling and recharging.

There is a need to improve synergies between all relevant EU Directives by multifunctional solutions, and from that point of view, application of NWRM. Interest of NWRM results in cost-savings and in that respect future strategy planning should include NWRMs' multifunctional (decentralized) solutions as they allow for modernize urban planning, provide economic motivation and optimization of cost-savings. This may bring benefits to the society by paying less and living better.

Considering mechanisms to stimulate implementation, there is a need for further adjustment of the legal framework to the new reality at State, regional and city levels. Furthermore, financial and other incentives, technical guidelines, capacity building methods including e-learning, raising awareness of decision-makers, broad promotion and Public Relations (PR), convincing case studies, projects and access to multiple funding sources should be further developed in order to increase application of NWRMs in urban areas.

Integration will be the key work when dealing with Natural areas, such as integrating NWRMs in the future RBMPs and FRMPs as a cross-compliance solution considering WFD, FD, Natura 2000, Nitrates Directive, etc. In the first WFD cycle these were isolated cases that could/should be expanded in the second cycle. Their relevance for flood and drought issues is recognised but it is rather difficult to implement them on a small, isolated cases. In addition, the effects are significantly dependent on the scale of implementation.

Rehabilitation of Danube floodplain started in 2006 as a feasibility study and the group opts for restarting it again. It should be an integrated flood control project with dyke strengthening, flood monitoring and control and floodplain restoration. Nutrient load, which is an issue not easy to deal with, should be also considered.

Participants from Romania and Bulgaria underlined similarities in post 80s development in their countries, characterized by collapse of irrigation and drainage systems, lack of national strategies or codices concerning implementation of NWRM and cost recovery matters, existence of isolated cases and steps toward reconstruction actions and a complete absence of multipurpose effects monitoring. It is difficult to find common indicators that identify impacts at decent costs. In addition, institutions do not do monitoring unless it is their obligation by law or by-laws. The WFD compliant monitoring is not fully suitable for NWRM projects' as they required project specific monitoring.

Concerning policy relevance, NWRMs are compliant and should be used when fulfilling requirements of the WFD, FD and Climate change policy and included in feasibility studies.

V.5.4 Developing an NWRM community within and beyond the Danube region

In order to develop the NWRM community of practitioners and interested parties within the Danube region and beyond, individual contacts and relations were made in both, all EU Member States and non-EU Member States - the ICPDR Contracting Parties. To identify and discuss case studies of NWRM, encourage dialogue (including via the LinkedIn site) and invite attendance at the regional workshops, a wide range of stakeholders from water sector, agriculture, business, industry, navigation, energy, tourism and other relevant sectors has been engaged in NWRM. Activities that have been carried out by the project team include:

- Close liaison with practitioners at national and regional concerning relevant actions by keeping track of on-going and new activities and initiatives in relevant fields, via direct participation in relevant actions and meetings that took place within the region or by making contacts (via phone calls, emails, etc.) with lead organizations and experts of these initiatives;
- Facilitation of the LinkedIn site, the Danube Region group web-forum on regional issues that included: posting information and questions on progress with project activities; making short syntheses of discussion topics; contacting experts and "motivating" them in providing input (in particular before, during and after the regional workshops that played the role of a milestone for bringing specific discussions to an end so that syntheses can feed into the workshop discussions;
- Identification of NWRM case studies and information sources that were used to feed the knowledge platform. In addition, in case of countries that belong to two or more NWRM regions relevant "contributor"/practitioner or researcher were contacted and

connected with the partner(s) in charge of the respective MS and relevant information were forwarded to the partner in charge of the country/MS where the case study takes place...).

- Synergy with the ICPDR and its Expert Groups. In order to couple activities of the NWRM project with the activities of the International Commission for the Protection of the Danube River (ICPDR), regular communication was carried on during the life of the project. It ensured close interaction and coordination with the ICPDR Expert Groups (EG) that are relevant and can benefit directly from the outcomes of the NWRM project. In total, five ICPDR EG Meetings were attended by the Danube Region NWRM Network lead, Ms Jovanka Ignjatovic (REC), providing an overview on current state of the NWRM project, the expected deliverables and results that are aimed to support countries in preparing the 2nd RBMPs and improving water status for all purposes.

All those activities and, in particular, combined effect that has been built between the Danube countries and the project team enriched significantly the data collection process concerning not only the missing information about the identified but for the new Case Studies as well. At the same time, the work carried out by the NWRM project team has been evaluated as equally important for the preparation of the 2nd River Basin Management Plans (level A & B) and the Danube FRMP.

In order to maintain macro regional perspectives, continual exchange of information and consultation have been kept with the EUSDR, in particular with Priority Area (PA) 4 regarding water quality restoration; PA 5 dealing with management of environmental risks and PA 6: concerning protection of biodiversity by floodplain and habitats restoration.

V.6 Key outcomes of the regional processes with respect to NWRM implementation

V.6.1 The main features of NWRMs in the four regions

The type of NWRMs implemented in the four regions obviously responds to region-specific water management issues and challenges. However, it is possible to identify some common NWRM features across the four regions, both in terms of drivers and types of intervention, and namely:

- In the four regions, flood risk management and protection is a common driver of NWRM implementation, and it is the very main driver of NWRM implementation in both the Western and Danube regions. In the Western region, in particular, Natural Flood Management (NFM) is a well-established practice, where different NWRMs are implemented in a coordinated way according to an integrated catchment-based approach. Measures adopted on NFM plans and interventions include run-off attenuation, floodplain restoration, sediment management, re-meandering and forestry measures to control run-off. In the Danube region, flood risk management is often dealt with river and floodplain restoration. In both regions, natural flood management is often linked to nature protection, biodiversity and water quality improvements.

In the Mediterranean and Baltic regions, interventions on natural flood management are responding to specific regional challenges. In the **Mediterranean region**, NWRM

implementation is mainly aimed at managing the risk of and protecting from flash-floods and storm-flows. This region, in fact, is mainly concerned by water scarcity, and precipitations are unevenly distributed across the year, so that heavy rainfall is often concentrated in a very short time lapse. A completely different situation is found in the **Baltic region**, where floods are mainly occurring in urban areas only at the beginning of the warm season, when the abundant snow fallen during the winter melts, or during heavy summer rains. In this case, the rural-urban relation is a key feature of NWRM implementation, focusing on (i) making room for the river in rural areas; and (ii) keeping rain where it falls in urban areas.

- River, floodplain and wetland restoration is a common practice, widely applied in the four regions for managing flood risks and improve biodiversity. In addition, wetland restoration is often implemented to improve water quality in the Western and Baltic regions –but some case studies can also be found in the Mediterranean and Danube regions.
- Sustainable Urban Drainage Systems (SUDS) can definitely be considered as a cross-cutting theme in the four regions, as it addresses similar water management issues and faces similar challenges.
- In the Mediterranean region, in contrast, water scarcity is the main driver of NWRM implementation. The main objective of these measures is then to increase the water stored in aquifer by enhancing infiltration in soils; the final purpose, however, it is not only to secure the supply to water use sectors, but primarily to enhance or restore natural functions and ecosystems. Relevant NWRMs in the region are thus early sowing and traditional terraces (agricultural sector), targeted planting to harvest water and afforestation of riparian areas (forestry sector), re-meandering, floodplain and wetland restoration in natural areas, as well as rainwater absorption pits and the use of permeable materials in urban areas. In some cases, water scarcity issues have also been reported in the Western and Danube region, and this may become increasingly prevalent with climate change. Therefore NWRMs could have an increasingly important role to play in helping to regulate the hydrological cycle, in terms of both flood peaks and dry periods.

Common drivers and practices are summarized in the figure below. The figure also includes other key regional NWRM features.

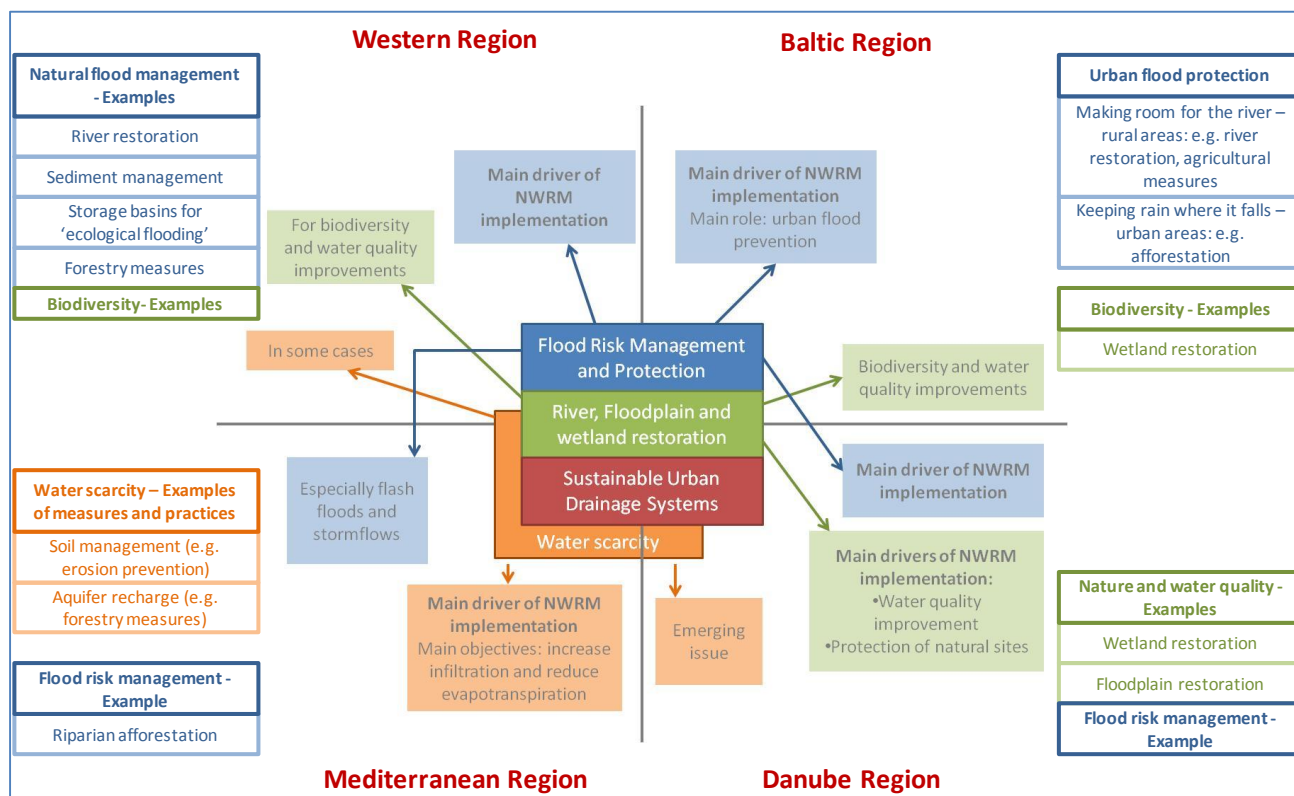


Figure 9. Main features of NWRMs across the four regions

Note: SUDS are generally implemented across the four regions, but they cannot be considered as main drivers to NWRM implementation in any of them.

V.6.2 The keys to successful NWRM implementation

Going beyond the differences and peculiarities among the four regions, exchanges with practitioners, experts and policy makers during the workshops highlighted some common, underlying elements which are key to successful NWRM implementation across Europe. These elements can be linked together to form a basic framework for successful implementation, as presented in the Figure below.

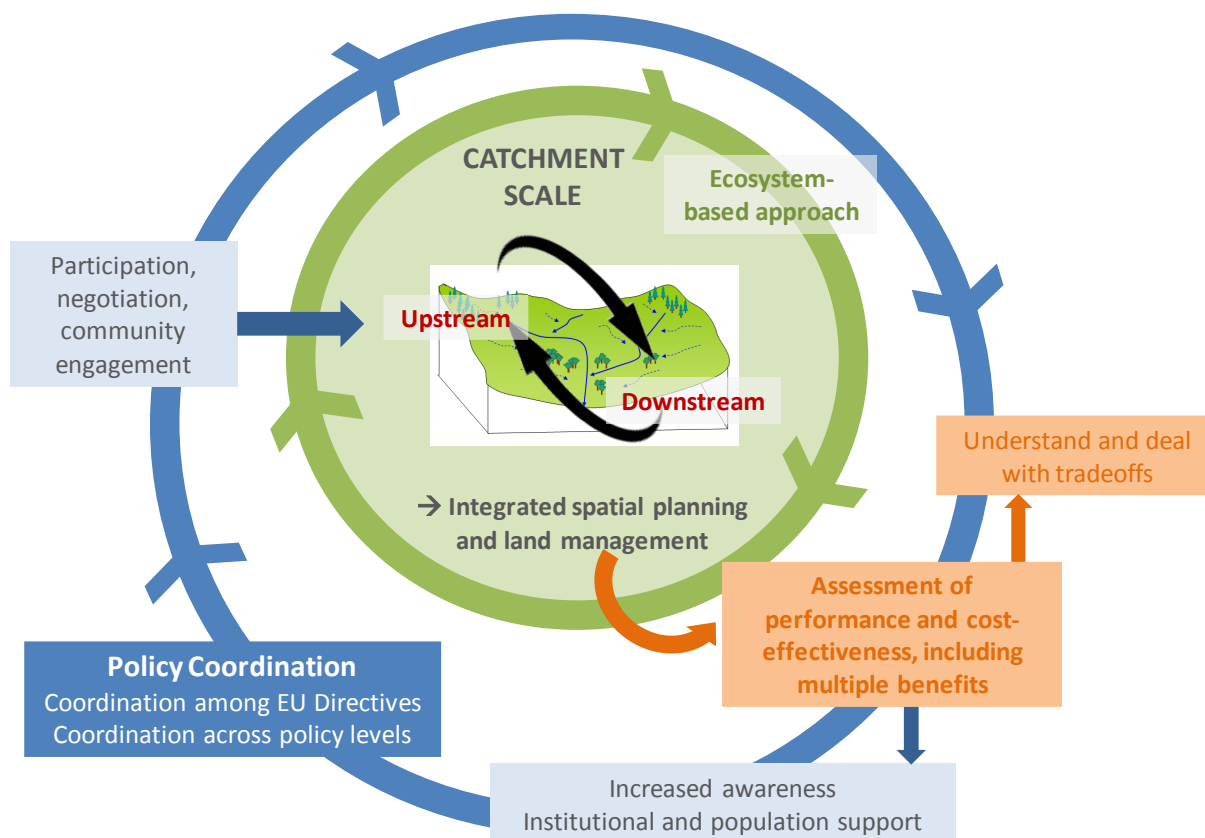


Figure 10. An overall framework for successful NWRM implementation

The keystone of successful NWRM implementation is the **catchment scale**: as shown, for example, by case studies in the Western region, individual measures may have little effect, and it is rather the cumulative effect of measures appropriately situated throughout a catchment that is relevant when considering benefits. In the Mediterranean workshop, it was observed that the scale of implementation tends to be very local and thus technically biased, and the importance of a catchment-wide perspective was also highlighted.

However, the importance of planning, designing and implementing NWRMs goes beyond the technical aspects: as noted in the Mediterranean region, it is not that NWRMs must be based on an ecosystemic perspective, but their implementation in itself is an **ecosystem-based approach** to water and environmental management. And this requires that NWRM implementation is the result of an **integrated, long-term spatial planning** and land management.

Only this approach, in fact, can overcome the main **challenges to NWRM implementation**, which can be summarized as follows:

- The large application scale of NWRMs poses some challenges when it comes to assess the performance and effectiveness of measures: the benefits are often widespread, and often interventions in one place generate benefits elsewhere (i.e. downstream);

- NWRMs provide multiple benefits, which go well beyond water retention itself and include, for example, water quality improvement, biodiversity improvement, enhancement of soil features, better ecosystem adaptation capacity to climate change and so on. If some of the multiple benefits are overlooked or unknown, NWRMs might not appear cost-effective, and thus key stakeholders might not have an incentive to engage in NWRM implementation;
- NWRM can often present trade-offs, as changing land practices is likely to involve opportunity costs. These trade-offs can only be understood and addressed from a catchment-based perspective.

A catchment-wide perspective to NWRM implementation, which embraces all linkages between measures, ecosystems and human beings, is better suited for capturing and **assessing the performance** of the measures and, in turn, their **cost-effectiveness** –which includes a comprehensive understanding of the **multiple benefits** realized across the catchment. Measuring those benefits is a challenging task, and in fact most of the discussions highlighted the **need for a better knowledge about multiple benefits** and their values. As observed during the Mediterranean workshop, at present evidence on effectiveness mostly refers to design conditions, and few projects assessed NWRM contributions to water policy objectives. This knowledge is the key for highlighting and demonstrating the cost-effectiveness of NWRMs, which at the moment is still debated.

Building a **strong evidence base** on NWRM performance and, especially, on their **cost-effectiveness**, is perceived as a crucial step to induce a change in the policy processes and in public awareness. **Legislative and policy support** is a crucial success factors for the implementation of NWRMs. Ensuring institutional support can also ensure **financial support**, for example through the establishment of appropriate funding mechanisms. Promoting multiple benefits, in particular, is key to ensure such support –provided that such multiple benefits can be demonstrated.

A comprehensive knowledge of NWRM performance is also crucial to gain **acceptance and support from local communities**. This, however, must not be just seen as an end-point of the process: participation of local communities and stakeholders must in fact be an integral part of integrated planning at the catchment scale, from the very first phases of measure planning and design. NWRM implementation can never be successful without local support, and this support must be sought from the very beginning.

Integrated planning and implementation at the catchment scale, in turn, can only be possible in an overall framework of **policy coordination, both among relevant EU Directives and across administrative levels**.

The links between NWRMs and different EU Directives, in particular, appear evident if one thinks about the multi-dimensionality of NWRMs, which include both interventions on rivers but also on floodplains and riparian areas throughout a catchment. At present, NWRMs are directly linked to the implementation of the Floods Directive, and in a very few cases the Water Framework Directive was the main driver for implementation. This Directive, in fact, does not give much attention to riparian issues, but rather focuses on the water body as a central concept, and this might be hindering a good approach to NWRMs. The link between forestry measures and the WFD, for example, needs to be clarified, as such measures are rarely on water bodies. Overall, **an explicit link with the WFD needs to be made**. The multi-dimensional character of NWRMs also calls for a **full integration** not only of FD and

WFD, but also of the **Bird and the Habitat Directives**, as NWRMs can play a major role in nature conservation and restoration, with consequent biodiversity improvements –and, in some cases, these have been the main drivers of implementation, whereas water retention was rather a side benefit. NWRMs can also contribute to climate change adaptation and mitigation, and this calls for integration with EU adaptation and mitigation strategies.

These considerations not only suggest that a more complex approach to NWRMs would be needed but, more importantly, they highlight that **NWRM are an important part of the emerging paradigm shift in water management**, towards a holistic, ecosystem-based approach to environmental challenges. However, in order to realize this shift, current knowledge gaps (e.g. impacts, performance, cost-effectiveness and benefits in particular) must be filled.

V.7 Participation in activities of the WFD CIS

The consortium partners contributed to different meetings of the Common Implementation Strategy (CIS), making presentations on the project activities, intermediary results, or presenting the content and focus of the guide, or on the main messages and results obtained from the Pilot project and the analysis of the information collected. In addition to informing CIS participants about the activities and progress of the NWRM pilot project, these presentations also helped collecting feedbacks and input that helped steering and guiding the project activities, in particular the development of the guide (see below¹³). It is important to note that different CIS WG members participated in the regional workshops organised by the project, strengthening the links between the project and the CIS activities.

The following table summarises the involvement of partners in different CIS meetings.

Table 12: List of WFD CIS meetings and participation of NWRM project partners and contributions

WG CIS	Meeting date	Participant from consortium : Name (Organisation) mail	Participation type : * chairman * sessions chair-animation / round tables * PowerPoint presentation: title + store as file on a CD	Observations / decision taken / input brought for NWRM project
WG PoM	12 & 13 Nov. 2013	Pierre Strosser (ACTeon)	Presentation of the project (objectives, activities, deliverables)	Suggestions on types of measures to be considered, links to other initiatives (including CIS WG activities – e.g. Floods), input to definition of NWRM

¹³ A specific consultation note on the focus, target group and content of the guide was developed and sent to all WG members for feedbacks and input.

WG CIS	Meeting date	Participant from consortium : Name (Organisation) mail	Participation type : * chairman * sessions chair-animation / round tables * PowerPoint presentation: title + store as file on a CD	Observations / decision taken / input brought for NWRM project
WG Agri	6- & 7 March 2014	Alistair McVittie (SRUC)	Presentation of the project (objectives, activities, deliverables), preparation of a concept note how to link NWRM and CAP reform, including clear link between the respective CAP budgets and the individual NWRM, and presentation	The link between CAP and NWRM is established by the table of the concept note.
WG PoM	24 & 25 March, 2014	Pierre Strosser (ACTeon)	Presentation on the definition and Classification of NWRM,, common Understanding of NWRM, presentation of practical Case Studies from Pilot Project, and identification of lessons learned, consultation on the objectives, focus and expectations vis-à-vis the Practical guide and the knowledge base	Clarification that further work on the definition of NWRM will take place in the context of NWRM drafting group, guidance on the focus and content of the guide
WG Floods	1 & 2 April 2014	Dennis Collentine (SLU)	Presentation of the NWRM project and of the concept note prepared by the NWRM partners for the WG	The key feedback is that NWRM are mostly dedicated to small scale flood protection and mitigation.
WG Groundwater	8 April 2014	Maggie Kossida (IACO)	Presentation of the NWRM project and of the concept note prepared by the NWRM partners for the WG	
WG PoM	13 & 14 October 2014	Gonzalo Delacamara (IMDEA), Benoit Fribourg-blanc (OIEau), Pierre Strosser (ACTeon)	Presentation of the platform on NWRM, presentation of the NWRM guide and evidence on costs and benefits of NWRM	Participants were very much interested by the platform and its key content.
Workshop Linking Water Framework Directive and	8 & 9 November 2014	Pierre Strosser (ACTeon) & Sonia Siauve (OIEau) for	Facilitation of the session on NWRM, presentation on the key messages developed by the project	Reactions on key messages – but no disagreement with the

WG CIS	Meeting date	Participant from consortium : Name (Organisation) mail	Participation type : * chairman * sessions chair-animation / round tables * PowerPoint presentation: title + store as file on a CD	Observations / decision taken / input brought for NWRM project
Floods Directive		preparation	(including the need for further policy coherence and pre-conditions for NWRM to be considered)	messages proposed
WG Floods	9 & 10 November 2014	Pierre Strosser (ACTeon)	Presentation on progress with discussions on NWRM, progress with the pilot project activities and the development of the policy document on NWRM	Feedbacks sent by WG members on the draft policy document that have been further integrated into the final version of the policy document – no specific input to the finalisation of the Pilot Project deliverables
WG PoM	2 March, 2015	Pierre Strosser (ACTeon)	Presentation of structure, content and main messages of the final guide	General reactions on the content, questions on the plans made for disseminating the projects results and deliverables
WG Floods	10 & 11, March 2015	Pierre Strosser (ACTeon)	Presentation of structure, content and main messages of the final guide	Limited general reactions
4th Water conference	23 & 24, March 2015	Benoît Fribourg-blanc (OIEau), Pierre Strosser (ACTeon)	A complete NWRM stand was organised with a roll up, a poster, distribution of the NWRM leaflet and the guide and presentation of the NWRM platform	Many leaflets distributed (over 200) and the printed EN version of the guide (120)

In addition; ACTeon participated actively in the drafting of the EU policy document on NWRM¹⁴, participating in the different meetings of the NWRM drafting group (sub-group of the WG PoM) and developing, writing and reviewing specific sections/paragraphs of the

¹⁴ European Commission. 2014. EU policy document on Natural Water Retention Measures. By the drafting team of the WFD CIS Working Group Programme of Measures (WG PoM). https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures_Final.pdf

document. This helped in particular bringing some of the Pilot project knowledge and lessons into the EU policy document, and enhancing the coherence between the EU policy document and the guide on NWRM that was developed later on as part of the project activities (see below).

V.8 Raising awareness by creating synergies with other initiatives

➤ Euro-INBO (October 2013/ October 2014)

OIEau participated twice at the International Network of Basin Organisation (INBO) general assembly. In October 2013, in Sibiu (Bulgaria) the project objectives were presented and invitation to become members to the Community of practice and join NWRM regional forum.

In October 2014, the general assembly was held in Bucarest (Romania). The presentation prepared by OIEau on the platform and other results of pilot project were combined and presented by the project officer who widened her speech to the European vision.

➤ WFD Workshop in Dublin (December 2013)

OIEau participated at the WFD conference organised by the city of Dublin in December 2013. During this event, a presentation on the project was made and a round table was facilitated. The round table focussed on the three following points: (i) what are NWRM? How would you describe them? (ii) What would be your needs to integrate them into PoM? (iii) Share feedbacks on NWRM case studies. One major lesson learnt from this event was the importance of raising awareness. The participants at the round table were initially dubitative and not sure what NWRMs dealt with. After a while, the semantic issues were tackled and the participants realised they were implementing NWRM (ex: Dublin city council developing wetlands within the city). Some of the participants became members of the western region forum.

➤ DG Environment, 4th water conference (23-24 March 2015)

OIEau and ACTeon with the support of the project officer held a NWRM stand at the entrance of the 4th Water conference held in Brussels to promote the platform and officially launched the practical guide. The conference gathered more than 400 participants and was a high success, making wide reference to green infrastructures and NWRM. It only comprised 4 stands, one for EEA, one for LIFE, one for the JRC and one for DG ENV: the NWRM stand. The stand included a roll up specifically elaborated for the event but that can be used later for other similar events to promote NWRM. The poster of the project was also presented and the knowledge platform was demonstrated with a laptop available for consultation. More than 20 participants asked for a specific demonstration and explanation on the platform. The leaflet explaining the NWRM and its key features and allowing to find the website and all further information in English was distributed (over 200 copies), as well as a printed version of the guide in English (over 120 copies).

➤ ASTEE congress on cities¹⁵ (Montauban, France, June 2015)

More recently, OIEau presented the project results under a specific angle: Eco-engineering applied to water: How Natural Water Retention Measures « NWRM » can improve urban area's resilience. The European approach related to NWRMs was brought to local stakeholders interested to learn about this. Again, one outcome of the presentation was to bring awareness and reach local decision makers and practitioners. Some of them were really interested in providing information on their own case studies. Some others were looking for technical answer to their implementation needs.

➤ IMDEA and ACTeon, in partnership with Wetlands International, co-organised a dedicated working session on “Natural Water Retention Measures Restoring Ecosystems Providing Multiple Benefits” as part of the European River Restoration Conference (ERRC) that was held in Vienna 27-29th October 2014. The session included in particular: an introduction to NWRM by Chris Baker (Wetlands International); a presentation entitled “Natural Water Retention Measures explained” by Chris Baker (Wetlands International, Headquarters); a presentation by Gonzalo Delacámara (IMDEA) entitled “Good enough? Evidence on multiple benefits of NWRM from EU’s NWRM Pilot Project”; two illustrations on the implementation of NWRM in Poland (Speaker: Tomasz Okruszko, Warsaw University of Life Sciences) and in Spain (Speaker: Josu Elso, Iberian Centre for River restoration); and a final presentation by Pierre Strosser (ACTeon) entitled “Ready to go? Preconditions to implementing NWRM”.

➤ The International Commission for the Protection of the Danube River (ICPDR) is an international organisation consisting of 14 cooperating states and the European Union, which deals with the whole Danube River Basin. This international organisation has been carrying out several Meetings in order to prepare the 2nd Danube River Basin Management Plan and the 1st Flood Risk Management Plan. During the life of the project, the Danube Region NWRM Network lead, Ms. Jovanka Ignjatovic (REC), attended five ICPDR EG Meetings in order to couple activities of the NWRM project with the activities of the ICPDR, providing an overview on current state of the NWRM project, the expected deliverables and results. The project outcomes have ensured close interaction and coordination with ICPDR Expert Groups and have supported the countries on preparing the 2nd Danube River Basin Management Plan and the 1st Flood Risk Management Plan and improving water status for all purposes.

➤ After participation in the 1st Danube Regional workshop, an article of the Natural Water Retention Initiative was published in the ICPDR official magazine called Danube Watch (Putting nature to work), and identified cases studies within the project that have been shared with the ICPDR and included in the 2nd DRBM Plan under the

¹⁵ ASTEE (Association Scientifique et Technique pour l'Eau et l'Environnement), congrès "*Des villes et des territoires sobres et sûrs - Les services publics locaux de l'eau et de l'environnement relèvent le défi*", 1-3 juin 2015

topic of the Hydro morphological and Flood Protection Expert Group. Furthermore, information about the NWRM project were also presented to the participants of the 5th Workshop on the Follow-up of the “Joint Statement on Inland navigation and Environmental Sustainability in the Danube River Basin” that was held in Zagreb, on February 4-5, 2014. The Joint Statement was concluded in October 2007 between the ICPDR, the International Sava River Basin Commission (ISRBC) and the Danube Commission, with the main focus on Guiding Principles on the Development of Inland Navigation and Environmental Protection in the Danube River Basin. The meeting was attended by the representatives of the EU concerning navigation, responsible government authorities and various interest groups. Interest about the NWRM project and further information were requested by national representatives. The follow-up of the NWRM project achievements was assessed as important for further discussion concerning issues that the “Joint statement” is dealing with and the preparation of the 2nd DRBM Plan, providing the opportunity to strengthen application of the Joint Statement in the fields of NWRM for the reduction of hydro morphological pressures.

- In order to maintain macro regional perspectives, continual exchange of information and consultation have been kept with the EUSDR, in particular with Priority Area (PA) 4 regarding water quality restoration; PA 5 dealing with management of environmental risks and PA 6: concerning protection of biodiversity by floodplain and habitats restoration.

VI Task 3: Supporting future implementation

VI.1 Practical guide

Building on the knowledge collated by the different partners, and the many experiences presented and discussed at the different regional workshops, the consortium produced a guide to support the selection, design and implementation of Natural Water Retention Measures in Europe- capturing the multiple benefits of nature-based solutions. The guide places the emphasis on the multiple-benefits NWRM can deliver, specifying how best to implement or adapt the different steps of a (river basin management) planning process so NWRM are adequately considered. Overall:

- The guide aims at supporting the selection, design and implementation of NWRM in Europe.
- It targets in priority managers, decision makers, experts and stakeholders involved in the selection, design and implementation of NWRM as part of plans and programmes addressing water, floods, biodiversity, climate change adaptation, forestry, agriculture or urban issues.
- It helps navigate throughout the internet-based NWRM knowledge base (<http://www.nwrn.eu>), proposing logical steps to access the different types of information and experiences that have been assembled in this knowledge base.

The guide complements in particular the EU NWRM policy document that sets the overall policy umbrella and the relevance of implementing NWRM for achieving water and related policy objectives¹⁶.

The guide includes three main parts:

- The main text of the guide, that addresses the following issues:
 - The definition of NWRM (title: What makes a measure.... a Natural Water Retention Measure)
 - The main reasons that might justify the choice of NWRM as compared to traditional grey infrastructure measures (e.g. as they deliver multiple benefits, contribute to the achievement of the objectives of different policies, etc.) (title: the Good reasons for selecting and implementing NWRM)
 - Possible adaptations, or issues to be addressed with particular care, in the different steps of a planning process so NWRM are given a chance to be considered and potentially selected (title: Enhancing policy coordination for making the most out of NWRM in your planning process)

¹⁶ European Commission. 2014. EU policy document on Natural Water Retention Measures. By the drafting team of the WFD CIS Working Group Programme of Measures (WG PoM). https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures_Final.pdf

- Preconditions for ensuring NWRM are given their due role (title: Selecting, designing and implementing NWRM - pre-conditions for ensuring effectiveness)
- Five illustrations that summarise the practical experience in implementing NWRM in five different areas/countries (see table below);
- A toolbox that present the identify cards of 53 individual NWRMs.

Table 13: Case studies included in the NWRM guide

Case name	study Country	Main characteristics of the territory	NWRM implemented	Institutions involved & governance
Rural runoff attenuation in the Belford catchment	UK	The catchment (5,7km ²) is upstream of Belford village and covered by pasture and cultivated grasslands	Basins and ponds (N1), Coarse woody debris (F10), Overland flow areas (F10), Peak flow control structures and (F14)	Environment Agency and Northumbrian Regional Flood Defence Committee, Newcastle University and Northumberland River Trust, farmers' involvement
Floodbreaking hedgerows in Southern France	France	The watershed is covered for 83% (A2) by agricultural land. Riparian vegetation and trees are dense, but within 28 years, 300km of hedgerows have disappeared	Buffer strips and shelter belts	SMIVAL (association of 24 municipalities), Chambers of agriculture, considered as part of the process for developing an Action Programme for Preventing Floods in the Lèze basin
Wetland restoration in Persina	Bulgaria	The two sites are former wetlands along the Danube River, of 1 755 ha and 2 280 ha within the Persina Nature Park.	Wetland restoration and management (N2)	Ministry of the Environment and Water of Bulgaria, Participatory process mobilizing inhabitants
Nummela "gateway" wetland park	Finland	Half of the 500ha watershed is urbanized, but agricultural lands remain; the wetland has been implemented at an abandoned crop field site.	Retention ponds (U11)	University of Helsinki, Municipality of Vihti, Uusimaa Centre for Economic Development, Transport and the Environment, involvement of a wide range of local and regional stakeholders
Órbigo river ecological status improvement	Spain	The floodplain is covered by broad-leaved forest, mainly of dam/longitudinal barriers along with the River Basin	Floodplain restoration and management (N3), Stream bed re-naturalization (N5), Removal of dam/longitudinal barriers	Ministry of the Environment and Rural and Marine Affairs of Spain, River Basin

Case name	study	Country	Main characteristics of the territory	NWRM implemented	Institutions involved & governance
			irrigated poplar (N9), plantation, narrow natural riparian band, Elimination of riverbank vegetation cereal protection (N11), crops, moors and heathlands and urban areas. Riparian buffer restoration and maintenance (F1)	bank stabilisation	Authority. Involvement of municipalities and NGOs

The following table presents the different steps that were followed for developing the guide.

Table 14: Steps of development of the NWRM guide

Steps	What and with whom?	When?	Where? (if relevant)
Agreement on the focus and target group	Discussion within consortium, presentation for feedbacks at the CIS WG POM & WG Floods	From June to October 2014	Electronic communication, Brussels
Development of the structure	Discussion within consortium, presentation for feedbacks at the CIS WG POM & WG Floods	From June to October 2014	
Development of the draft guide	Direct contributions of external experts for the presentation of selected case studies	From June to January 2015	
Review of the draft guide	Workshop with thematic leads of the consortium	November 2014	Brussels
	Workshop with key practitioners (representing different countries, sectors, etc.)	December 2014	Paris
	Review by the EC	December 2014 & January 2015	Via emails
Finalisation of the guide		February & March 2015	
Translation of the guide	Translation in DE, FR and ES		
	Translation in other EU languages (IT, PL, RO, NL, EL, CZ, PT, HU, BG, HR, SK)		
Printing	Printed in English in 500 copies	March 2015 – for EU Water Conference	
	Printed in DE, ES, FR and PL in 200	May 2015	

Steps	What and with whom?	When?	Where? (if relevant)
	copies each		
Dissemination	English version disseminated at the EU Water Conference	March 2015	Brussels
	IT, PL, RO, NL, EL, CZ, PT, HU, BG, HR, SK, DE, FR and ES disseminated	From May 2015 onwards	

The guide was translated in 14 languages. A printed version in English was distributed at the 4th European Water Conference on 25 and 26 March 2015. More than 100 versions were distributed and received positive feedback during and after the conference. The document was highly appreciated as a synthesis of the NWRM information and in making the links between NWRM and the practical delivery of WFD objectives.

The representative from NO at the SCG even told the project officer:

"Thank you so much for bringing the copies of the NWRM practical guide. Even if this guide exists on the web, it is something quite different to have it in the hand, especially the attached "pocket" of cards explaining different NWRMs. I guess this is an example of how we should have structured the numerous documents of CIS-guidance....."

VI.2 Publication material

To allow for providing information to the different external experts for the NWRM project, but also all potential end users and interested stakeholders, and for raising awareness on the potential for - and benefits from - NWRM, the production of publication material is a cornerstone. A high-quality layout for all publications was always considered so as to make all communication documents homogenous and easily identifiable as belonging to the NWRM project.

VI.2.1 Project's leaflets

The preparation of a leaflet on DG ENV NWRM initiative and the study (including the process and the role of the regional networks) was deemed necessary early in the project, to be used for communication about the project (e.g. when contacting potential members of the regional networks or stakeholders for interviews). Prepared in English, it was discussed and validated with DG ENV, and used in all communication events during the project: participation to conferences, regional Workshops, information exchange with various experts. This project leaflet was used and distributed at all events, and more than 1000 printed versions were disseminated all along the project. In addition, it was also put online on the website, and put at the forefront, allowing all interested experts or stakeholder to download and print it.

At the end of the project, a second leaflet was prepared, to act as a communication tool on the NWRM platform and guide. This second leaflet was developed in view and as support to the communication on the NWRM platform and NWRM networks for wider communication on NWRM and their practical implementation in the medium and long term.

It was built on the main results and deliverables of the project and in particular on the guide, both in terms of the content but also in terms of the format (e.g. the choice of the main photos, design, etc.).

The English version of the leaflet was developed and printed in 2.000 copies in time for the EU Water Conference organised in Brussels March 23rd and 24th, 2015. Thus, it was distributed to the participants at the Conference that addressed NWRM in different sessions. Translation into all EU languages was then performed and the leaflet made available on the <http://nwrn.eu/implementing-nwrn/how-does-it-work> for further dissemination in all EU MS by the Commission services.

VI.2.2 The concept note

As briefly described under I.1.1, at the onset of the project it appeared the NWRM concept needed some further delineation. To help this and exchange views with key experts within and outside the project, and raise key methodological issues, which might contribute to clarify the content and scope of the pilot project, a long and detailed <http://nwrn.eu/ressource/concept-note-natural-water-retention-measures> was elaborated and submitted (publically) to the NWRM community. The document gathered key arguments and proposed a first delineation of the core building blocks when addressing what are NWRM. It has formed the basis of further discussion between experts within the consortium but also with the WG PoM and the SC, but also with external experts. The document was further elaborated and shortened and an amended light version was submitted to the WG PoM in March 2014.

VI.2.3 Poster describing the project

The leaflet presenting the project was more seen as an introduction to the topic and it was not possible to bring into it very detailed or high level information on the project and its key focus.

Some of the events organised or where the NWRM project was represented also needed some further clearly delineated and high level communication material. A poster was therefore developed and printed in A0 format for presentation at the different regional Workshops, but also in autumn 2014 at the River Restoration Centre annual conference, the Euro-Riob conference, the water in mountain annual conference and finally at the 4th European Water Conference held in March 2015.

The poster presents the context and objectives for the NWRM initiative, explains what are NWRM, presents the NWRM platform and key components, make an overview of the regional networks, their coverage and objectives, introduces the guide and gives an overview of the governance of the project with access to the platform and contact point for further information. It was developed in January 2014 and discussed and agreed by the project officer before the first series of regional Workshops and then used systematically in all events.

VI.2.4 Power point presentation

In line with the requirement of the ToR, a PowerPoint presentation presenting the key messages of the project as regards NWRM implementation and to be used by DG ENV/EC officials at workshops, meetings, conferences... was developed. Similar to the second leaflet, it built on the main results and deliverables of the project and in particular (a) the key

products of the project: case studies, NWRM factsheets, synthesis documents, ontology, guide and (b) the different PowerPoint presentations prepared for different workshops and CIS WG meetings. It aims at presenting in more details than the leaflet the key elements to consider when implementing NWRM and provide in a user friendly way a structured presentation about NWRM.

The English version of the PowerPoint presentation was developed and submitted to the EC for review prior to finalisation and is available [here](#).

VI.2.5 Role playing game to promote NWRM and insure SPI

Building on the material collated and synthesized by the project team, ACTeon, with the support of the other NWRM partners, developed an interactive role play aimed at illustrating how NWRM can be considered in a specific (river basin) planning process and the role they could play in delivering multiple benefits/addressing simultaneously the objectives of different policies. (see in section VII.2)

Under the guidance of a play facilitator, it is played by a group of 5-7 participants who represent different interest groups, e.g. a river basin manager, representatives of government services (dealing with knowledge, financing, legal issues), a municipal councillor (in charge of urban development), representative of economic sectors such as farming, forest, hydropower.... A journalist is also involved in the role play, ensuring that (some) information travels (officially or not) between participants.

The material that is provided to each group/participant includes:

- Information provided to all participants: an overview map of the case study area that is targeted by the plan, and background information presenting the salient technical, environmental and socio-economic features of the case study;
- Information provided to each participant depending on its role (e.g. series of fact sheets presenting different NWRM and their expected impacts and costs, available financial instruments for supporting their implementation, components of the legal framework that are relevant to their implementation, expected impacts on key sectors, etc.), and that not known by the other participants

The group has also paper, a whistle (to start/stop specific steps or discussions), a camera, a beamer, pens and scissors, a flipchart...

The role play is structured following a series of steps such as:

- Launching the interactive session: The game facilitator presents the background situation of the role play with its major stakes, explaining the rules of the game and allocating roles (and accompanying information) to individual players;
- Introducing the role players, with each player introducing herself/himself after having read the basic information describing its role and main challenges;
- Presentation by the river basin manager of the pre-management plan that is proposed building on traditional/grey infrastructure including further channelization of the river.
- Getting everybody into its role: Reading information provided and identifying its own demands/interests, sharing with the river basin managers its own concerns and issues seen as essential to be considered in the planning process;

- Identification of measures: each stakeholder provides its own ideas and suggestions for measures (NWRM) to be included in the management plan for their case study, based on the information they have.
- River basin managers develop a revised draft river basin management plan that take account of all suggestions:
- Press Conference 1: The river basin managers present their revised management plan to all stakeholders, each of them raising some critical issues.
- Negotiation phase: The players meet at a round table to discuss alternative measures, their pros and cons, and what could/should be in the management plan. The discussion is led by the game facilitator.
- River basin managers develop a final river basin management plan that accounts for compromised between all suggestions accounting for new (NWRM) measures.

When the role play is organised in small sub-groups, the sub-groups working sessions are followed by a plenary presentation and discussion of the results of each sub-group. This helps identifying key lessons on the potential, role, expected impacts and pre-conditions for implementation.

The role play was developed initially for the second Western Regional Network workshop organised in Strasbourg (France) in July 2014. Material was prepared for three different case studies for the Ill River (France), the Oppenheim Polder (Germany/Rhine) and the Quaggy River (UK). It was slightly adapted and used for working sessions of the second Mediterranean Regional Network workshop that was held in Torino (Italy) in September 2014.

VII Transversal task

VII.1 Project management

A key feature of the pilot project was to deal with the data collection and promotion of the NWRM innovative concept. Many challenges were to be faced in order to gather the existing state of the art and from it to be able to settle a consensual agreement involving the key actors in the field of water within a broader context including other environmental policies such as climate change and biodiversity.

The aims of the transversal supporting activities were (i) to provide a transparent and effective communication and share of knowledge with DG ENV and the Pilot project Steering Committee, and within the consortium, (ii) to ensure an efficient mobilisation of available (human and financial) resources, and (iii) to provide effective reporting of project's activities, deliverables and implementation challenges.

Three main groups of actors: the project partners and experts, the DG Env project officer and team and the SC and CIS WGs were involved in the project management and worked together during the project to ensure objectives would be reached and audiences targeted.

The overall process could be described as followed: the consortium intervened at the production level guided by DG ENV which was active at the interface with the steering committee and more largely with the CIS WGs. Thanks to this management process, products/deliverables delivered by the project benefited from comments and feedbacks of key institutional actors.

In terms of IT support, a collaborative platform was used to store the documents of the projects

<http://collaborate.oieau.fr/OpenKM/com.openkm.frontend.Main/index.jsp?fldPath=/okm:root/DGENV-retention/Interim-report-for-DGENV/Deliverables> . This platform was also accessible to the EC. The Adobe webconference tool was used for all electronic meetings with partners.

The current final report is also provided with a CD-ROM containing all documents produced and listed in section VII.2 and cited in the other sections.

VII.1.1 Internal meetings

Project management level

All along the project, internal meetings were held between partners to work in an adaptive way. Progress in activities, key challenges faced, and possible solutions were regularly discussed. In some cases, this iterative process led to adaptations in deliverables so these would best fit with available knowledge and potential end-users demands. For example, the need to develop 60 best practices on NWRM implementation was adapted to better fit with recognised needs of understanding and promotion. And this deliverable was replaced with the development of 125 NWRM (light and in-depth) case studies complemented by 11 synthesis documents on key design and implementation issues.

Consortium meetings were organised as back to back events to meetings with the Commission (inception and interim meetings), with the Project's Steering Committee and with regional workshops. A series of 8 web conferences involving the consortium as a whole

complemented physical meetings. And additional web conferences related to different tasks and activities were organised by tasks leaders.

- 8 web conferences were held during the project to tackle overall issues of the project involving all the partners. Following the progress of the project, the first ones focusses on the NWRM concept, database structure and preparation of the 1st round of workshops (and related fora) as well as the participation of the partners to the CIS WGs.
- The following ones focussed on the collection of data for NWRM and cases studies, the preparation of the 2nd round of workshops and the practical guide.
- Partners also met at the occasion of the kick off meeting (back to back to the inception meeting with the Commission), interim meeting and according to their participation to the regional workshops (to which OIEau and Acteon all participated).

Task management level

Each task leader also organised web conferences to discuss technical and organisational issues related to their individual task, identify solutions for responding to comments made by the Steering Committee and to discuss feedbacks from regional workshops.

A specific web conference was dedicated to the facilitation of virtual networks to optimise the use of LinkedIn by the 4 regional networks.

A communication group (composed of OIEau and Acteon with the support of task leaders and partners) was also set to manage the production of communication materials, its translation into different EU languages and its dissemination.

VII.1.2 Meetings with the EC

As planned in the technical offer, meetings with the EC were regularly held in order to monitor progress, share draft deliverables and discuss feedbacks, and ensure good communication with the Steering Committee.

Communication with the EC included in particular;

- The inception meeting (3 October 2013) aimed at setting the scene for the project development. It helped discussing technical choices with the Commission, and proposing adaption to the tools so they would better fit with needs. Specific attention was given to the hand-over of the NWRM pilot project outcomes (the knowledge platform and the catalogue of measures in particular). The inception meeting helped also assessing the demands (in terms of formats and type of information) from the EEA and the JRC as members of the Steering Committee. The minutes of this meeting are available in the document named DTT1 NWRM Inception report-vf.doc
- The interim meeting (17-18 February 2014) aimed at presenting the preliminary results of the data collection exercise, the outcome of the first series of regional workshops and the first key results of the project's partners involvement in the CIS process. The key points of the meeting are presented in the document named DTT3 NWRM interim report_final.doc, section V.2.3.
- The final meeting (12 December 2014) aimed at presenting the website platform and the NWRM outputs (Cases studies, NWRM fact sheets, synthesis documents, Glossary and all other key functionalities) and on the guide, and allowed addressing

also the follow up of the project and final steps. The key points of the meeting are presented in the document named DTT4iv NWRM SC final meeting key points 121214.doc, section V.2.3.

In addition, regular phone and web conferences with the EC were held during the duration of the project.

VII.1.3 Steering Committee and WGs of the CIS

The Steering Committee (SC) was composed of project officers from the different units concerned by NWRM in DG ENV, from EEA and from JRC. Some of the members are also active participants in the different Working Groups of the CIS. The SC aimed at guiding and validating the main steps of the pilot project in order to ensure the products delivered would fit into the environmental policies and also offer a follow up of the pilot project. It played a key role at the interface between the consortium, the European institutions and the regional levels. It was involved since the beginning of the project, met at three meetings, and was regularly informed and consulted between the meetings on the progress and solicited to gather its feedbacks and comments on draft deliverables. In addition, it helped identifying additional sources of information for strengthening the knowledge base.

The links with the CIS WGs also played a major role for the NWRM project, in the development of the key deliverables of the pilot project, in particular the concept note, the catalogue of measures (see section V.7) and the practical guide.

The NWRM project was also identified as a key support to the WG PoM work and a wide set of documents and elements were communicated to this group. The consortium contributed to the development of the NWRM policy document developed by WG PoM. In addition, the clear connection of NWRM to other aspects of WFD implementation was also used to present elements to the respective other CIS WGs and support and guide the development of the key documents of the pilot project, in particular to refine and adjust the concept note and catalogue of measures (see for more details section V.7).

The first bullet list presents the meetings key points. The second bullet list summarised the inputs of the SC on the pilot projects outputs.

- Inception meeting (3 October 2013): the project was presented with its related deliverables. The role of the SC members during and after the project was discussed. The minutes of this meeting are available in the document named DTT1 DTT4i NWRM Inception report-vf.doc. The overarching points were:
 - A common agreement on the necessity of a permanent and iterative process of information exchange with JRC and EEA; among partners and the Commission, between regional workshops and related experts.
 - The success of the project relies on the ability to mobilise potential users of the information system from the beginning in order to ensure their needs (in terms of knowledge, storing/processing and access to the information) are covered.
 - JRC mentioned their needs on measures and more specifically on economic related issues. It seems not possible to use the JRC model to get NWRM scenarios at the scale of Europe as the project would need this within the next 6 months but JRC could only test it during the next summer.

- After the interim phase (11 April 2014): this meeting focussed on the interim report and aimed at presenting NWRM outputs (cases studies, NWRM, policy question factsheets) and related templates to structure NWRM (catalogue) and store information (XLS template and the associated database). The key points of the meeting are presented in the document named DTT4iii NWRM SC interim meeting key points 110414.
- The final Steering Committee meeting (12 December 2014) focussed on the website platform (recette.nwrm.eu), aimed at presenting NWRM outputs (Cases studies, NWRM fact sheets, synthesis documents) and on the guide, and allowed addressing also the follow up of the project and final steps. The minutes are available in the document named DTT4iv NWRM SC final meeting key points 121214.doc

The SC participated on the following outputs of the projects

- At the beginning of the project, the concept note presenting NWRM was sent to the SC (as well as to the WGs) providing back its comments and proposition to adapt the document to better address issues related to institutional key actors and to focus on the definition part to support the promotion of the NWRM.
- During the course of the project, the data collection template for the case studies and associated database structure and the NWRM catalogue were submitted to the SC and the WG PoM which provided their feedback. These elements were considered thoroughly with the production of a log file of all the 15 sources of comments and how they were considered to produce an updated version of the database structure. Part of the comments were also related to other products of the project: catalogue of NWRM, concept, cross comparison and assessment of NWRM, and were considered for adjusting the approach
- The elaboration of the NWRM glossary ran also all along the project. After the final SC, a review of the glossary was launched and DGENV, JRC and the EEA provided feedbacks and suggestions for amendments to the definitions that were considered in the finalisation of the glossary on the platform.

VII.2 Reports and deliverables

The list of documents and products delivered by the pilot project is presented in annex 4.

The list of the documents sent to the Commission with the final report and the main changes in terms of deliverables according to the technical offer are explained in this section.

Table 15. NWRM List of documents sent with the final report¹⁷.

 0415-ACEON-GUIDE-NWRM-to-translate_HU-web.pdf	 DT2.5 NWRM Dublin Dec13 N Amorsi.ppt
 0415-ACEON-GUIDE-NWRM-to-translate_NL-web.pdf	 DT2.5 NWRM INBO Plovdiv 2013 N Amorsi.ppt
 0415-ACEON-GUIDE-NWRM-to-translate_SK-web.pdf	 DT3.1 NWRM _draft structure of the practical guidance_vf.doc
 0415-ACEON-GUIDE-NWRM-to-translate_BG-web.pdf	 DT3.1 NWRM _draft structure of the practical guidance_version 3.docx
 0415-ACEON-GUIDE-NWRM-to-translate_CZ-web.pdf	 DT3.1 NWRM_guidance_version 2.0.pdf
 0415-ACEON-GUIDE-NWRM-to-translate_DE-web.pdf	 DT3.1 NWRM_guide_illustration table.xlsx
 0415-ACEON-GUIDE-NWRM-to-translate_FR-web.pdf	 DT3.2i NWRM leaflet 130113.pdf
 0415-ACEON-GUIDE-NWRM-to-translate_HR-web.pdf	 DT3.2i NWRM leaflet version oct 13.pdf
 0415-ACEON-GUIDE-NWRM-to-translate_IT-web.pdf	 DT3.2ii NWRM Poster VF.pdf
 0415-ACEON-GUIDE-NWRM-to-translate_RO-web.pdf	 DT3.2iii NWRMpresentation.pptx
 150917-ACEON-NWRM-ID-CARD-WEB-FR.pdf	 DTT1 DTT4i NWRM Inception report-vf.doc
 DT1b1i NWRM Note_Database_filling_Draft_1912.doc	 DTT3 DTT4ii NWRM interim report_final.doc
 DT1b1i NWRM AnnexIII Literature_list_Version_1912.xls	 DTT3 NWRM EC 140514 webconf keypoints v1.doc
 DT1b1ii NWRM case study factsheet.doc	 DTT3 NWRM interim meeting EC key points 170214.doc
 DT1b1iii NWRM individual factsheet.doc	 DTT3 NWRM quantitative data-note-final.doc
 DT1b3 NWRM cases studies collected.zip	 DTT4iii NWRM SC interim meeting key points 110414.doc
 DT1b3 NWRM_DBparameters_v2-1.xlsx	 DTT4iv NWRM SC final meeting key points 121214.doc
 DT2.1 nwrn conceptnote_to_regional_stakeholders.pdf	 NWRM 53-nwrn-illustrated.pdf
 DT2.1 NWRM WS1 background note MED.pdf	 NWRM GSG workshop_presentation & synthesis of comments dec 2014.ppt
 DT2.2 Western NWRM WS2 synthesis.pdf	 NWRM GSG_workshop_November 2014_Bruxelles.docx
 DT2.2 Baltic NWRM WS1 synthesis.pdf	 NWRM GSG_workshop_Paris_04122014.pdf
 DT2.2 Baltic NWRM WS2 synthesis.pdf	 NWRM guidance_workshop_Paris_04122014.pdf
 DT2.2 Danube NWRM WS1 Synthesis.pdf	 NWRM Newsletter_IssueNo1_FINAL.pdf
 DT2.2 Danube NWRM WS1 Synthesis_v2.pdf	 NWRM Restore web meeting dec13.doc
 DT2.2 Danube NWRM WS2 Synthesis.pdf	 NWRM sd1_Biophysical and effectiveness.pdf
 DT2.2 MED NWRM WS1 synthesis.pdf	 NWRM sd1_what are NWRM.pdf
 DT2.2 MED NWRM WS2 synthesis.pdf	 NWRM sd3_methods and tools.pdf
 DT2.2 roleplay.zip	 NWRM sd4_benefits.pdf
 DT2.2 Western NWRM WS1 synthesis.pdf	 NWRM sd5_cost.pdf
 DT2.4i NWRM CIS WG POM presentation nov2013.ppt	 NWRM sd6_cost effectiveness.pdf
 DT2.4ii NWRM CIS WG AGRI March 2014.doc	 NWRM sd7_eco assessment methods.pdf
 DT2.4ii NWRM CIS_WG_Agri_presentation march 2014.pptx	 NWRM sd8_windows of opportunities.pdf
 DT2.4ii NWRM WG Agri key points.doc	 NWRM sd9_barrier and success factors.pdf
 DT2.4iii NWRM link NWRM&CAP.xls	 NWRM sd10_policy coordination.pdf
 DT2.4iv NWRM CIS-WG PoM bkg note annex 2 March 2014.pdf	 NWRM sd11_financing.pdf
 DT2.4iv NWRM CIS-WG PoM bkg note annex 3 March 2014.pdf	 NWRM streamlining NWRM classifications.doc
 DT2.4iv NWRM CIS-WG PoM bkg note March 2014.pdf	 NWRM training facilitation key points 121213.doc
 DT2.4iv NWRM CIS-WG PoM presentation March 2014.ppt	 Output T1a1 NWRM Glossary 140314.doc
 DT2.4iv NWRMconceptnote_versionCISWGPOMv2final.doc	 Output T1a5 NWRM DB-conceptual-v1bis-circulated-byEC.rar
 DT2.4v NWRM CIS-WG Floods bkg note April 2014.doc	
 DT2.4vi Analysed feedbacks from the WGPoM.doc	

As explained in the project's section, some activities have evolved to others. In response to these changes, additional ones were conducted. In both cases, the reasons (mainly the stronger need for raising awareness and difficulty to gather quantified data due to the lack of existing information¹⁸) of these changes have been explained to the Commission and validated.

¹⁷ Some of the deliverables are only available on NWRM platform (see annex 4).

¹⁸ Explained in DTT3 NWRM quantitative data-note-final.doc

The main adaptations were:

- Task 1c: “hand over of the catalogue and practical guide for integration into WISE”
EEA and JRC were two active members of the steering committee. The project developed its platform as much as possible to offer a compatibility with WISE and provide relevant information for JRC. During the life time of the project, the decision could not be made on who would welcome the platform afterwards as it proved that WISE could technically not host the information of the platform. During the very last stages (July 2015), the decision was made by JRC to take over the NWRM platform.
- Task 2: sub task: “selection of 60 best practices, etc.”
The concept of best practices was quite difficult to apply as NWRMs definition took some time to be finalised (in relation with WG PoM) and the information on NWRMs’ implementation and demonstration was fragmented. Instead of best practices, the concept of case studies were preferred and two levels were introduced; light and in depth cases studies. This choice was also made to include less developed case studies that can provide very relevant information and illustrations while not having the full set of information that was identified as relevant and necessary to be accepted as a NWRM case study.
- Task 2: sub-task “Raising awareness”
Initially, this sub-task should have been focussed on the synergy with other networks/initiatives and participating to their events (contribution CIS WGs belonging to another sub task 2). After the first presentations of NWRM at different events, it appeared really important to extend the raising awareness to provide documents dedicated to the understanding of NWRM. In addition to the deliverables described into the Technical Offer, partners provided a concept note on NWRM (used for the communication with WGs, and to prepare the first series of regional workshops). A series of 11 synthesis documents covering the NWRM issues from understanding to policy relevance were produced.
A newsletter was also issued in May 2014.
Related to the forum facilitation task, a mini training on virtual network facilitation was provided by OIEau.
To support the Workshops organisation and animation, the NWRM partners of the Western network developed a role play that was used in the second workshop of the Western and Mediterranean networks. The role play is covering a set of 3 concrete cases developed from real NWRM case studies. Building on a series of factsheets representing different stakeholder groups, and different NWRM Identity Cards, the role play aims at proposing specific NWRMs for addressing the management challenges faced in individual catchments. It proved useful in raising workshop participants’ awareness on NWRM and on the practical challenges faced when implementing them. .

VII.3 Full integrated website

The dedicated NWRM web site was launched in December 2013 with the aim of transferring it to JRC by July 2015. Over the course of the project, the website has evolved to progressively become an interactive tool that facilitates access to the NWRM knowledge base.

To avoid confusion and to test various website organisations, the interactive platform gathering the catalogue of NWRM and the case studies, was first separated from the initial website and developed with the address www.recette.nwrm.eu. In March 2015, all the content developed in this “recette” website was transferred to the initial website along with its new functionalities and the entire website reorganised to allow giving access to the main products of the project.

VII.3.1 Technical aspects

To allow and guarantee a unique access to the website or platform, OIEau bought the four following domain names for the period 15/10/2013 – 15/10/2015, which means anyone looking for one of these will arrive on the website:

- nwrm-net.eu
- nwrm.eu
- natural-water-retention-measure.eu
- natural-water-retention.eu

The platform is based on Open source software, robust to maintain and easily transferable via virtualization (a so called dump file gather all elements and can be transferred to another server). It combines a set of integrated modules/software allowing to provide key services required for the platform including: the database (Postgres with Postgis extension), the website (Drupal with all the language modules for the 25 EU languages to facilitate translation if necessary); the map server (Geoserver); the search engine (SOLR); the statistics module (Google analytics and Webtrends).

It was created at the beginning of the project in December 2013 to gather all information already available on NWRM. The content management system (CMS) was developed under Drupal to allow a person possessing an account to modify or update the website's content in an easy manner by editing the page as illustrated hereunder. Everything has been first produced in English. However, the Drupal system is equipped with an automatic translation system allowing the website to be consulted in other languages when the webpages are translated.

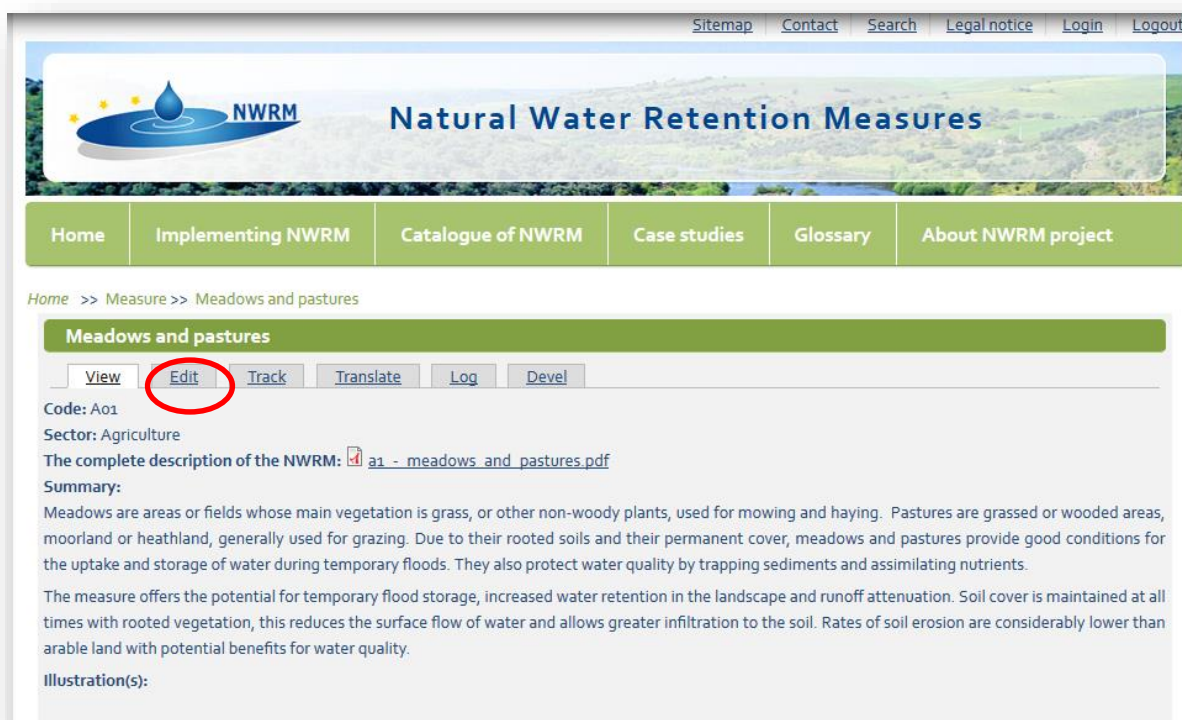


Figure 11: How to edit and modify the pages of the NWRM website

VII.3.2 Visit of the website

The website is divided into 6 sections:

- The Home section giving a direct access to the communication material on NWRM, and to (i) the catalogue of measures presented by sector (agriculture, forest, hydro morphology and urban) in an interactive way, (ii) the short NWRM definition and a map access to all case studies identified during the project's duration. It also gives access to the NWRM project and regional networks LinkedIn fora (see Figure 12 and Figure 13)



Figure 12: NWRM website: home page (1/2)




Figure 13: NWRM website: home page (2/2)

- ➔ The Implementing NWRM section which presents information on NWRM dealing with (see Figure 14):
 - The practical guide available in 15 languages (see section VI.I for a detailed presentation) with the IDCards available in 6 languages, which can be read from the website and downloaded.
 - Communication material in particular the project's leaflet (available in all EU languages) and a PowerPoint presentation presenting the main lessons of the pilot project
 - The definition and understanding of NWRM related issues presented in the 11 synthesis documents (see section III.3.2.2 to III.3.2.4 for detailed presentation)



Figure 14: NWRM website: menu of the implementing NWRM section

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Natural Water Retention Measures

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the practical Guide

The practical guide:



Translated versions: [BG](#), [CZ](#), [DE](#), [EL](#), [EN](#), [ES](#), [FR](#), [HR](#), [HU](#), [IT](#), [NL](#), [PL](#), [PT](#), [RO](#), [SK](#)

The NWRM identity cards (included in a dossier in the printed version of the practical guide)



Translated versions: [DE](#), [EN](#), [ES](#), [FR](#), [IT](#), [PL](#)

This guide, entitled **A guide to support the selection, design and implementation of Natural Water Retention Measures in Europe: capturing the multiple benefits of nature-based solutions**, has been developed as part of the NWRM project. It places the emphasis on the multiple-benefits NWRM can deliver and on the required policy coordination and coherence that is required to make best use of NWRM.

- It aims to support the selection, design and implementation of NWRM in Europe.

Figure 15: NWRM website: the practical guide and IDCards

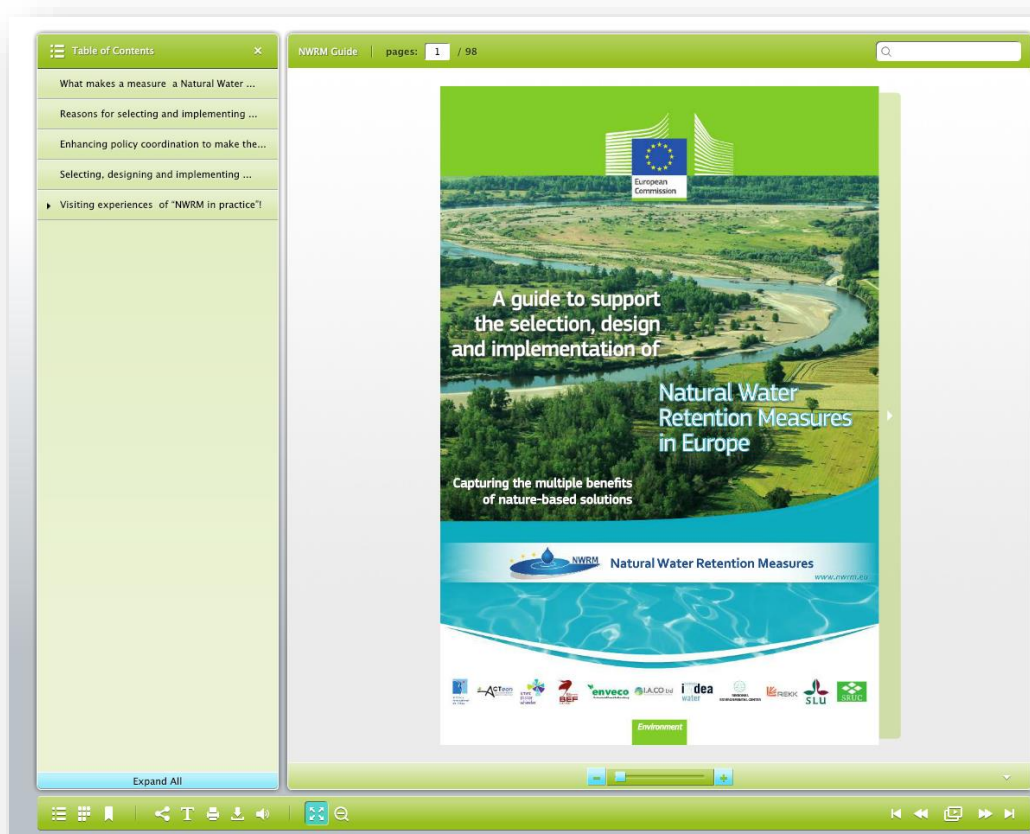


Figure 16: NWRM website: the flipping tool to read the practical guide

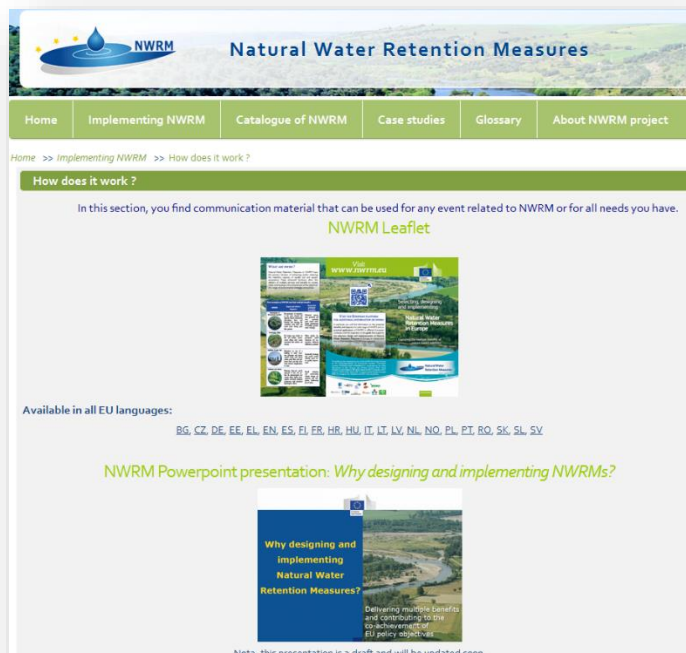


Figure 17: NWRM website: communication material on NWRM

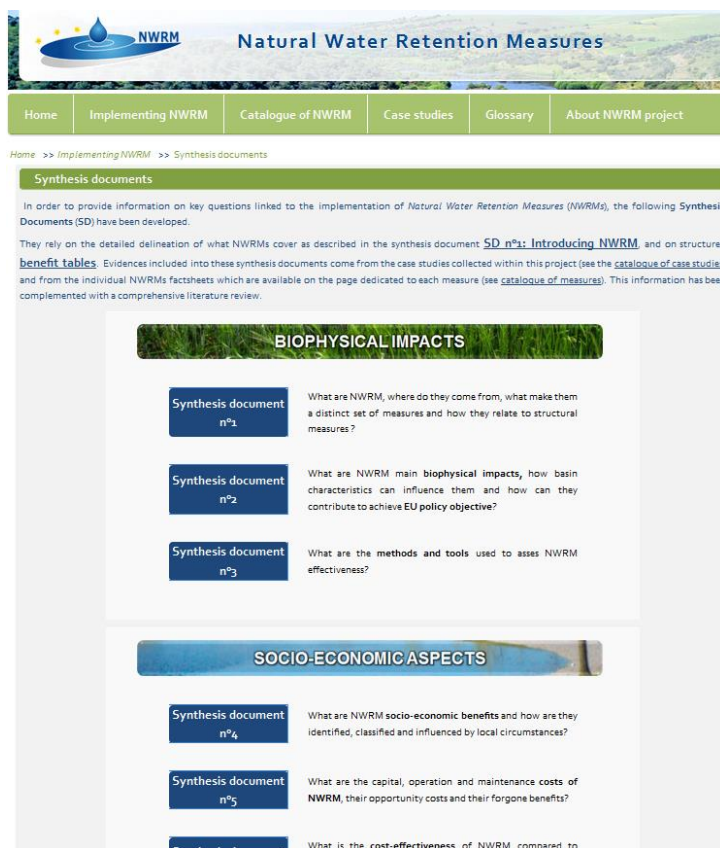


Figure 18: NWRM website: the Synthesis documents

- The Catalogue of NWRM section presenting the basic features and expected impacts/benefits of 53 measures organised in 4 different sectors (see Figure 19).

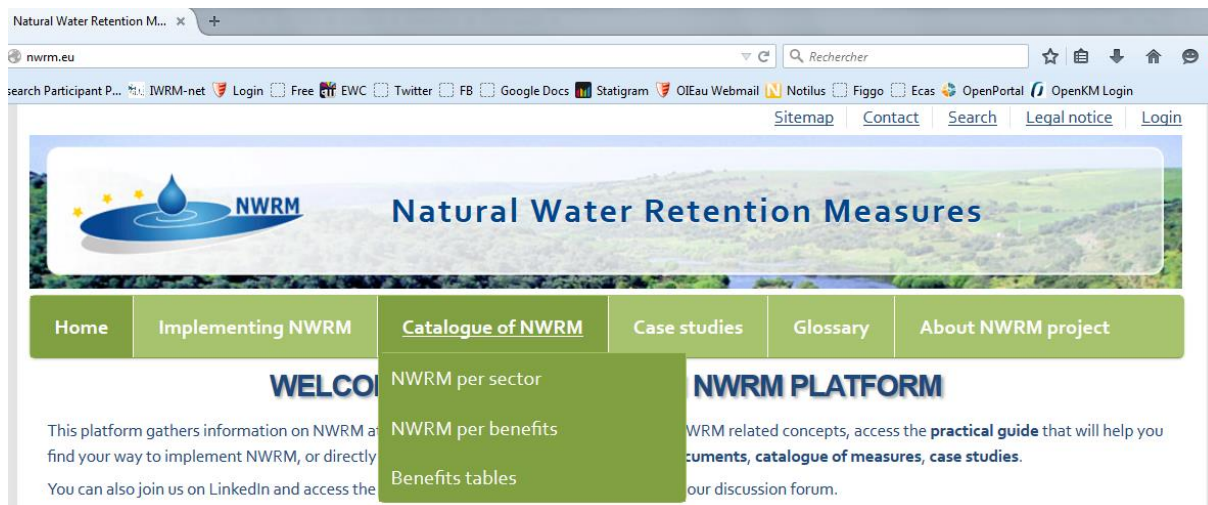


Figure 19: NWRM website: catalogue of NWRM section

- The “per benefits presentation” is interactive (Figure 20). It is possible to select specific biophysical impacts, ecosystem services/benefits or policy objectives to obtain the list of the most appropriate NWRM that could be expected to deliver these impacts/ecosystem services or to contribute to specific policy objectives.

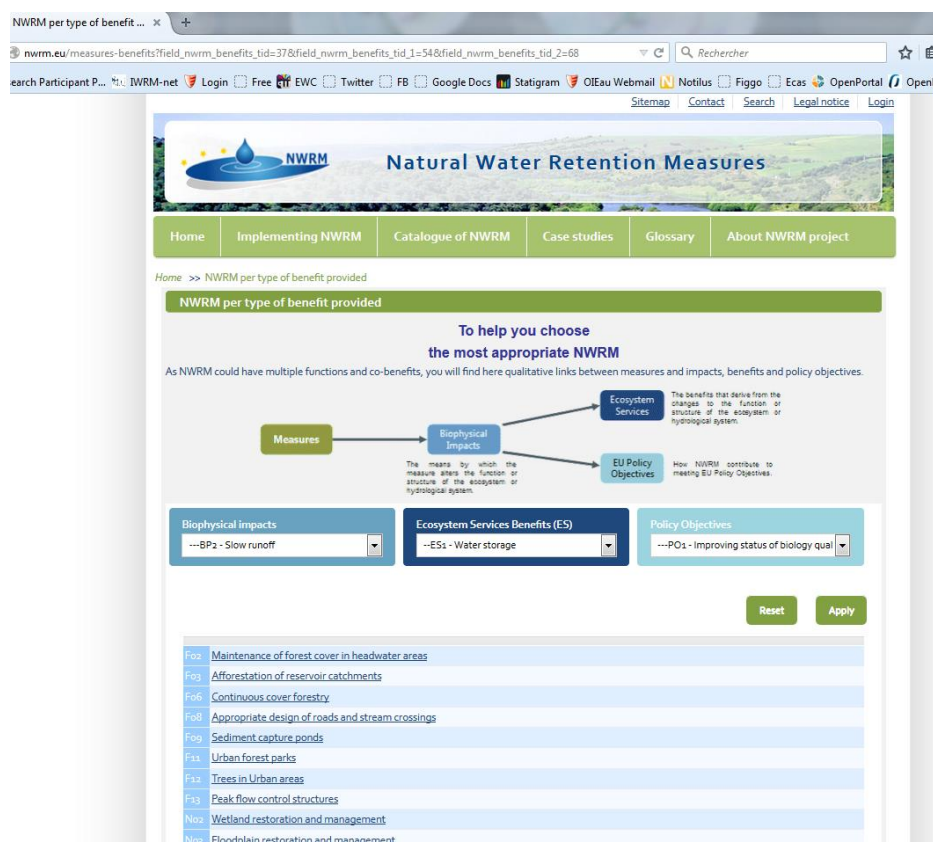


Figure 20: NWRM website: Catalogue of NRWM – presentation of the per benefits sub-section

- The Case studies section (Figure 21) that presents the 125 NWRM case studies developed by the project. The case studies are divided in two main categories (light and in depth) depending on the level of details provided in their description and assessment of impacts. All the case studies have been geo-referenced and are accessible via a map. More details on the elaboration of case studies are given in section III.3.2 of the present report.

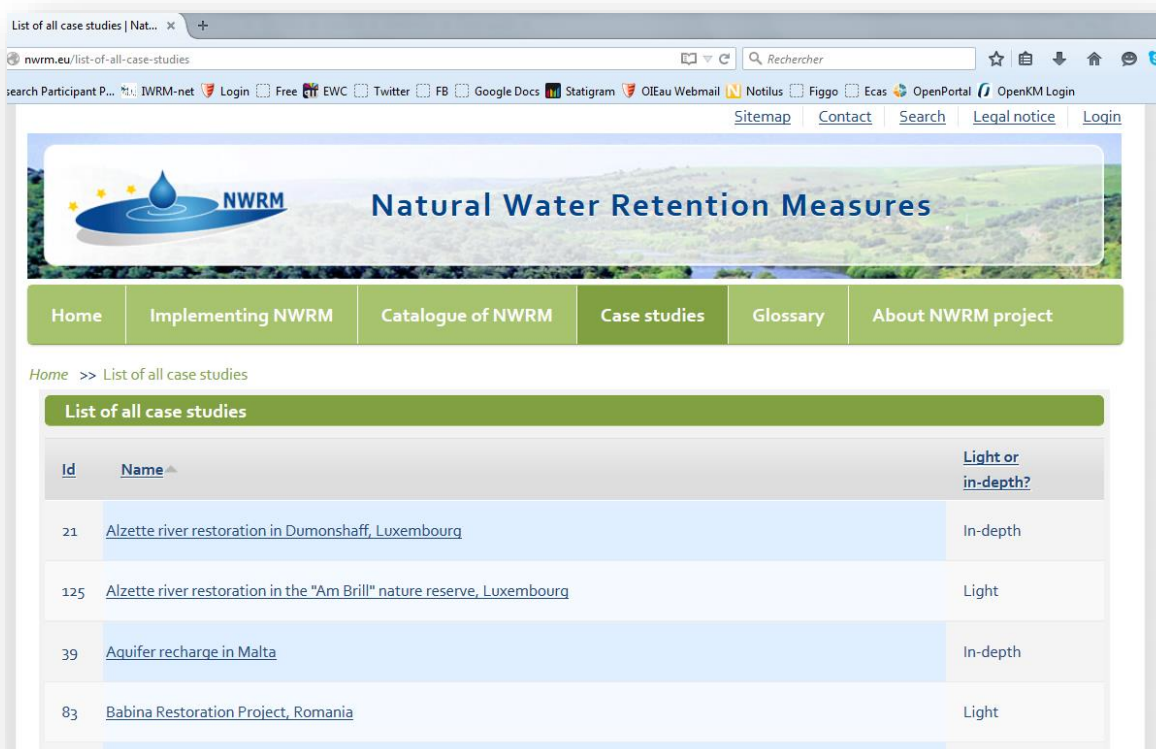


Figure 21: NWRM website: Case studies section

- A Glossary section which gathers definitions for a set of 106 key concepts related to NWRM. The key concepts are available by alphabetic order (Figure 22) and via semantic relation tool (Figure 23). This last allows linking concepts and therefore provides a powerful tool to explore the content of the platform and fixes in an agreed definition the exact delineation of key concepts, thus reducing the ambiguity that may exist between the natural language when expressing notions and their computational representation in a formal language.

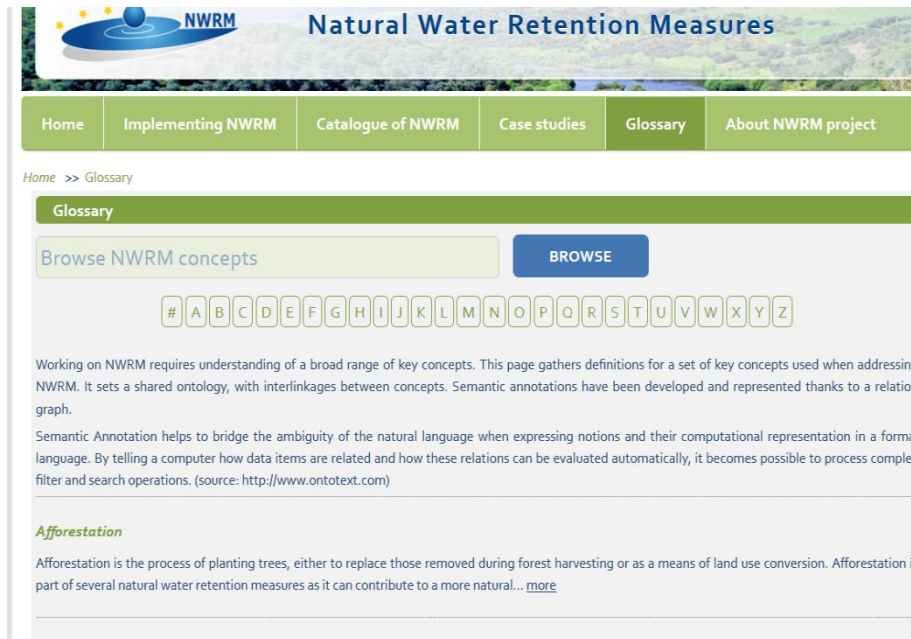


Figure 22: NWRM website: Glossary home page

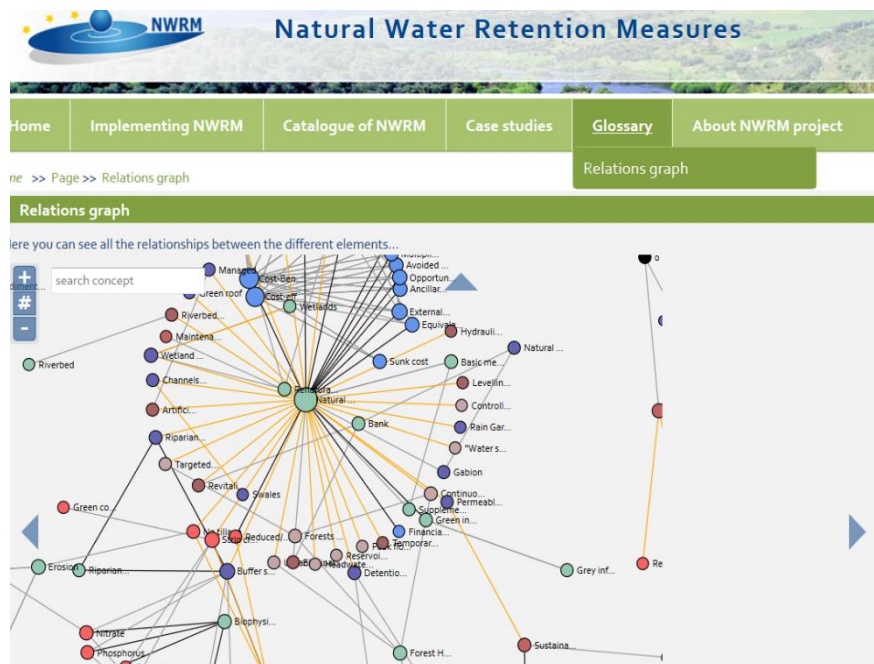


Figure 23: NWRM website: glossary relation graph

- The About NWRM project section that is composed of two sub-sections; (i) “about” which displays information on the project and of the consortium partners; and (ii) “regional networks” that provides information on the LinkedIn forum and on the two workshops organised for each regional network (Danube, Baltic, Western-Europe and Mediterranean - see Figure 10)

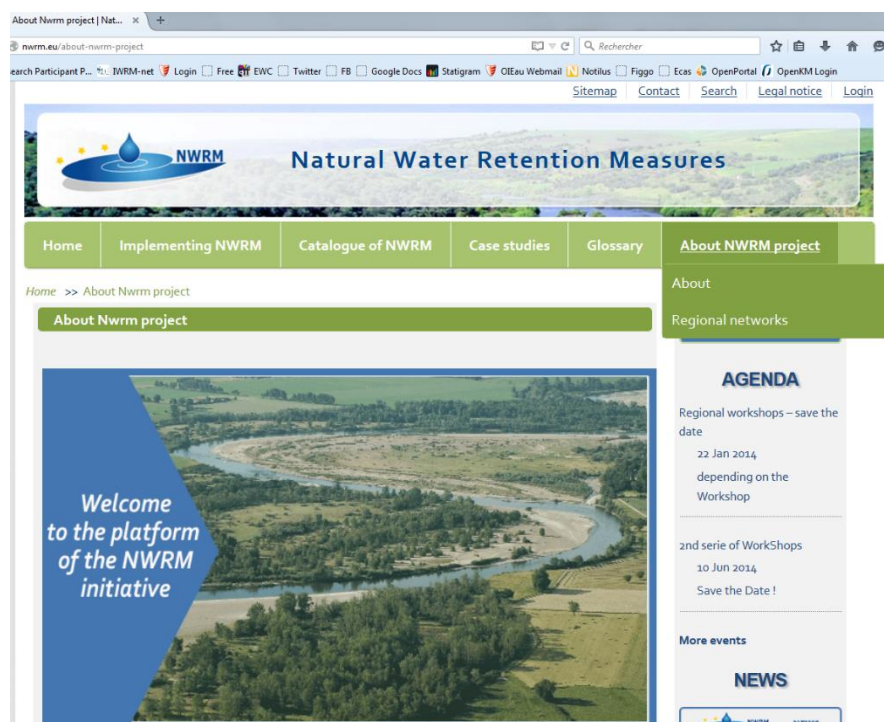


Figure 24: NWRM website: About NWRM project section

In June 2014, the project had gathered enough information to propose a first version of the interactive NWRM web platform. The structure of this platform was thus shared among all project members and with the EC. It has two specific goals:

- Giving a friendly access to all NWRM related information thanks to the structure of the web platform home page and a facilitated navigation through all sections of the interactive platform.
- Allowing all NWRM users to access information stored in the database constructed all long the project.

To avoid confusion and to test various website organisations, the interactive platform was first separated from the initial website and developed with the address <http://www.recette.nwrn.eu/>. In March 2015, all the content developed in this “recette” website was transferred to the public website along with its new functionalities.

VII.3.3NWRM website statistics

The statistics of NWRM website visits from December 2013 (opening of the website) to June 2015 are presented in the following chart. They represent the number of individual visits by month and its evolution from the opening of the platform until end of the project.

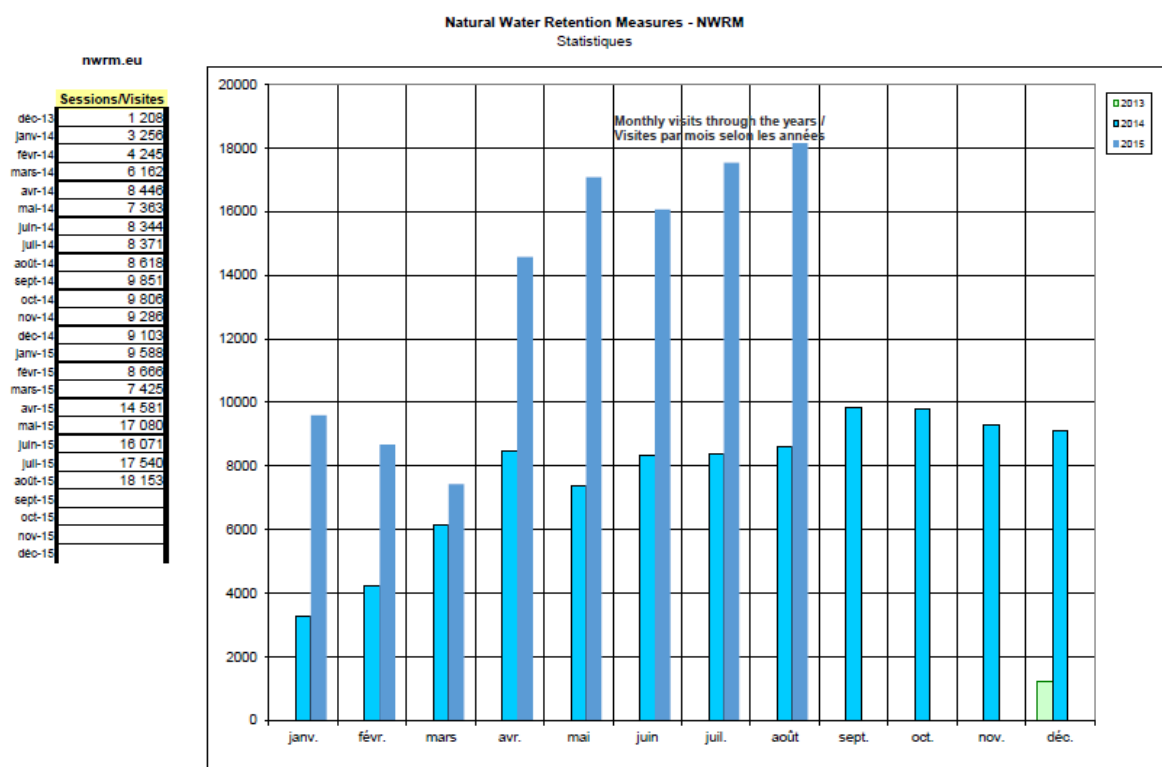


Figure 25: NWRM website statistics

These statistics stressed the influence of key events organised by the project on web site visits, in particular the regional workshops, or key communication events such as the project's contributions to the 4th Water conference end of March 2015.

VII.4 Quality assurance

The quality of the NWRM case studies has been ensured mainly by the thorough work of each project partner responsible for the respective case study. Information sources include both literature research and interviews with local stakeholders. Furthermore, an internal review process by sector and disciplinary leads has been organised for all in-depth case studies to check their internal consistency and clarity. For information entered into the case study database, an online validation tool was developed to check the validity of all entries.

Globally, five dimensions of quality were addressed by the project:

- Quality of the information and knowledge was insured by
 - the involvement of key experts of the consortium with a two steps process: the elaboration of the data collection tools, the selection process and collection, and a review by another expert of the team. It was coordinated by consortium experts leading disciplinary issues (technical / biophysical, socio-economic, governance/implementation), experts in charge of the information system and database, and experts for the four key sector issues (agriculture, forestry, urban, hydromorphology);
 - For the specific case of case studies, the quality was also ensured by the thorough work of each project partner responsible for the respective case study with the local implementer of the case. Information sources include both

literature research and interviews with local stakeholders. Furthermore, an internal review process by all sector and disciplinary leads has been organised for all in-depth case studies, to check them mainly for internal consistency and clarity. For information entered into the case study database, an online validation tool had been developed to check the validity of all entries.

- the structuration of the database and a high level of standardisation with the use of relevant reference lists commonly in use at EU level (Gemet thesaurus, Corine Land Cover, ...)
 - the external review by the SC experts and DGENV experts. For the synthesis documents the DGENV reviewed each document and provided comments and feedbacks that were used to produce the final version. For the individual NWRM the review was conducted by three appointed experts. For this last and after the development of all individual NWRM factsheets by the experts of the Consortium, an ultimate review process was launched: the content of the factsheets as well as their titles and references had to be studied and assessed by external experts. Such experts were to be proposed by the leaders of the 4 sectors. Two of them were present during the workshops, proving the effectiveness of the workshops in gathering relevant people and experience around the theme of NWRM. All experts provided a quality feedback in the form of summary comments and suggested changes to the set of factsheets they reviewed. The review took place in March 2015. The Forest factsheets were reviewed by Dr. Zane Libiete, Senior Researcher on Forest Ecology and Silviculture at Silava (Latvia). Dr. Freddy Rey, Research Director in Ecological Engineering at Irstea (France) was responsible for the review of the Hydro morphology factsheets, and Thierry Maytraud, Director of the ATM agency (France), took care of the Urban factsheets. Each set of factsheets was updated, discussed bilaterally with the thematic experts of the consortium for final adjustment and then put online as final version on the platform. As for the Agriculture sector, the Commission took care of reviewing the Agriculture factsheets, already containing relevant information at that time.
- Quality of links with ongoing or past relevant projects. All along the project, specific links were established by linking the different documents to specific references, using a common terminology, participating to events or inviting relevant project leaders. The Stella Consulting report, REFORM, RESTORE, MAES are among the projects or studies that were considered in the delineation of NWRM catalogue and case studies and for the synthesis documents.
- Quality of the language used in deliverables: native English-speaking experts reviewed all documents produced in English. In addition, translation in other EU languages were made combining: 1) professional translation; with 2) a systematic review of produced translated documents by native-language experts of the project team.

- Quality of the communication and publication materials produced, as part of dissemination activities: professional graphic designers / communication specialists have been involved in the elaboration of the website platform and the printed documents (poster, roll up, leaflet, guide).
- Quality of the guidance produced: the draft guidance was reviewed by a specific Guide Support Group (GSG). This group was formed of practitioners gathered in individual regional networks and representatives from relevant EU-wide organisations.

VII.5 Translation

The core working language for this project was English.

In addition, the platform was implemented so as to allow translation in each of the 25 EU languages. It allowed for the regional networks to create some news in the most common language for their respective region. To make the most of the translation function the platform offers, the tool was customised so that in such case when a user will access the platform, all the content in his/her language would appear immediately. The number of pages (>2.000) and the progressive evolution of the website (recette and production website merged, new pages added, pages modified and completed...), together with the absence of a dedicated budget did not allow to conduct a complete translation of all web-site content. However, the translation of all or part of the pages is relatively easy and could be progressively performed depending on individual MS interests. It would therefore be possible to translate one or more pages of the site in one or more languages. This can be done progressively and could be one of the possible updates of the platform proposed to MS representatives at the WG PoM.

For information, this is a very simple process that works as follows: when connected, a user has access for each page of the site to some functionalities and the translation function is directly available from each page as illustrated in

Figure 26

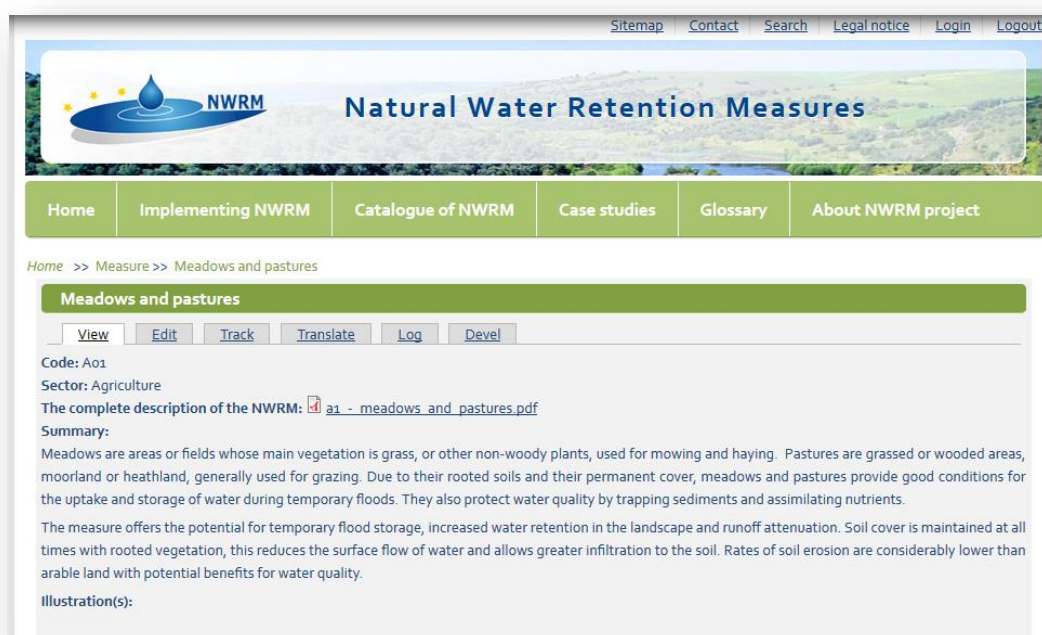


Figure 26: How to translate the pages of the NWRM website

For raising awareness on NWRM, the project has organised a series of events. Translation service was provided at some events to allow non-English speaking participants to contribute effectively to the discussions.

To support the dissemination and follow up of the NWRM platform and activities, it was also proposed to translate some of the project deliverables, namely the guide, the leaflet and the fields of the NWRM database. As the guide and its annexes were longer (almost 200 pages) than anticipated (50 pages), it was not possible to translate the guide in all EU languages as originally planned. Decision was made by the EC project officer to translate the guide from its original English version in 14 languages: 5 priority languages (DE, ES, IT, FR and PL) and 9 additional languages (BG, CZ, EL, HR, HU, NL, PT, RO, SK) that were feasible within the existing translation budget while making possible to reach the largest audience possible.

Because of the limited translation budget available in the project, the EC proposed that the annexes of the guide were translated in all languages by EC translation services. The need to have the guide and its annexes appropriately designed and in a printable format made it necessary to use a dedicated software and format usable both by a professional printer and a professional translating company (e.g. Trados, a software able to use most formats used for professional printing). However, the format selected (software InDesign, format idml) was not among the formats the EC translation services could manage. It was therefore not possible to have the annexes translated by the EC translation services. And some budget initially allocated to printing and quality assurance was reallocated to translation of the annexes.

When launching the translation of these documents, and to insure both a professional design for the printing and a sound language quality check, it was found necessary to follow a step by step approach as:

- Step 1 – To transfer the English version of the idml files to the translation company (2 files for the guide: figures and text of the guide, 5 files for the IDCards: empty cards, cards for the 4 sectors: agriculture, urban, forest, hydro morphology),
- Step 2 – To develop a draft version (translation company), for initial quick review by NWRM project partners,
- Step 3 – To update the draft version (translation company) based on comments received from NWRM project native speaker and a second translator;
- Step 4 – To deliver the "final version" after language check (translation company" (layout improved but not complete)
- Step 5 - thorough review by a native speaker from NWRM project
- Step 6 - consideration of comments by the translating company and provision of the as final idml files
- Step 7 - To prepare the printable version and the electronic version, (NWRM project partners) by importing all illustrations and other graphical elements in two formats: idml and pdf
- Step 8— To import all translated version on the website and + print the file for 3 languages (FR, DE and SP) in addition to EN.

While one month was initially allocated for translation, this process proved much more time consuming. Thus, while translation was initiated in February 2015, the full set of translated documents was finally delivered by the end of July 2015.

VIII Conclusion and perspectives

VIII.1 Conclusion

The pilot project lasted longer than the 14 months initially planned as it started in September 2013 and ended in July 2015. The consortium was composed of 11 partners (OIEau as Coordinator, Acteon, Amec Foster Wheeler, BEF, Enveco, IACO, IMDEA, REC, REKK, SLU and SRUC) covering 11 Members states, 25 languages and including thematic experts in the different sectors (agriculture, forestry, urban, natural/hydro morphology) and disciplines (governance & implementation, technical & biophysical; socio-economic) relevant to NWRM.

The following summarises the key achievements of the pilot project as compared to the tender specification in terms of expectations, contributions, deliverables and outcomes.

As stated in the technical offer based on the tender specifications, the main objective of the pilot project was “to improve the knowledge base on NWRM and their delivery as part of policy implementation and to foster knowledge dissemination and exchange at the various levels of stakeholders so as to promote”. Five specific objectives completed the scene (see Table 16). The following table confronts the specific objectives with the pilot project deliverables and outcomes and show in which way the different objectives were covered.

Table 16: Objective and pilot project deliverables/outcomes

Objectives set in the tender specifications	Pilot project deliverables/outcomes
(i) To collect the state of the art knowledge, available data and information and best practices in the current application of NWRM for managing fresh water precipitation across EU (...)	The knowledge related to NWRM collected by the consortium is organised as followed and available on the website: the catalogue of 53 measures (also presented by ID cards), the catalogues of 125 case studies, the 11 synthesis documents. The invisible part of the data and information collected is the database storing all the information related to the case studies
(ii) To provide a detailed assessment of effectiveness, costs and benefits of NWRM, supporting further scenario modelling with the JRC integrated water modelling platform	A synthesis document focuses on « what is the cost-effectiveness of NWRM compared to traditional / structural measures, and with regards to their multiple objectives?» at the early stage of the project, exchanges with JRC went on to ensure the compatibility of the NWRM database and structure with the scenario modelling requirement.
(iii) To further develop and maintain catalogue of measures and cases studies (...)	Based on the structure developed from the Stella study for the measures and the database dedicated to case studies collected by the pilot project, 53 measures have been illustrated during the lifetime of the project using 4 main categories (urban, hydro morphology, agriculture and forestry). In addition to further support the demonstration of the added value of NWRM, specific document on the biophysical impact of NWRM has been prepared (http://nwrn.eu/sites/default/files/sd1_final_version.pdf)
(iv) To link to	This specific objective was covered by the general

Objectives set in the tender specifications	Pilot project deliverables/outcomes
"delivery/implementation" projects/good practice examples that are using NWRM across a range of geographies and land use, to extract the learning from these sites and to foster knowledge exchange (...)	approach consisting in basing the work throughout 4 regions (Mediterranean, Danube, Baltic and western). Projects/goods practices examples were presented during the regional workshops and discussed on the fora. In addition, an important part of the work of the consortium was dedicated to collect case studies (in the 125 are catalogued) and to illustrate each of the 53 NWRM
(v) To contribute to the WFD CIS and to identify or create operational tools that can be used at national, river basin and/or local level to facilitate inclusion of NWRM in the 2 nd or 3 rd RBMPs and FRMPs. (...)	Between September 2014 and March 2015, partners participated to meetings of the WG PoM, Agriculture, Flood, and Groundwater. Furthermore, they contributed to the development of the EU policy document on NWRM. Finally, the NWRM platform (nwrn.eu) and NWRM LinkedIn groups provide operational tools where practical knowledge for supporting implementation of NWRM is directly accessible.

In addition, operational terms expected from the pilot project were identified at the beginning of the project. In the following table, these operational terms are confronted to the outcomes of the project.

Table 17: operational terms expected from the pilot project and its deliverables/outcomes

Operational terms expected from the pilot project	Pilot project deliverables/outcomes
Cover the entire European Union (28 Member States - MS), plus countries associated to the implementation of the WFD such as Norway and Switzerland	The 28 Member States, Norway and Switzerland are covered by the cases studies (see Table 5)
Recognise regional features and specificities in terms of knowledge (e.g. expected impacts and implementation constraints being different for a given NWRM depending on the region/river basin where it is applied), good practice and opportunities for NWRM, and process (specific regional networks being established)	4 regional networks were established (Mediterranean, Danube, Western, Northern) reflecting the different European geographical features and environmental related issues. 4 sectors were used to classify the NWRM: Agriculture / forestry / urban / hydro morphology and three disciplines: technical & biophysical/ socio-economics / governance & implementation. This structure allows different perspective of NWRM and to highlight the geographical characteristics of the NWRM thanks to the cases studies. Nevertheless, many NWRM or combination of NWRM can be applied no regards to the geographical features. In many cases the biophysical impact appears to be one key element to decide how/where/when the NWRM could be used. For each case study the individual NWRM implemented are identified and in each NWRM factsheet it is possible to link all case studies
Address all dimensions of NWRM including: technical specificities, environmental impact and effectiveness, socio-economic impacts (costs and benefits), implementation and institutions/governance....	

Operational terms expected from the pilot project	Pilot project deliverables/outcomes
	<p>that have implemented the measure.</p> <p>The 11 synthesis documents illustrate the wide range of NWRM dimensions (http://nwrn.eu/implementing-nwrn/synthesis-documents) and the practical illustrates their implementation (http://nwrn.eu/implementing-nwrn/practical-guide)</p>
Further test the methodology proposed in the parallel DG ENV pilot project on the Integration of Ecosystem Services Approach with WFD and FD implementation for ensuring ecosystem service delivery is optimised while achieving the objectives of the WFD and FD	The matrixes developed by the pilot project allow link NWRM to policy objectives, to ecosystem services and to biophysical impacts. This tool should allow this testing by providing the key information necessary.

And finally, a set of expectations were expressed at the beginning of the project and have been covered by the project. The following table details the main contributions of the project to the identified expectations.

Table 18: Expected contribution of the pilot project and its deliverables/outcomes

Expected contribution of the pilot project	Pilot project deliverables/outcomes
Supporting water-policy implementation at the MS level (in particular the implementation of the WFD, the FD and water-related adaptation strategies) and the integration of NWRM in the following RBMPs, FRMPs or more local catchment-based management plans	<p>The link between NWRM and water/environmental policies was set since the beginning of the project. The Steering Committee meetings allowed to meet key European institutions involved in different policies (water, biodiversity, climate change, and environment). Exchanges with the European Environmental Agency and JRC ensured the production of the pilot project would be relevant to the implementation of policies.</p> <p>The regional process allowed targeting water managers in charge of the plans' implementation.</p> <p>Furthermore, the pilot project contributed to the development of the policy document for supporting the implementation of NWRM in the WFD and FD which was adopted by Water Directors.</p>
Supporting the development of shared information systems and reference datasets in an EU coherent way, with an open source approach and close connection to (coherence with) WISE and INSPIRE, using the latest development in terms of semantic approaches	The database, the platform and the structure (fields) of the factsheets and case studies were developed after the compatibility with the existing platform and tools (WISE, JRC scenarios modelling) were checked. NWRM platform and tools are open source and would require a few more steps to be 'technically' transferred (half day training). In terms of content, as the decision was not made during the project on who would welcome the platform, the pilot project deliverables have been developed in an adaptive way but nevertheless some information (dealing with case

Expected contribution of the pilot project	Pilot project deliverables/outcomes
	studies for example) would require further work to be adapted in the exact format of the welcoming structure.
EU-wide water policy making, feeding into the WFD Common Implementation Strategy (CIS), the activities of the European Environment Agency and the current scenario modelling initiative of the Ispra Joint Research Centre (JRC)	<p>The link with the WFD CIS, EEA and JRC was set at the beginning of the project.</p> <p>Partners participated to CIS Working groups (Agriculture, floods, Groundwater, PoM). Specific actions were carried out with the WG PoM as it developed a guide dealing with NWRM. The exchanges allowed the consortium to revise its concept note and to adapt the description of NWRM.</p> <p>EEA and JRC were active members of the steering committee and guided the project to be aligned to water policy.</p>
Identifying gaps in knowledge and information that will demand further research at the MS, regional and European levels to support effective NWRM implementation in the medium- to long-run	<p>Since the beginning of the project (presentation to the project at the EURO-RIOB, Dublin conference and later on the regional workshops) it was clear that (i) NWRM was known under different names and required a dedicated promotion to raise awareness (ii) providing evidences on the NWRM effectiveness related to their multiple benefits and combination of uses requires more time to gather quantified data. As explained in section III.5 and synthesised hereafter, some actions related to the gaps in knowledge could be: (i) work in a time frame allowing the analysis of the data. For example, projects implementing NWRM suggested below should be running for 5 years minimum (ii) Fund news projects dedicated to the implementation of the NWRM at the local scale including monitoring processes and tools (ex : volumetric recorder) (iii) Projects should be built in a multidisciplinary way including integrated analysis of environmental policies. (iv) Build a permanent state of the art (using the structuration developed by the project) to provide a map of the existing technical documents dealing with the implementation of NWRM, and create an online library using the NWRM ontology (v) Support the facilitation of the Platform (vi) Settle a quality charter through a labelling and agreement process detailed in following section for NWRM, certifying the related integrated approach and ecosystem services (vii) Set twinning among cities implementing NWRM (viii) Organise technical days and training sessions, and provide technical arguments to public owners/contracting authorities</p>

In summary, the NWRM pilot project developed an innovative knowledge platform structuring the state of the art knowledge on NWRM throughout Europe and delivered a framework and structuration for these. Thanks to the Platform and related technical documents developed by the project consortium, the knowledge platform is now structured and publicly accessible.

From the beginning, the project raised a series of semantic challenges. NWRM concept gathers measures that already existed and which had been defined far before the emergence of NWRM. The gap between the European vocabulary and the ones used at the national and regional scales highlighted the need for complementary work dedicated to the promotion, communication and training on NWRM.

From a policy and institutional point of view, the project underlines the need for the integrated and transversal approach to water management as mentioned by the EU Water Blueprint (2012). At the operational scale, it requires a clear multidisciplinary approach. Both approaches are considered as key elements that help highlighting the multiple benefits and functions of NWRM for water, environmental and landscape management policies.

Specific attention was given to the collection of information on the effectiveness of NWRM. However, a sound assessment of the effectiveness of NWRM remains challenging as a result of scarce quantified data¹⁹. **The collection of quantified data on the multiple impacts/benefits of NWRM remains key** to ensuring NWRM are well understood, demonstrated and in fine adopted by stakeholders in charge of landscape and environmental policy implementation.

VIII.2 Perspectives and recommendations

With this basis, the NWRM story has not come to an end but on the contrary, the knowledge platform and the guide provide a full set of tools for the NWRM community to progress towards a greener economy and a higher implementation of Green Infrastructures, with NWRM as a core component.

NWRMs through their multiples functions and benefits seem highly appropriate to tackle cross environmental policy challenges (from climate change through biodiversity to water, agriculture and urban issues).

The context of NWRMs is peculiar. In the sense used in the WFD and FD, they are supplementary measures. At the same time, they are not new measures: most of them have been already implemented.

Based on the experience of the project, three key features seem to symbolise the context as well as the challenges and path to be built to bring NWRMs into the practitioners, policy and decision makers:

- Raising awareness: by developing the common understanding of NWRMs based on demonstration from case studies and feedbacks from experiences undertaken in different places throughout Europe to envisage their transferability;
- Matching policy implementation needs and knowledge availability, which highlights the importance of their respective time issues. For example, the implementation of the WFD, water and environmental directives/strategies have set planning's. In the

¹⁹ This aspect is explained in the Synthesis Document n°3 available on the website. A specific note was addressed to the Project officer by the consortium on the 04/07/2014.

field of water, knowledge related to NWRMs should be available at least one year before the RBMP are validated.

NWRMs' implementation requires a change of practice of environmental stakeholders (from the European to the local levels and from policy to practitioners) that can only be initiated once the multiple benefits and functions of NWRMs are demonstrated, which is related to the third features:

- Availability of quantified data. When gathering information on case studies, the difficulty of reaching an exhaustive panorama on how, when NWRMs are implemented and their related costs reveal the need for more demonstration that would integrate stronger and longer monitoring.

The NWRM pilot project has built a strong basis of knowledge through its platform which contains materials presenting these measures providing information, links with environmental policies for improving their implementation, and related LinkedIn forum divided into four European regions. This community set by the project would benefit from specific resource dedicated to knowledge brokers/facilitators/trainers aiming at (i) promoting NWRMs (ii) supporting the match between the practitioners needs and NWRMs related knowledge (covering the technical aspects of their implementation as well as providing the economics and environmental criteria to decide the appropriate set of NWRMs)²⁰ (iii) providing technical support to implement NWRMs. In the following, practical suggestions are made for the future of NWRM, and a set of actions are proposed.

Practical suggestions for moving ahead with the NWRM agenda

- Provide quantified data to stakeholders to support them and convince them of the importance of implementing NWRM
- More systematically monitor NWRM so additional knowledge on their effectiveness and on the multiple benefits they deliver is obtained (targeting a wide range of environmental policies)...
- Perform more robust NWRM assessments that capture the different ecosystem services delivered, comparing in particular ecological engineering and grey-engineering solutions or their best combinations
- Launch additional pilots to demonstrate the feasibility of NWRM and to gather additional quantified data (ensure that financial resources are allocated to sound monitoring)
- Work on the continuity between the European level and the levels of implementation of the PoM at national/regional/local (including owner/contracting authority) levels. The project accomplished a first essential step by structuring and gathering NWRM knowledge and making it accessible via the NWRM knowledge platform. Involvement of stakeholders is essential to ensure the platform lives, and that new initiatives, experiences and quantified data are regularly integrated into the knowledge platform. Additional resources will be required for supporting the emerging NWRM networks.

²⁰ Which is among other things related to policy and research programming

How ?

We have distinguished two profiles which could promote these actions. Nevertheless, the European Commission/members states and stakeholders could initiate all the actions.

Table 19: Possible follow up actions for NWRM development and their expected impacts

	Actions	Impacts
European Commission/Members states	The listed actions should be settled within a time frame allowing the analysis of the data. For example, projects implementing NWRM suggested below should be run for 5 years minimum because the nature based solution generally need more than 2-3 years for natural processes to run at their optimum.	<p>Allow the collection of time series of quantified data to provide a good basis for demonstrated arguments to water and others stakeholders (including the owner/contracting authority)</p> <p>Demonstrate in a quantified manner the NWRM's effectiveness</p> <p>Envisage long term perspective</p>
	Fund new projects dedicated to the implementation of the NWRM at the local scale including monitoring processes and tools (ex : volumetric recorder)	<p>Ensure the collection of quantified data demonstrating the added-value of NWRM (multiple benefits and functions)</p> <p>Enlarge the stakeholders' panel within consortiums (involvement of key actors from the water and landscape management sectors: owner/contracting authority, scientists, PoM managers, farmers, etc.)</p>
	Projects should be built in a multidisciplinary way including integrated analysis of environmental policies.	<p>Highlight win-win situations for environmental policies and landscape management</p> <p>Demonstrate the multiples benefits of combined NWRM</p>
	Realise a permanent state of the art (using the structuration developed by the project) to provide a map of the existing technical documents dealing with the implementation of NWRM, and create an online library using the NWRM ontology	Correlate European vocabulary with practices implemented at the members states level and then promote/communicate on NWRM
	Support the facilitation of the Platform	<p>Capitalise on the existing knowledge and provide an exchange area to the experts and stakeholders</p> <p>Maintain the platform delivered by the project and ensure it becomes the source of NWRM knowledge</p>

	Actions	Impacts
	Settle a quality charter through a labelling and agreement process for NWRM, certifying the related integrated approach and ecosystem services	<p>Define a list of indicators based on the different actors and services economically valued. From this, establish a NWRM label certifying the project is effectively implementing NWRMs.</p> <p>By bringing funds through the labelling, convince stakeholders to move their management paradigm towards a shared and integrated approach</p> <p>Federate funding actors thanks to the charter</p>
Stakeholders	Set twinning among cities implementing NWRM	<p>Exchanges of practice and allow experts to meet at the European scale</p> <p>Confront the different funding possibilities</p>
	Organise technical days and training sessions, and provide technical arguments to public owners/contracting authorities	<p>Promote NWRM by targeting stakeholders in charge of NWRM implementation</p> <p>Bring understanding and tools to support stakeholders to implement NWRM and demonstrate their multiple benefits and functions</p> <p>Help find funding</p> <p>Assist ecological engineering work and convince implementers</p>

The proposed actions and identified actors could form a basis for the further discussion in the WG PoM or between the European Commission and Member States when delineating the set of measures to be implemented in the PoM.

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Annexe 1: List of Acronyms

CAP	Common Agricultural Policy
CCF	Continuous Cover Forestry
CIS	Common Implementation Strategy
CS	Case Study
EAV	Entity Attribute Value
EEA	European Environmental Strategy
EC	European Community
ERDB	Eastern River Basin District
EU	European Union
FD	Flood Directive
FRMPs	Flood Risk Management Plans
GSG	Guide Support Group
NFM	Natural Flood Management
NWRM	Natural Water Retention Measures
OIEau	Office International de l'Eau
PoM	Programme of Measures
RBMP	River Basin Management Plans
RDF	Resources Description Framework
SKOS	Simple Knowledge Organization System
SUDS	Sustainable Urban Drainage Systems
WFD	Water Framework Directive
WG	Working Group
WG PoM	Working Group Programme of Measures
WISE	Water Information System for Europe
WssTP	Water Supply and Sanitation Technology Platform;

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Annexe 4: List of deliverables

The structure of this table is the one proposed in the inception report. It is based on the list of deliverables and outputs described in the technical offer

	Responsible Coordinator	Main contributors	Deliverables' name	Deliberables 1 st period	Deliverables 2 nd period
Transversal Task (TT)					
Project management	OIEau Acteon	all partners, in particular sector and discipline leads	DTT1: Inception report	DTT1 DTT4i NWRM Inception report-vf.doc	
	OIEau Acteon	OIEau Acteon	DTT4: Minutes of the 6 meetings with the Steering committee	DTT1 DTT4i NWRM Inception report-vf.doc DTT4iii NWRM SC interim meeting key points 110414.doc	DTT4iv NWRM SC final meeting key points 121214.doc
	OIEau Acteon	all partners, in particular sector and discipline leads	DTT3: Interim report	DTT3 DTT4ii NWRM interim report_final.doc (including key points of the meeting with the Commission and SC) DTT3 DTT4 NWRM interim report_draft1.1.doc	
	OIEau Acteon	all partners, in particular sector and discipline leads	DTT5: Final report		DTT5 NWRM final report.doc
	OIEau		Meetings with the commission	DTT3 NWRM interim meeting EC key points.doc	DTT3 NWRM EC 140514 webconf keypoints v1.doc DTT3 NWRM quantitative data-note-final.doc
Web based forum	OIEau	all partners, in particular sector and discipline leads	DTT2: Web based forum (eventually LinkedIn's group)	DTT2 LinkedIn NWRM group + four regional subgroups ²¹	

²¹ LinkedIn address : <https://www.linkedin.com/grp/home?gid=7410406&sort=POPULAR&trkInfo=idx%3A1-1-1%2CtarId%3A1424873972737%2Ctas%3Awater+retention&trk=tyah>

	Responsible Coordinator	Main contributors	Deliverables' name	Deliberables 1 st period	Deliverables 2 nd period
	Task 1 (DT1): Building the knowledge base: typology of measures and assessment of impacts, costs and benefits, and implementation potential (OIEau)				
	T1a Build a catalogue of measures and case studies with semantic annotations (OIEau/IACO)				
Web based tool creation	OIEau	IACO	Output T1a4: Web based forum (eventually LinkedIn's group) sourcing application to get real feedback on the impact of the measures	In relation with DTT2 LinkedIn NWRM group + four regional subgroups	
Design of the catalogue of measures	IACO OIEau	All partners (eventually regional experts)	Output T1a1: Fully semantic glossary implementing a catalogue of measures and case studies featuring	<i>NWRM 53-nwrms-illustrated.pdf</i>	Became the IDs Cards in the practical guide
				http://nwrms.eu/glossary http://nwrms.eu/page/relations-graph Output T1a1 NWRM Glossary 140314.doc	http://nwrms.eu/implementing-nwrms/practical-guide
			Output T1a2: Embedded map viewer for the localisation of case studies and potential application area	http://nwrms.eu/ http://nwrms.eu/list-of-all-case-studies	
			Output T1a3: extensive search capabilities using map viewer	http://nwrms.eu/ http://nwrms.eu/list-of-all-case-studies	
	OIEau ACTeon	Core team	Analysis the scoping study 'cost, benefits and climate proofing of NWRM	NWRM streamlining NWRM classifications.doc	

Responsible Coordinator	Main contributors	Deliverables	Deliverables 1 st period	Deliverables 2 nd period
T1b (DT1b): Gather information on assessment methods and practices and collect data for assessing measure impact and cost effectiveness and efficiency (Acteon/ All partners based on share of countries and sector and discipline leads)				
OIEau	IACO	DT1b1: conceptual note illustrating in detail the methodology developed for data collection (template in annexe)	DT1b1i NWRM Note_Database_filling_Draft_1912.doc DT1b1i NWRM AnnexII Literature_list_NWRM_Version_1912.xls DT1b1ii NWRM_DBparameters_v2-1.xlsx DT1b1ii NWRM case study factsheet.doc DT1b1iii NWRM individual factsheet.doc	
OIEau	IACO	output T1a5: conceptual model notice, including geographical fields for map viewer	Output T1a5 NWRM DB-conceptual-v1bis-circulated-byEC.rar	
OIEau	IACO all partners (eventually regional experts)	DT1b3 Detailed Database content imported on the website of catalogue of measures and case studies, linked electronically to the practical guide of T3 an integrated in WISE + Map viewer	DT1b3 NWRM_DBparameters_v2-1.xlsx DT1b3 NWRM cases studies collected.zip	
OIEAU/ Acteon	all partners	DT1b2: contribution to interim report	related to DTT3	
OIEAU/ Acteon	all partners	DT1b4: contribution to final report (including report on conceptual model and implementation of DB)		related to DTT5

	Responsible Coordinator	Main contributors	Deliverables' name	Deliverables 1 st period	Deliverables 2 nd period
Task 2 (DT2): launching a dynamic process: create networks of best practice exchange, organise meetings with practitioners and stakeholders and participate in CIS Workshops (OIEau/Acteon)					
Overall steer to the networks at EU scale	IMDEA / Acteon	IACO	DT2.1: backgrounds doc	DT2.1 NWRM WS1 background note MED.pdf DT2.1 nwrn conceptnote_to_regional_stakeholders.pdf	
			workshop 1 (DT2.3 incl.ppt pres)	http://nwrn.eu/about-nwrn-project/regional-networks/mediterranean-network/workshop-n%C2%B01-mediterranean-region	
			workshop 2		http://nwrn.eu/about-nwrn-project/regional-networks/mediterranean-network/workshop-n%C2%B02-mediterranean-region
			DT2.2: minutes (English language)	DT2.2 MED NWRM WS1 synthesis.pdf	DT2.2 MED NWRM WS2 synthesis.pdf
			regional web forum facilitation	NWRM training facilitation key points 121213.doc	
Regional workshops	REC/ Acteon	REKK	DT2.1: backgrounds docs	DT2.1 nwrn conceptnote_to_regional_stakeholders.pdf	
			workshop 1 (DT2.3 incl.ppt pres)	http://nwrn.eu/about-nwrn-project/regional-networks/danube-network/workshop-n%C2%B01-danube-region	
			workshop 2 (DT2.3 incl.ppt pres)		http://nwrn.eu/about-nwrn-project/regional-networks/danube-network/workshop-n%C2%B02-danube-region
			DT2.2 minutes (English language)	DT2.2 Danube NWRM WS1 Synthesis.pdf	DT2.2 Danube NWRM WS2 Synthesis.pdf
			regional web forum facilitation	NWRM training facilitation key points 121213.doc	
	BEF / Acteon	SLU	DT2.1: backgrounds docs	DT2.1 nwrn conceptnote_to_regional_stakeholders.pdf	
			workshop 1 (DT2.3 incl.ppt pres)	http://nwrn.eu/about-nwrn-project/regional-networks/baltic-sea-regional-network/workshop-n%C2%B01-baltic-sea-region	
			workshop 2 (DT2.3 incl.ppt pres)		http://nwrn.eu/about-nwrn-project/regional-networks/baltic-sea-regional-network/workshop-n%C2%B02-baltic-sea-region
			DT2.2: detailed minutes (English language)	DT2.2 Baltic NWRM WS1 synthesis.pdf	DT2.2 Baltic NWRM WS2 synthesis.pdf

			regional web forum facilitation	NWRM training facilitation key points 121213.doc	
	AMEC / Acteon	Acteon	DT2.1: backgrounds docs	DT2.1 nwrn conceptnote_to_regional_stakeholders.pdf	
			workshop 1 (DT2.3 incl.ppt pres)	http://nwrn.eu/about-nwrn-project/regional-networks/western-network/workshop-n%C2%B01-western-region	
			workshop 2 (DT2.3 incl.ppt pres)		http://nwrn.eu/about-nwrn-project/regional-networks/western-network/workshop-n%C2%B02-western-region
			DT2.2 minutes (English language)	DT2.2 Western NWRM WS1 synthesis.pdf	DT2.2 Western NWRM WS2 synthesis.pdf
			regional web forum facilitation	NWRM training facilitation key points 121213.doc	
Contribution to WFD/CIS	OIEau ACTeon	SRUC, AMEC, SLU, IMDEA	DT2.4: background docs (including ppt presentation)	DT2.4i NWRM CIS WG POM presentation nov2013.ppt DT2.4ii NWRM CIS_WG_Agri_presentation march 2014.pptx DT2.4ii NWRM CIS WG AGRI March 2014.doc DT2.4ii NWRM WG Agri key points.doc DT2.4iii NWRM link NWRM&CAP.xls DT2.4iv NWRMconceptnote_versionCISWGPOMv2final.doc DT2.4iv NWRM CIS-WG PoM bkg note annex 2 March 2014.pdf DT2.4iv NWRM CIS-WG PoM bkg note annex 3 March 2014.pdf DT2.4iv NWRM CIS-WG PoM bkg note March 2014.pdf DT2.4iv NWRM CIS-WG PoM presentation March 2014.ppt DT2.4v NWRM CIS-WG Floods bkg note April 2014.doc DT2.4vi NWRM Analysed feedbacks from the WGPoM.doc	
Raising awareness	OIEau	SRUC, AMEC, SLU, IMDEA	Synergies with other networks	NWRM Restore web meeting dec13.doc	
	OIEau /ACTeon	All partners	DT2.5: ppt presentations made events and WGs	DT2.5 NWRM Dublin Dec13 N Amorsi.ppt DT2.5 NWRM INBO Plovdiv 2013 N Amorsi.ppt	

Responsible Coordinator	Main contributors	Deliverables name	Deliverables 1 st period	Deliverables 2 nd period
Task 3 supporting future implementation: practical guide for planning and implementing measures at the catchment level target audience: river basins managers, experts and/or stakeholders -(Acteon)				
OIEau	Acteon SRUC, AMEC,SLU,IMDEA	DT3.1 Guide	DT3.1 NWRM draft structure of the practical guidance_version 3.docx DT3.1 NWRM _draft structure of the practical guidance_vf.doc	DT3.1 NWRM_guidance_version 2.0.pdf DT3.1 NWRM_guide_illustration table.xlsx http://nwrn.eu/implementing-nwrn/practical-guide (available in 15 languages)
		Guide Support Group		NWRM GSG_workshop_Paris_04122014.pdf NWRM GSG workshop_presentation & synthesis of comments dec 2014.ppt NWRM GSG_workshop_November 2014_Bruxelles.docx
OIEau/ Acteon	all partners in particular regional coordinators	DT3.2: PowerPoint presentation (translated in all EU languages)	DT3.2ii NWRM Poster VF.pdf (additional deliverables)	DT3.2i (PPt presentation): http://nwrn.eu/implementing-nwrn/how-does-it-work
		DT3.2 leaflet with format/design taken care of by OIEau (translated in all EU languages)	DT3.2i NWRM leaflet version oct 13.pdf DT3.2i NWRM leaflet 130113.pdf	http://nwrn.eu/implementing-nwrn/how-does-it-work (available in 22 languages)
Additional deliverables				
OIEau	all partners	projects 's website	www.nwrn.eu	
ACTeon	All partners	newsletter		NWRM Newsletter_IssueNo1_FINAL.pdf
OIEau/Acteon		Roll up		rollup-NWRM-v1.zip
All partners		Synthesis documents		NWRM sd1_ what are NWRM.pdf NWRM sd2_Biophysical and effectiveness.pdf NWRM sd3_methods and tools.pdf NWRM sd4_benefits.pdf NWRM sd5_cost.pdf NWRM sd6_cost effectiveness.pdf NWRM sd7_ eco assessment methods.pdf NWRM sd8_windows of opportunities.pdf NWRM sd9_barrier and success factors.pdf NWRM sd10_policy coordination.pdf NWRM sd11_financing.pdf Also available on http://nwrn.eu/implementing-nwrn/synthesis-documents



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Annexe 5: Overview of all light and in-depth case studies

[illegible]

	in- death Light	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14
Restoration of Atanasovsko Lake, Bulgaria	x																								x																														
Restoration of the Vesselina river, Bulgaria	x																	x																																					
Floodplain restoration in the Russenski Lom Nature Park, Bulgaria	x																																																						
Wetland management on the Burgas lakes, Bulgaria	x																x																																						
Constructed wetland in Vidrare, Bulgaria	x															x																																							
Green Borders: Transboundary conservation activities in Romania and Bulgaria	x															x																																							
Croatia																																																							
Floodplain Restoration in the Lonjsko Polje Nature Park in Croatia	x																x																																						
The Vonarje flood storage reservoir in Croatia	x														x																																								
Cyprus																																																							
Oroklini wetland restoration in Cyprus	x															x																																							

	in- death Light	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14
Ezousas artificial groundwater recharge of treated effluent in Cyprus	x																									x																													
Germasogeia riverbed artificial groundwater recharge in Cyprus	x																									x																													
Czech Republic																																																							
Restoration of the Cerny Potok stream, Czech-Republic	x																		x																																				
Drainage management in the city of Hradec Kralove, Czech Republic	x																																																						
Revitalisation of the Borova stream, Czech Republic	x															x		x				x																																	
Mire restoration within the Sumava National Park, Czech Republic	x																						x																																
Restoration of the Sumava peatbog, Czech Republic	x															x																																							
Denmark																																																							
Restoration of the Odense river, Denmark	x															x	x	x				x																																	
Estonia																																																							
Restoration of Coastal Meadows in Matsalu, Estonia	x															x																																							

	in- death Light	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14
Restoring the Kuresoo bog, Estonia	x	x																																																					
Reconstruction of the Lepiku channel in Tallinn's Botanic Garden, Estonia	x																																																						
Finland																																																							
Kylmäojankorpi forested wetland, Vantaa, Finland	x														x	x																																							
Nummela 'GATEWAY' Wetland Park, Finland	x															x																																							
Urban green roofs in Helsinki, Finland	x																																																						
France																																																							
Floodbreaking hedgerows in Southern France	x		x																																																				
Flood meadows in the Marais Poitevin, France	x	x															x																																						
Restoration of river Hermance, France	x																	x	x			x		x																															
Revitalisation of riverbanks and connection of hydraulic annexes alongside the Scarpe river in France	x																																																						
Lunéville, Floodplain restoration and reconnection of hydraulic annexes,	x																																																						

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	IN- depth Light	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14
Restoring the River Quaggy in London, UK	x																x	x																				x																	
Rain gardens for the Day Brook, UK	x	x																																		x																			
Exmoor Mires peatland restoration, UK	x															x																				x																			
		10	6	2	0	0	2	2	3	0	2	0	1	0	15	39	26	16	11	1	6	10	6	8	2	9	4	3	3	1	2	4	3	3	1	1	1	2	8	0	1	10	2	1	2	2	1	0	0	2	2	2	0	2	1



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