Nature-Oriented Flood Damage Prevention – NOFDP

- an INTERREG IIIB NWE funded project -

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Motive and Abstract

Introducing UNCED´s proposal for a global sustainable development by the world summit in Rio 1992 and its follow-up conference in Johannesburg 2002 the EU Water Framework Directive (EU-WFD) consequently calls for a sustainable water management including both protection and development of water bodies and water related habitats towards a good ecological quality. While there are many national guidelines referring to the management of water bodies in strict there is poor assistance regarding water related habitats like floodplains emphasising water quality and nature protection. Good ecological functionality depends on river morphology that is mainly shaped by flood events. In spite of this, flooding is rarely represented in the EU-WFD and existing national guidelines regarding water management and spatial planning. As a matter of fact we have complementary and conflicting situations concerning flood damage prevention and ecological improvement.

Traditionally flood damage prevention strategies aimed at minimising the monetary losses caused by flood events. In the last century flood damage prevention meant flood protection only and was based on purely technical structures such as reservoirs and dykes to control the water levels. After several severe floods in the early 90's the International Commission for the Protection of the Rhine (ICPR) developed the "Action plan on flood defence" being an enhanced strategy based on the reduction of damage potential within flood prone areas and providing the river with sufficient discharge capacity. Restoring the former natural floodplains and increasing natural water conservation in the entire catchment were then a first ecological approach towards a balanced consideration of technological, economical and ecological aspects in the management of water-systems. As river catchment hydrology is strongly related to topographic rather than political boundaries, a basin-wide integrated flood prevention and ecological improvement strategy needs management at a high transnational level. Within the historical development of flood prevention strategies, the NOFDP project enters the phase of sustainable planning and will be followed up by the final implementation of the EU-WFD in 2015 (Fig.1).

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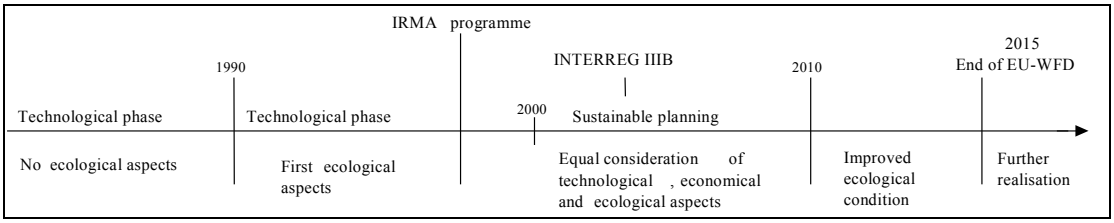

Figure 1: Historical development

Building a support system covering spatial planning and water management is important and innovative because the – in many member states traditionally independently acting – planning instruments "spatial planning" and "water management" are supported to enhance integrated planning in fields of comprehensive water management at local, regional, national and transnational levels. NOFDP will strengthen the ecological importance of water bodies and catchments in flood damage prevention by providing guidelines and software tools for planners and decision makers. Spatial planning is strongly involved in the integrative planning process. The former, ongoing and future investment projects will be the basis for the formulation of the guidelines and the software tools to guarantee the practical applicability within the North-West Europe (NWE) region. NOFDP gives transnational added value to all planning and action along rivers.

1 Project description

The importance of the ecological status of the water body, adjacent riverine ecosystems and catchments has increased with the implementation of the EU-WFD. In article 1 the EU-WFD demands the prevention of further deterioration as well as protection and enhancement of the status of the aquatic ecosystem and, with regard to their water needs, of terrestrial ecosystems and wetlands directly depending on the aquatic environment.

Logically, the ecological value of riverine ecosystems will be affected by technical structures such as weirs, dams, dikes, the river morphology itself and in interdependence with these driving forces by corresponding water quantity and quality. Spatial water conservation is complementary to flood damage prevention. Technical measures in stream channels, however, often have considerable conflict potential with regard to nature preservation and improvement.

EU member states have to achieve the objective of good status of water bodies by defining and implementing necessary measures within integrated river basin management plans. One logical sub-issue of the EU-WFD is the combined consideration of the ecological status of surface water bodies and adjacent riverine ecosystems together with flood damage prevention strategies concerning their hydrological, hydraulic and morphological characteristics. This combination, however, is not formulated in the EU-WFD.

Within NOFDP a three layer approach is introduced (Fig. 2). The first layer represents the water and soil system itself, the second the human infrastructure including land use, and the third layer integrates the status of ecosystematic functionality of the whole river ecosystem. This system is embedded into a political framework of decision making. For this reason a decision making process with

respect to integrative flood damage prevention is linked with assessing the possible future status of the three layers.

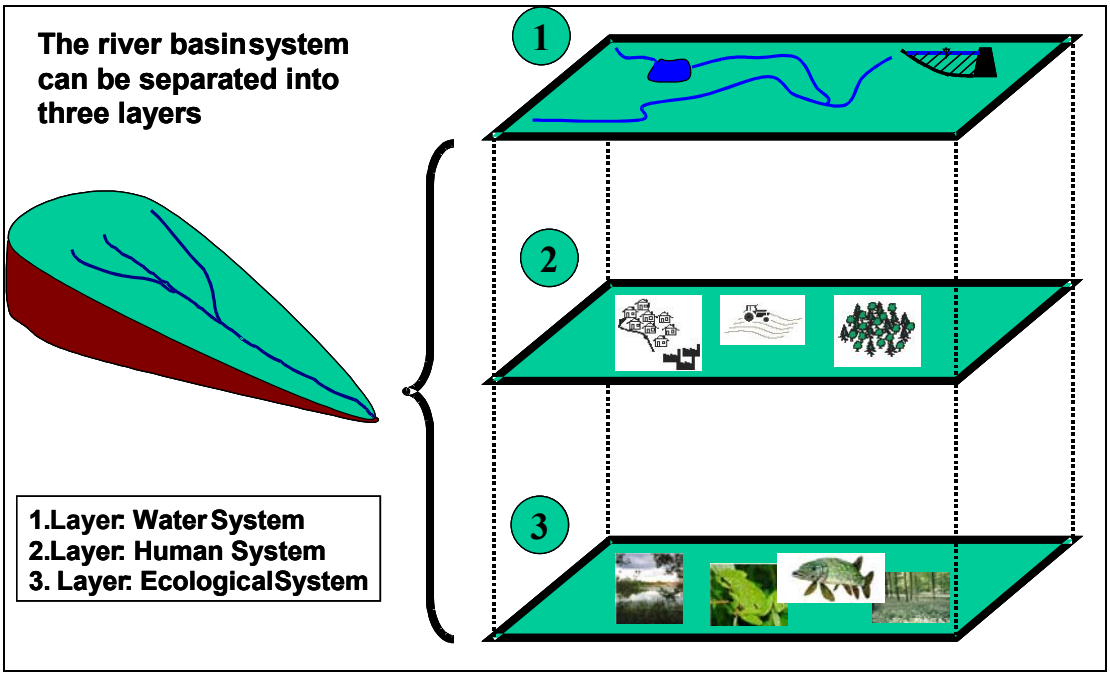

Figure 2: The three layers approach

Therefore, target values must be defined, assessed and evaluated taking into consideration the objectives “ecological damage”, “flood damage” and “spatial development”. Considering this variety of target values a multi-sectoral as well as a multi-objective planning approach must proceed the decision making process as shown in Figure 3.

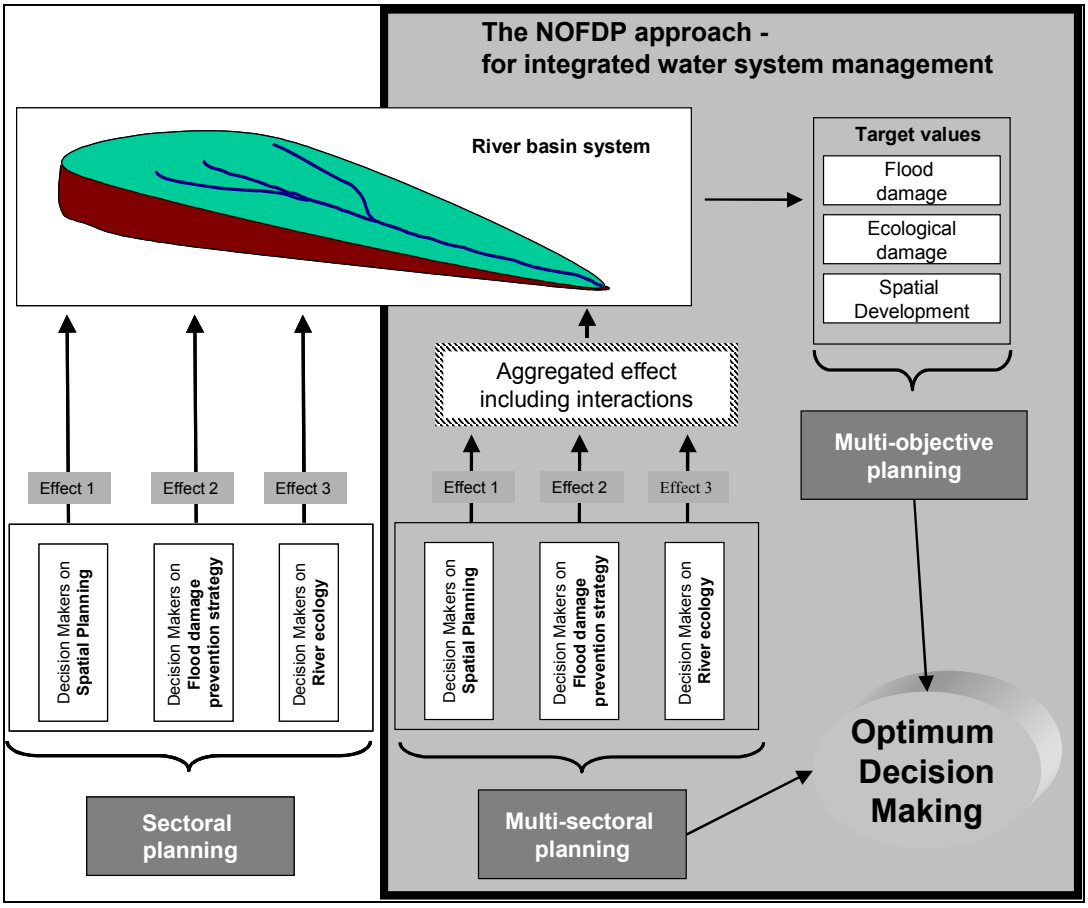

Figure 3: The NOFDP approach for optimum decision making

Each human decision will change the physical system (land use, infrastructure, …) that will consequently cause an anthropogenic impact on the ecosystem (soil, vegetation, river ecology). The INTERREG IIC programme was a first step towards multi-sectoral planning. It has complemented the purely technically oriented flood damage prevention strategy by spatial planning aspects. The spatial aspect in flood damage prevention (land use, reactivation of floodplains, de-central measures, ….) has gained importance. The NOFDP project ties in with the INTERREG IIC programme and will add the objective of ecological damage in the decision making process.

With the development of a knowledge base and (software) tools, combined in a decision support system with guidelines, the NOFDP project wants to assist member states of the NWE-region in making optimum decisions for riverine flood damage prevention planning. This is to break new grounds in terms of a multi-sectoral (river ecology, flood damage prevention & spatial planning) and multi objective planning approach (ecological damage, flood damage, economic evaluation). Coupling an ecological model with hydrological / hydraulic models is an important objective of current research activities.

Analysing respective project targets a couple of approved INTERREG IIIB projects (date 2003-1-28) can be topically related to targets of NOFDP. The **SDF** aims at sustainable development of floodplains in the Rhine corridor in order to improve both ecological functioning and capacity for water retention. In contrast to NOFDP, SDF however will not create an overall technical system for advising stakeholders in

floodplain management. **SAFER** focuses strategies and actions for flood emergency risk management and thus mainly deals with the monetary aspects of flood damage. **TIMIS** wants to develop a transnationally applicable Internet map information system on flooding for allocating areas of flood risk. **WaReLa** focuses on the Rhine catchment (esp. section Moselle - Rhine) and wants to elaborate a software supported tool for forecasting and assessing the effects of land use change (forestry, agriculture) on the incidence of flooding (water levels) complemented by a monetary eco-efficiency analysis. **Noah** deals with optimising information transfer during high water periods within flood partnerships by use of the information system **FLIWAS** taking into account relevant data for flood occurrence and flood prevention.

A strong connection to NOFDP is given in some of these listed projects but as no eco-hydrological modelling is incorporated they differ essentially from NOFDP and its objectives. In summary a co-operation with listed projects is helpful for getting a stronger and sound knowledge base in NOFDP and vice versa. Exemplarily a co-operation with WaReLa or Noah could result in the following tasks:

- transfer of joint instruments of WaReLa to NOFDP and vice versa
- transfer of eco-efficiency elaborated in WaReLa to NOFDP (open source)
- transfer of ecological models elaborated in NOFDP to WaReLa (modelling land-use change)
- synoptical exchange of evaluation schemes and guidelines of WaReLa and NOFDP
- decision makers and stakeholders of NOFDP investment projects as exemplary flood partnerships for being tested within Noah
- flood partnerships of Noah as template for measure related target group in NOFDP
- supplementing the IDSS-knowledge base of NOFDP by Noah and vice versa
- introducing aspects of NOFDP-ecology (e.g. assessment) to FLIWAS
- NOFDP Investment Projects as full scale exercises aimed at in Noah (providing test data for FLIWAS)
- integration of FLIWAS as a supplementary tool for NOFDP European Information Centre (action 6.7)

Further it helps to prevent mis-selections of flood damage prevention measures not taking into account today's requirements of sustainability, nature conservation and development following EU-WFD. Now, considering the ecological status as an equal objective in riverine planning, long-term effects have to be taken into account and as a consequence thereof modifications of recent flood damage conceptions have to be made.

Hereby the NOFDP project is integrated into the basic and specific framework of the International Commission for the Protection of the River Rhine (ICPR); it is focused on the category "Storage in the catchment area" of the action plan on flood defence of the ICPR, i.e. in the area and in small to medium streams. In addition to flood control issues other timely issues will be addressed being stressed by the European Union, which is the EU-WFD but also the EU-Fauna-Flora-Habitat Directive.

Both an integrated river management with an equal consideration of socio-economical and ecological aspects and the implementation of the EU-WFD require a

high level of transnational co-operation. The ICPR clearly states that flood prevention must be tackled within the entire river basin; starting at a very regional level within the catchment area and resuming along stream corridors where existing human infrastructure is endangered or future planning might cause problems.

A NWE region-wide assistance network and information centre for sustainable riverine planning measures with respect to water management, nature conservation and development and spatial planning will be installed.

Guidelines and computational tools to be developed must consider the legal structure as well as administrative rules in order to support a transnational strategy for a nature-oriented flood damage prevention.

2 NOFDP objectives

Based on the demand of the Hesse Ministry of the Environment, Rural Development and Consumer Protection (Germany) and of the Provincie Noord-Brabant (The Netherlands) to meet ecological, spatial planning and water management requirements concerning specific investment projects for flood protection they both launched the INTERREG application to put this task into a NW-European wide context.

A basic future requirement is the development of catchment wide integrated planning methodologies for land, water and infrastructure systems. NOFDP is an important step forward to combine riverine ecological functionality and development, spatial development and flood damage prevention. In particular NOFDOP is addressing spatial planners and water managers.

The **overall objective** of the NOFDP project is

to develop an information and knowledge base as well as decision support tools to assist Member States of the NWE-Region in making optimum decisions for riverine planning considering ecological improvement for river corridors with a high degree of public participation, spatial development and flood damage prevention.

It is supposed to support sustainable riverine development and to prevent mis-selection of flood damage prevention measures in relation to potential violation of EU-WFD and to comply with other EU-directives. To give solutions for this ambitious target, a specific objective is the development of a computer based and web linked information and decision support system coupling data base and integrated modelling techniques. Additional deliverables of the project will be printed guidelines and a web-based “NOFDP - European Information Centre“ to provide information for the public and support for planners and multi-level decision makers beyond the end of NOFDP.

The integration of four real-world investment projects located in the province Noord-Brabant (The Netherlands) and South Hesse (Germany) ensures both the participation of planning authorities in the development of the IDSS by contributing

models, data and knowledge and later the active involvement of the IDSS software tool in the planning process. In addition several transnational studies will be carried out.

This aims at the integration of experiences with different national administrative structures and policy instruments as well as various approaches of managing flood control into the overall concept of NOFDP. Furthermore several reports on transnational co-operation in flood damage prevention and ecological improvement will be incorporated into the project. For the transboundary catchment areas of the River Mark and the River Dommel, a report on different scenarios on flood damage prevention, ecology and water shortage will be compiled in close co-operation with the Cross-border Committees. In these Cross-bordering Committees of the River Mark and the River Dommel all relevant governmental and non-governmental organisations from Belgium and the Netherlands are involved. These reports shall have on one hand a strong reference to the NOFDP Investment Projects located on the River Dommel and River Mark, on the other hand as integral riverwide studies they will provide enormous input of information for the overall knowledge base.

The essential component in supporting the decision making process in on-going planning processes is the development of eco-hydrological software to forecast and evaluate ecological effects of planning scenarios. Herein it is important to assess the role and effect of small to medium scale measures as part of integrated river basin management. While the effect of a single small-scale flood defence measure on downstream flood water levels is known to be minimal, an integrated view, both in the hydrologic and the environmental sense, is most important. It is significant to convince the local population of the necessity to improve both spatial flood storage and the ecological state of river corridors and the merit of these measures. Therefore, in the action events it is essential to develop the common sense of upstream and downstream regions to do whatever is feasible technically and economically being socially and ecologically positive at the same time.

The merger of practical experiences in flood damage prevention and the development and application of eco-hydrological planning tools is essential to reach the objectives set.

This project will also foster the spatial vision of the NWE-Region to develop a sound natural riverine environment which is a requirement for basic nature conservation, smooth tourism and regional recreation as a stimulation for sustainable development in an intensively used industrial region.

3 The NOFDP project structure

The NOFDP project, with the structure as laid out in Figure 1, will thematically be subdivided into 8 work-packages called Action 0 – 7, each contributing a partial result to achieve the overall project objective. Each action is composed of several sub-actions referring to a detailed Action Plan as part of NOFDP INTERREG IIIB Application.

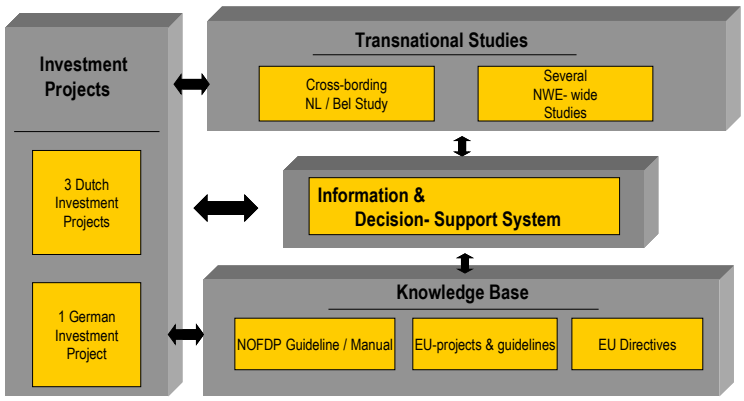

Figure 4: NOFDP project structure

Chronologically the NOFDP project is divided into four phases. The progression of Actions 0 – 7 will be simultaneously, whereby the progression of the sub-actions has an intended sequence based on the imperative of results. The first phase, the Preparation Phase (PP) has already started with the INTERREG IIIB meeting at Wageningen / The Netherlands in October 2002. The preparation phase ended with the approval of the NOFDP project with the 4th Call in 2003. Once the project is approved a first meeting of the NOFDP Steering Committee will be launched. Main activities of Phase I is gathering a knowledge base and the development of the IDSS. This is followed by Phase II (2005 – 2008) where the IDSS will be applied and the IP's will be realised. A short termed Phase III (2008) will finalise the NOFDP project with an assessment of the overall project performance. The results will be published in an evaluation report.

3.1 Groups of partners within the NOFDP project

The NOFDP project is composed of three partner groups, in brackets their contributions to the overall project:

Development Group (DG)
D1 - German Scientific Co-ordinator (hydrological models, German investment project, scientific co-ordination, communication)
D2 - Dutch Scientific Co-ordinator (hydrological models, Dutch investment project scientific co-ordination, scenario studies Dommel and Mark, communication)
D3 - German Federal Institute of Hydrology (ecological models)
D4 - External Expert (knowledge transfer former EU projects & EU-directives)
D5 - External Expert (spatial planning, planning methodologies)
D6 - External Expert (decision-support systems)
D7 - External Consultant (guidelines)
D8 - External Consultant (informatics system structure)

Investment Group (IG)
I1 – Water Board Brabantse Delta
I2 – Water Board Aa en Maas
I3 – Water Board De Dommel
I4 – Mümling Water Board
I5 – External Experts (report on Belgium / Netherlands transnational co-operation)

Associated Group (AG)
AG – (External Experts, knowledge contribution to the NOFDP project)

The **Development Group (DG)** is in charge of the development of the IDSS software tool and the development of the guidelines. The **Investment Group (IG)** is in charge of the realisation of the IP's. The existence of the **Associated Group (AG)** secures NOFDP a high degree of flexibility that enables extra input of knowledge into the overall project. This is to establish a NWE-wide network of associated partners in Phase I that will support both groups, the DG and the IG. For these actions financial resources are allocated. Potential participants are water authorities, stakeholders and NGO's.

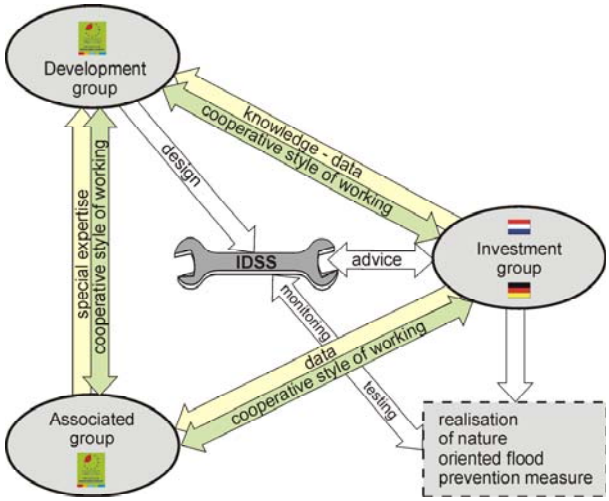

Figure 5: Communication and interaction

A consistent well defined co-operation between the DG and the IG is essential to match all the NOFDP objectives. This co-operation is being fostered by the two Scientific Co-ordinators (D1 & D2). They are responsible for the integration of the hydraulic / hydrological models applied for the design of the IP's into the IDSS and to assist the IDSS development with respect to the needs of the local authorities (IG). Furthermore they ensure an interactive communication of the IG with the DG. In Phase II the Scientific Co-ordinators are in charge of applying the draft versions of the IDSS to the IP's. The Scientific Co-ordinator will be the pivot point between the Province Noord-Brabant & Hessian Ministry and the development of the IDSS. One co-ordinator is located in The Netherlands, the second one in Germany. This is to consider the specific characteristics in legislation and administration as well as to guarantee a permanent presence for consultation with the IG.

Vice versa in phase I & II the IG will assist the DG in the realisation of the IDSS. It provides data, models and knowledge concerning the planning methodologies and administrative structures. Knowledge transfer and given recommendations will assure the development of an applicable IDSS and guidelines, which will obtain acceptance in science and administrative / planning authorities. Giving feedback to these actions during phase II the DG will assist the IG with its software tools and knowledge to improve the planning process & management concept of the IP's with respect to ecological functionality. The success of the NOFDP project is closely related to the

co-operation of both groups representing the scientific and practical point of view. The required interaction between both groups is indicated again in Figure 5.

To contribute to the transferability and transnational relevance of results, several external experts will be hired. One important selection criteria will be their experience in co-operations at transnational level and former participation in EU-funded projects. Another selection criteria will be that the commissioning of a potential candidate increases the degree of transnationality. This is to ensure professional solutions as well as to add long-term transnational contributions to the NOFDP project. This solution was chosen due to the fact that most of the potential experts fulfilling these criteria are not able to contribute own match funding in order to participate in NOFDP as formal partners. Undergoing a tendering procedure according to EU-directives these experts will have the possibility to participate as long-term quasi-partners being fully integrated into the communication structure. Tasks of these experts will be:

- input for implementation of EU-Directives and knowledge transfer from former EU-projects into NOFDP (D4)
- spatial planning and planning methodologies ranging over different levels from local to internationals level (D5)
- decision making processes and tools, showing the linkage of local decision with decision on transnational level (D6)
- preparation of transnational applicable guidelines (D7)
- report on BEL/NL transnational co-operation to give additional transnational experience to design the IDSS and to the Investment Projects located on the River Dommel and River Mark

In addition expertise will be supplemented and activities will be supported by members of the AG. Potential members should be recruited from other NWE member states (e.g. United Kingdom, Belgium) to support transnationality. All contacts will made within the course of NOFDP when extra expertise input is important.

The potential end-users of the NOFDP outcomes will be summarised as **Target Group (TG)**. This group is composed of stakeholders, decision makers, planning and administrative authorities, scientific experts, NGO's and the general public located within the NWE-region. NOFDP will provide them information and results and they will be invited to workshops / conferences (transnational feedback & knowledge).

4 The NOFDP action plan

The realisation NOFDP project follows an well elaborated action plan. This action plan is not identical with the timetable taking into account that some actions are relevant throughout the whole run time while others actions are limited to a specific phase. You can find a presentation of the action plan below and an extra description of important key actions in section 4.1.

Action 0 Launching NOFDP Project

The project application and approval was done in preparation phase and action 0 ends with the official NOFDP kick-off meeting 23 April 2004 in Wiesbaden, Germany.

Action 1 Knowledge base

Results:
- Knowledge base, report, measures, former EU-funded projects & EU-directives
- Report on planning methodologies, administrative organisations and policies within the NWE-region.
- Draft version of guidelines

The comprehensive analysis of flood damage prevention measures (existing, potential or planned) is a preliminary step for the advancing of the NOFDP project. A questionnaire will be developed and analysed in close co-operation, incorporating each partner's and expert's expertise. It will be answered by the IG and TG. This will build up the network of associated partners within the NWE-region at a very early stage. The analysis of the questionnaire, EU-Directives as well as the report "Planning methodologies, administrative organisations and policies" contribute to the overall knowledge base. The added value is the simultaneous making of these reports with interaction of the participating groups. By holding several working meetings recent results will be presented and discussed in order to elaborate cross connections. These reports enable the NOFDP project to establish first recommendations for a re-evaluation of IP's in flood damage prevention with regard to nature development giving recommendations for future strategic planning on similar projects. A NOFDP knowledge report will be a direct output of the "Closing Workshop" of this Action. In addition a first draft version of the guidelines will be presented (refer to Action 7).

Action 2 Information and Decision Support Tool – technical phase

Results:
- Eco-hydrological software to forecast and evaluate ecological effects of flood prevention planning scenarios.
- A model and internet based IDSS to optimise flood damage prevention with respect to ecosystem functionality.
- International Workshop for IDSS end-users

The main outcome of Action 2 is the IDSS and its installation on the Internet. A preceding work package is a NWE region-wide registration of hydrological, hydraulic, groundwater and ecological software tools used by planning authorities and scientific institutions. An analysis of their functionality with respect to applicability in eco-hydrological model will show a list of suitable models. An International Workshop for IDSS end-users will be organised to explore extra knowledge. International ecological and hydrological modelling experts are potential partners for the AG.

The development process of the IDSS can be subdivided into several work packages. The development of the eco-hydrological model, the DSS structure, data storage and communication with GIS as well as the implementation of an evaluation scheme will be carried out jointly by the DG with consultancy from the IG. Both Scientific Co-ordinators are again the pivot point (Fig. 5) between both groups. Once a milestone is reached the product is evaluated by the IG. An interim report gives suggestions for improvement and further development of the IDSS.

Action 3 Development of the evaluation scheme

Results: - Transnationally (NWE-wide) applicable evaluation scheme

Action 3 will provide the essential "knowledge-core" for the IDSS, involving all relevant aspects to be considered. To achieve this ambitious target the knowledge base (Action1) will be compiled in order to determine transnationally applicable target values. Guidelines, in particular the EU-WFD, EU-EIA, EU-SEA and the EU-Fauna-Flora Habitat Directive, will be in focus of interest. In addition control mechanisms of spatial planning applied to nature-oriented flood control measures will be studied intensively. Again several working meetings (DG + IG) will foster the discussions and the exchange of NWE-wide expertise.

A careful synopsis of all these aspects will lead to an evaluation scheme in terms of flood damage prevention and ecological issues. The resulting evaluation scheme will bring all involved aspects and guidelines important to sustainable riverine development as well as to flood damage prevention. Furthermore monetary aspects will be introduced. The results thereof will be transferred into the IDSS (Action 2). Building such a holistic evaluation scheme is an essential step for future successful application of the IDSS and the assistance network.

Action 4 IP realisation and IDSS application

Results:
- Iterative process of improvement (draft IDSS + IP design and management strategy)
- Realisation of pilot IP's for applied nature-oriented flood damage prevention.
- final IDSS

The main outcome of Action 4 is the realisation of four IP's under supervision of the IDSS. Each IP shows an innovative approach towards nature-oriented flood damage prevention. These investments successfully assisted by the IDSS serve as inspiring parameters for the project. Both the development of the IDSS and the realisation of the IP's will be carried out jointly by DG and IG in an iterative working process. Again both the Scientific Co-ordinators co-ordinate the progress and foster the communication within the partnership (Fig. 5).

Action 4 includes the first-time application of the IDSS to real-world projects covering both the stages of planning and operation. The realisation of the IP's within the NOFDP framework will generate first examples of applied nature-oriented flood damage prevention.

Action 5 Transnational reports / Integration AG into NOFDP

Result
- Cross-border scenario studies on the catchment areas of the River Mark and the River Dommel
- Additional report on transnational expertise relevant to NOFDP

The NOFDP partnership will benefit from studies and reports carried out under Action 5. Financial resources are allocated to hire external experts in the framework of the AG. This extra input of expertise and experiences in transnational co-operation increases the applicability of the IDSS and guidelines within the NWE-region. A first report, already decided by the NOFDP partnership, are cross-border scenario studies on the catchment areas of the Rivers Mark and Dommel. The outcome will be recommendations on the effects of flood damage prevention, ecology and water shortage prevention of the various scenarios.

The Dutch IP partners and Belgium authorities will jointly produce reports that show solutions and possibilities for a cross-border co-operation in both catchments. This action will be co-ordinated by the Province Noord-Brabant, as they are partners in both Cross-border Committees (Rivers Mark and Dommel) and in the NOFDP project. It will be a basis for co-operation and commitment on measures in both river catchment areas as meant in the EU-WFD. The scenarios will be an input for the IDSS, resulting in a forecast and evaluation on the flood damage prevention and the ecological effects of the planning scenarios, and also on water shortage prevention.

Action 6 Promotion publicity and public awareness

Results:
- A “NOFDP - European Information Centre” (platform as an Internet based knowledge network providing service of support for the TG)
- NOFDP web-site presentation and media promotional material
- Network of Associated Partners (AG)
- Several public workshops (regional, national and international levels)
- International Conference NOFDO
- NOFDO internal communication and management
- Training of partners and end users.

The main task of Action 6 is to promote NOFDP by organising workshops / conferences, web-site presentations and media promotional material at all levels and from the time NOFDP starts. Project Partners 1 and 2 are responsible for the implementation of flood damage prevention on a regional scale due to their status as upper planning authorities according to national regulations. Therefore the proper involvement of stakeholders, public and other planning authorities (like the NOFDP Project Partners 4, 5, 6, 7) with respect to NOFDP developments and outcomes is ensured. Furthermore they co-operate in flood damage prevention on national as well as NWE scale.

The iterative nature of the project demands a communication network amongst the project partners and the TG including a central document storage. These activities will build up a network of associated partners (AG). ELISE (http://elise.bafg.de) can be regarded as an example for successful Internet presentation and Internet platform.

Meanwhile a public domaine (http://www.wasserblick.net/servlet/is/19165/) and a project domaine (accessable for partners only) is installed on the internet platform Wasserblick (www.wasserblick.net). Additionally a separate NOFDP website (www.nofdp.net) is under construction.

The design of a well structured communication network is the basis of an informal project development and raises the chances for a successful follow-up of the project once it has been finished. Due to the iterative nature of the project, the development will follow the evolutionary delivery lifecycle model and provides first routines at an early stage in the project. To apply and test these routines, user-training for the IG at all action levels will be part of the communication plan. The great merit of this procedure is to learn, verify and develop an accepted and user-friendly tool for NOFDP.

As soon as the project enters the final phase the promotion to the transnational end-user community will take highest awareness. User training for the experts of the TG and the "NOFDP European Information Centre" will start working providing full service to interested parties. In Phase III a final international conference will be organised to present all NOFDP outcomes and especially to introduce the "NOFDP - European Information Centre" to the TG community. The closing of the NOFDP project is a final evaluation report that will be published (Phase III).

As Project Co-ordinator the Darmstadt University of Technology, Institute of Hydraulic and Water Resources Engineering is in charge of all Action 6 activities. The Project Co-ordinator controls the activities / events and assigns the NOFDP partners to contribute with recent results and information. Furthermore he is in charge of the day-to-day NOFDP management, co-ordination and communication.

Action 7 Development of guidelines

Results:
- Transnational multi-criteria and multi-sectoral assessment procedures ready for application with respect to ecosystem functionality and flood damage prevention.
- Guidelines to inform and support decision makers in developing a nature-oriented flood damage prevention strategy.

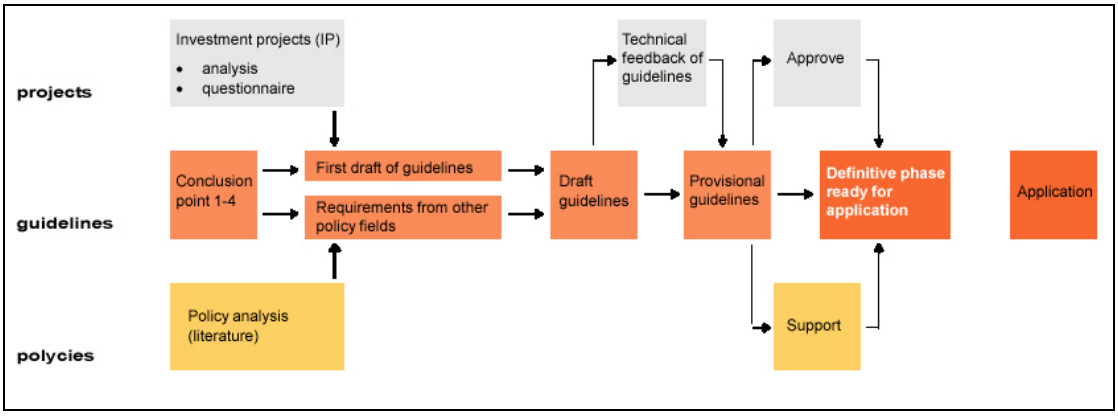

Figure 6: Steps for creating definitive guidelines

The above scheme illustrates the formulation of the guidelines. At first an analysis of all results of actions 1 - 5 will be conducted extracting issues related to NOFDP-targets that are relevant for setting up the first draft of the guidelines. The external experts (D7) will attend working meetings, workshops and conferences to develop the guidelines in close contact with the NOFDP partners and to receive feedback. This is to keep the guidelines actual and updated.

An intensive survey on existing literature, documents and guidelines prepared and applied by various policy levels of the NWE region with regard to flood control measures will be made. Spatial development, transnational and ecological aspects will be paid special attention to. It will be analysed to what extent aspects of water management, ecology and spatial planning are reflected in the planning process, transferred to practice and if / how these sometimes contradictory aspects are treated in a balanced way.

4.1 Key actions of the NOFDP action plan

Action 0: Project development

In addition to the development of the NOFDP Application Form a key action is to establish a network of contacts that have their foci on nature oriented flood damage prevention. This network will add extra transnational value to the overall project. The ECOFLOOD conference 2003 in Warsaw was a platform to meet European experts in floodplain ecology as well as hydrology. An oral presentation was prepared to introduce NOFDP and its objectives to the participants (download under http://levis.sggw.waw.pl/ecoflood/). Many contacts were establish as potential external experts.

Action 1: Knowledge base

Compiling a knowledge base is the key activity of Action 1. All project partners and external experts are highly involved in this action contributing with their respective expert knowledge. Both Scientific Co-ordinators are in charge of hydrological aspects, the German Federal Institute of Hydrology is in charge of ecological aspects, three external experts - to be selected by a tender procedure - are in charge of EU directives, knowledge transfer, spatial planning and decision-support.

Preliminary steps are the analysis of past and present projects dealing with aspects of flood control and ecological riverine development (IRMA projects, ECOFLOOD, EVALUWET [**E**uropean **V**aluation and **A**ssessment tools supporting **W**etland **E**cosystem legisla**T**ion - EU-funded project run by a consortium of research institutions] etc.) as well as running INTERREG IIIB projects like Sustainable Development of Floodplains (SDF) and Creative Flood Management (CFM). The respective reports and documentations will be analysed, organisations as well as people involved will be contacted for exchange of expertise.

Furthermore EU-directives and initiatives important for both riverine ecology and flood control aspects will be analysed. Special attention will be paid to the EU-WFD and EU-Fauna-Flora Habitat Directive.

A questionnaire to be answered by planning and administrative organisations will be analysed with respect to planning methodologies and ecological aspects. In addition to ecological and hydrological knowledge will be acquired with respect to cultural differences in administration and planning structures within the NWE-region. A comparison of different structures will show common interfaces for co-ordination and methods to tackle the issue of nature-oriented flood damage prevention on a transnational scale. This provides the knowledge base regarding the state of the art of ecological considerations in planning and operating flood damage prevention measures within the NWE-region.

A synopsis of these three levels (scientific, legal, practical) forms the knowledge base for nature-oriented flood damage prevention. This synopsis will be discussed and carried out jointly by the entire partnership. The direct outcome is a shared understanding among the partnership, published in a report. Based on this report first recommendations to the individual IP's will be given by the DG with respect to design and a later management strategy. The report is a reliable and comprehensive knowledge base, on which the later development of the IDSS will be based. It will be presented in a closing workshop to the TG.

Action 2: Information and Decision Support Tool – technical phase

The eco-hydrological model is an innovative product, which is not available up to now for the NWE-region. It is the first time that a model considers the effects of changing hydrological conditions (due to flood damage prevention measures located up- and / or downstream) on the further development of the river's ecological status. This first key action work will be carried out by the German Federal Institute for Hydrology and the Scientific Co-ordinators, whereby the latter two are in charge of the hydraulic and hydrological models. The second key action is the overall development of the IDSS. A DSS-structure interconnects all IDSS modules (eco-hydrological model, GIS (information data storage and visualisation) and an evaluation scheme). The structure is shown in Figure 7. Several working meetings are necessary to ensure a co-ordinated development of these modules. From the very beginning the IG will be incorporated into the development process by means of consultancy and testing the recent output.

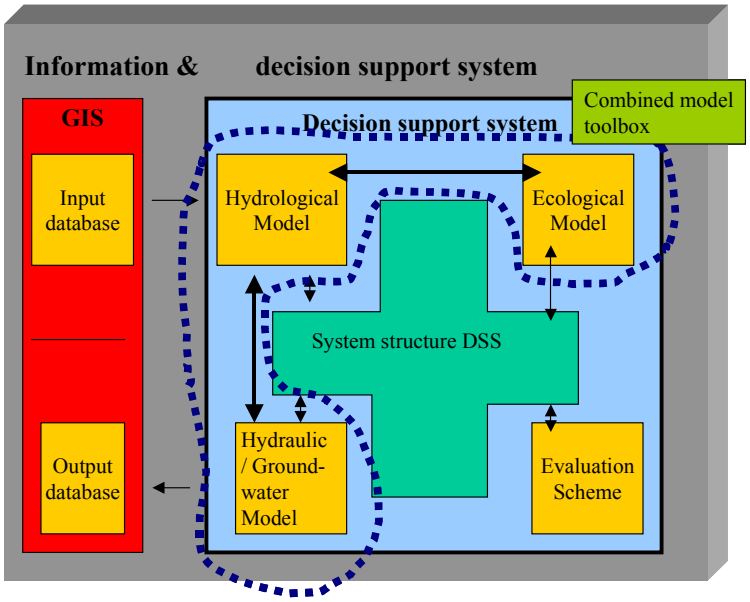

Figure 7: System structure IDSS

An innovative approach is the development of the IDSS being carried out under the continuous co-operation between the IG as potential end-users and the DG as modelling experts. Both Scientific Co-ordinators can be considered as connectors between the DG and the IG (Fig. 5). The development of such an IDSS to assist in making optimum decisions for river corridors and catchment areas is a transnational challenge that must be tackled in close co-operation with organisations from transnational level down to local level. The IG is composed of members of The Netherlands and Germany. Additional countries from the NWE-regions will be integrated by means of the AG and several transnational studies (refer to Action 5). Sharing the experience and expertise from different water systems in different member states and to make these available in an applicable support system to authorities, planners, stakeholders etc. in the entire NWE-region is the transnational added value of the project. Applying the IDSS to real-world projects the analysis results become comparable to each other using a single software tool, thereby setting up a transnational co-operation may be simplified. This is the benefit for the partnership as a whole.

Action 3: Development of the evaluation scheme

The careful synopsis of decision making and evaluation knowledge is the key activity of Action 3. As a prerequisite for this synopsis, a comprehensive study and selection of evaluation criteria (spatial planning, ecological and hydrological target values) has to be carried out by the respective NOFDP experts under consideration of the high transnational and cross-sector characteristics of this task. Action 1 provides the knowledge base to be analysed.

This aggregation of relevant aspects in spatial planning, ecology and hydrology forms the evaluation scheme. At the moment there are no standard methods available, which quantify ecological benefits/damage caused by flood damage prevention measures. Methods of assessing the monetary benefit of nature oriented flood damage prevention will be introduced. Co-operation with the WaReLa-project will

import the eco-efficiency analyses to NOFDP. Additionally, results of the EVALUWET project will be turned to good account.

As the decision making process is multi-sectoral and multi-objective a NOFDP internal discussion is not sufficient. Expert knowledge input from NOFDP workshops, AG studies and reports as well as discussions with international experts and decision makers substantiate the structure and theoretical background with respect to decision-making. This evaluation scheme as well as such an aggregated overview within the NWE-region are not available till now, especially not for transnational application.

This innovative approach enables to optimise flood damage prevention with respect to ecological improvement and spatial development criteria according to a set of target values. The transnational added value is to account for different criteria from the transnational down to local decision-making at the same time. It will facilitate a NWE-wide assistance network for sustainable riverine planning with respect to water management, nature conservation and spatial planning. By this innovative methodology future measures will contribute not only to flood damage prevention but also to a sustainable development of river corridors.

The implementation into the IDSS of this structure for a transnational applicable evaluation scheme is the final component for a decision support tool.

Action 4: Investment projects – application of IDSS and project assistance

The key actions of Action 4 are to elaborate a final version of the IDSS (including all individual modules) and the realisation of 4 IP's demonstrating the improvement of river ecology combined with flood damage prevention and spatial planning in a transnational context.

The development of the IDSS can be separated into three phases. During a **first phase** (=Action 2) the basic structures of the IDSS and its individual structures shall be elaborated. Holding an international workshop for IDSS end-users produces a catalogue of requirements for such a system. The selection and the testing of available models in Action 2 leads to a catalogue of suitable models, followed by the creation of interfaces for connecting the individual modules and the GIS. During the first phase the DG holds a position of a supporting and consulting expert in the application of water and environmental models.

The **second phase** (=Action 4) consists of an iterative process of applications to the 4 IP's. In addition to the improvement and valuation of the model base, the most important work assignment is to apply and evaluate the effects of planning and management methodologies such as the open planning process (Investment no. 1), the multi-functional land use (Investment no. 2), the Blue-Green Service (Investment no. 2), the use of nature area for water storage (Investment no. 3) and the GIS based retention register (Investment no. 4). This list of concepts may be enlarged as a result of Action 1 (knowledge base). Thus, the IDSS will provide a tool of aggregated modelling techniques (hydraulic, hydrologic & ecological) including multi-sectoral and multi-objective assessing procedures / methodologies.

A considerable exchange of knowledge within the entire NOFDP partnership can be expected by the application of the IDSS. The 4 IP's will serve as test application. The impact of actual planning scenarios of each investment on affected sectors (e.g. ecology, hydrology, spatial planning) will be forecasted by modelling techniques and evaluated by the transnational evaluation scheme. Modelling results and decision support functionality will be analysed jointly by the DG and IG giving recommendations for the improvement of both the IDSS system and the design & management of the IP's.

At last various scenarios of designing flood control will be performed by the IDSS. Recommendation on that solution will be given to the IP's meeting best the targets of flood retention and ecology as well as targets of other relevant sectors involved (e.g. spatial planning). This interactive process is illustrated in Figure 8.

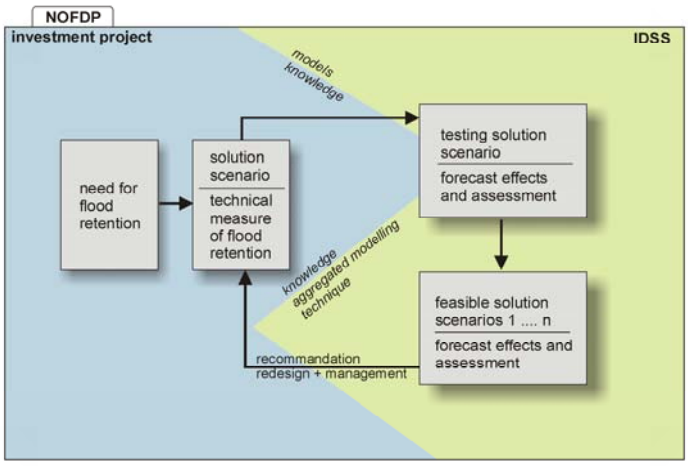

Figure 8: Iterative and interactive process of improvement

A budget within the framework of the Associated Partners is provided in order to expand this activity outside of NOFDP partner community. In addition to the half-yearly NOFDP Working Group Meetings several informal work-meetings shall take place in order to keep this iterative process going on a transnational & cross-sectoral working style.

In the **final phase** of NOFDP and, once the construction phase of an IP is accomplished, a monitoring phase connects in order to attempt an interim and later on a closing evaluation of the IDSS application and the results achieved due to an improvement of the IP design & management strategies.

Below innovative characteristics and transnational impacts of the respective IP's are summarised. All these are potentials for knowledge transfer from the IG to the DG. For further information on the IP's refer to the individual descriptions in the section "5 Investments within the NOFDP project" later on.

IP no. 1 (Mark- Vliet river basin; NL): Integrated into the NOFDP project is the Steenbergsche Vliet Cluster. This cluster is part of the overall plan for the development of the Mark and Vliet system which comprises several clusters. The overall project covers an area that is around 2000 ha and should become a very

robust connection between major nature reserves in Brabant, the Western part of the NL and BEL The Steenbergsche Vliet cluster covers 95 ha. Innovative are the Blue-Green Services, the open planning process and the objective of multi-functional use; all being supported by the IDSS.

IP no. 2 (River de Aa; NL): This first 1,5 km stretch will be a paradigm for further measures of this comprehensive project that combines both flood damage prevention and ecological improvement. Dikes will be removed and floodplains will be restored. Thereby the IDSS will support the decision making for multiple land use. A management concept will be developed to meet all aspects related to land use, ecological development and flood damage prevention. That includes the regional concept of Blue-Green Services. This investment project (dike re-location and management concept) serves as a pilot for densely populated low–land river regions.

IP no. 3 (Tongelreep / River Dommel; NL): In this integral project the water board uses a nature area for water storage for the first time. Because many different stakeholders with sectoral aspects and points of interests are involved, the IDSS will support the decision making process. An important question will be how to deal with the EU-Fauna-Flora-Habitat directive in this kind of integral projects. The reconstruction of the Tongelreep is split up into three phases. The partial project, which is part of the NOFDP project, is the first phase of the total reconstruction. For the remaining two parts the fully developed IDSS is available.

IP no. 4 (River Mümling, location Zell; GER): Flood damage prevention by flood storage basin such as being carried out at the River Mümling is a common measure to increase the storage capacity of existing floodplains located in low-mountain ranges. In comparison to the investments located in the Netherlands this measure is located in the upper course of a river where floods are generated. The requirements on this investment are different from those implemented in the lower course, but in developing catchment wide strategies the lower as well as the upper course of the river must be considered as a whole. The innovative approach is using the IDSS in combination with the existing GIS based retention register (RKH), including several hundreds of potential retention areas in the Federal State of Hesse. These two tools in combined operation would improve both flood damage protection and ecological improvement of river corridors, later important for the implementation of the EU-WFD. The realisation of this IP with the support by the IDSS & RKH will give suggestions for further flood damage prevention measures and is exemplary within the NWE-region.

Action 5: Transnational reports / Integration of the Associated Group into NOFDP

The objective of Action 5 is to add transnational value to the NOFDP project. External experts will carry out several studies having the objective of transnational co-operation in nature oriented flood damage prevention.

Two transnational studies are already decided by the partnership to be carried out. Additional ones will follow in Phase I and Phase II.

NL / BEL transnational study / Rivers Mark and Dommel

The catchment areas of the River Mark and River Dommel are located in the border region of the Netherlands and Belgium. Each river has its own Cross-border Committee that represents all relevant governmental and non-governmental organisations from the Netherlands and Belgium.

As both rivers flow through the Province Noord-Brabant, the Province is a partner and together with the Ministry of the Flemish Community it appoints the Chairman of both committees. For that reason and due to its partnership in NOFDP the Province will be in charge of the co-ordination of this key action. The members of the Committee are:

Cross-border Committee **Dommel**, among others:
Belgium / Flanders:

- Water, Land and Milieu Departments of the Ministry of the Flemish Community
- Vlaamse Gemeenschap (chairman)
- Provincie Limbourg
- Provincie Antwerpen
- Water supply service PIDPA

The Netherlands / North-Brabant:

- Provincie Noord-Brabant (chairman)
- Waterboard De Dommel
- Dutch Ministry of Traffic and Water Management
- Water supply service Waterleidingmaatschappij Oost-Brabant
- ICBM (Maas)

Cross-border Committee **Mark**, among others:
Belgium / Flanders:

- Water, Land and Milieu Departments of the Ministry of the Flemish Community
- Vlaamse Gemeenschap (chairman)
- Provincie Antwerpen
- Water supply service PIH

The Netherlands / North-Brabant:

- Provincie Noord-Brabant (chairman)
- Waterboard Brabantse Delta (per 1/1/2004 together in Waterboard de Brabantse Delta)
- Dutch Ministry of Traffic and Water management
- Dutch Ministry of agriculture and fishery
- Water supply service Waterleidingmaatschappij Oost-Brabant

In the coming years the Cross-bordering Committees will carry out a master plan for their catchment areas. As a part of the NOFDP project, scenarios on flood damage

prevention, ecology and water shortage prevention for both catchments will be developed. These scenarios will also be used as an input for the IDSS application.

The output will be general recommendations and special measures on flood damage prevention, ecology and prevention on water shortage for both catchment areas. These will be used on cross-border policies and measures on the development of both river systems. Furthermore they will also be a base for re-allotments in Flanders (BEL) and reconstruction of the rural area in The Netherlands. Two NOFDP investment projects are located within these catchment areas and therefore will be incorporated into these studies.

Another already existing contact is the French and Dutch initiative for a European framework on flood damage prevention (EU-Directive for flood damage prevention). There are ongoing talks with the EPRO-experts between The Netherlands an Belgium for functional mutual tuning that will strengthen and support both the French and Dutch initiatives for an European framework on flood damage prevention and the NOFDP. Next to that, the continuation of the NOFDP project will be assured by such a framework.

In order to launch additional transnational studies a budget is allocated. In the course of the NOFDP project potential contacts are asked to carry out additional studies. Selection criteria are a transnational added value to the project as well as a benefit for the partnership as a whole. Passing a tender procedure the decision will be made by the NOFDP Steering Committee in which the entire partnership is represented.

Action 6: Promotion of publicity and public awareness

The key action of Action 6 is promoting the NOFDP project as a well as its internal management and communication. As Project Co-ordinator the Darmstadt University of Technology is in charge of all Action 6 activities. The Project Co-ordinator is in charge of the activities & events and assigns the NOFDP partners to contribute with recent results and information. Furthermore he co-ordinates the day-to-day NOFDP management, co-ordination and communication.

For internal and external communication a handbook for the NOFDP partnership will be produced. The NOFDP Steering Committee Meetings will guarantee a continuous project management. At least half-yearly, NOFDP Working Group Meetings will be organised (Partners, External Experts & invited guests) in order to present and discuss recent results. The benefit for the partnership as a whole is an exchange of expertise and experiences. Smaller working meetings will be arranged on demand.

Promotion of NOFDP results, direct outputs and conclusions will be achieved by producing media promotional material (all furnished with a NOFDP logo to be produced by a professional designer), the participation in conferences (oral and poster presentations) and scientific as well as press publications. Several NOFDP workshops and conferences will be organised with the participation of the TG. On a local scale the IG will promote the NOFDP approach when presenting their investment projects in public, assemblies and information events.

In Phases I and II a NOFDP web-site informs about ongoing NOFDP activities, future activities and provides all NOFDP reports as downloads. In the end of Phase II the NOFDP web-site will be complemented by the Internet based "NOFDP – European Information Centre". All end-users and especially those from the NWE-region are invited to visit that platform. They may profit from the outputs of the NOFDP project in terms of the IDSS (models and data incorporated), guidelines, manuals and information with respect to the IP's as examples for a balanced consideration of river ecology and flood damage prevention. Direct support and user training will be offered to the TG. User-training will be given by the Scientific Co-ordinators to the IG members starting with the first draft version of IDSS, to the TG once the IDSS is operational. After 2008 the German Federal Institute of Hydrology and Darmstadt University of Technology will keep the "NOFDP – European Information Centre" running, providing user training, updating the knowledge model & data base as well as taking questions addressed to the system. The IG will provide data and information on future investment projects being designed by using the IDSS.

Response from the TG is required to prove public awareness, transnational relevance and in particular to verify the further development of NOFDP. The intention is to incorporate end-user participation from the very beginning of the project. This is innovative and guarantees product acceptance and future operation by end-users. Contacts with high potential for knowledge contribution will be asked to join the AG. Furthermore the participation of the TG in workshops will bring added transnational knowledge into NOFDP and raise the interest in applying the IDSS. These promotional activities are essential for the follow up of the project. Promotion will be one of the major activities of the Project Co-ordinator.

Action 7: Development of guidelines

The key action of Action 7 is the development of guidelines. Flood damage prevention as well as ecological development within river corridors and basins can be regarded as an essential transnational task within the European territory.

Projects for flood control and natural development often have structured contradictory or conflicting impacts on riverine environments, as a result of inadequate adaptation of spatial planning instruments.

In this context the European Spatial Development Perspective (ESDP 1999) provides the political framework for implementary sectoral policies with spatial impacts. Due to this jointly accepted document the co-operation of regional and local authorities across national boundaries is stimulated by the execution of INTERREG-programmes. Comparing the targets of EU-WFD and issues addressed by ESDP on an equal level it logically becomes clear that spatial planning may increase the chance of realising both a transnational effective flood damage prevention and an ecologically sustainable development of river corridors. Therefore, guidelines are necessary to support those that are confronted with the difficult task to integrate spatial planning into the water management policy and the ecological targets of the EU-WFD.

Based on this policy analysis, requirements from other policy fields will be identified. This first draft of guidelines together with these requirements are combined in the third step resulting in the draft guidelines. Draft guidelines will be confronted with the projects to have a first technical feedback of the guidelines. After that step, provisional guidelines will be listed.

In order to find the definitive form of guidelines ready for application, it is necessary that they are supported by the political as well as by the project level. The complexity of this approach is necessary for integrating ecology, hydrology and spatial planning in guidelines for NOFDP-measures. Action 7 results in a manual comparing for assisting and guiding planners, technicians and decision-makers of flood control measures aiming at sustainable and safe riverine development. The implementation of guidelines is included into the workflow of the IDSS.

External experts (D7) will attend working meetings, workshops and conferences in all stages of the NOFDP project in order to develop the guideline in close contact with the NOFDP partners and to receive feedback from the partners.

5 Investments within the NOFDP project

Four Investment Projects will be realised under NOFDP (Fig. 9). The award of contracts to third parties with respect to the design and construction will follow the respective national and European tender procedure directives of each partner bringing an Investment project into NOFDP.

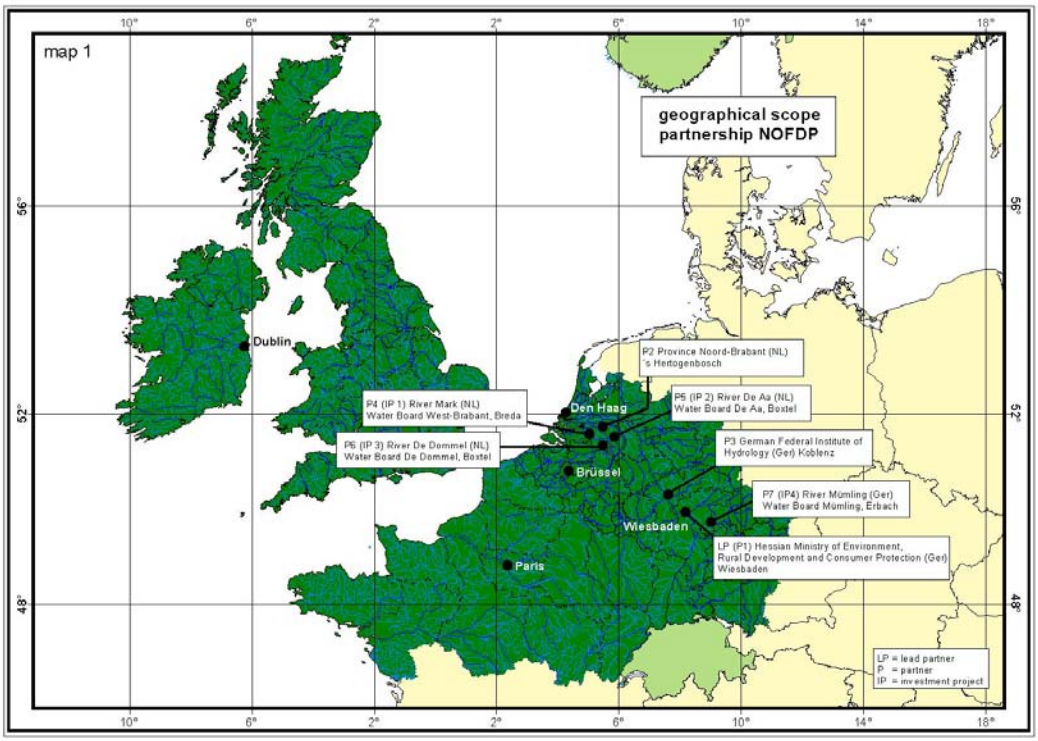

Figure 9: Geographical scope of partnership and investments within the NOFDP project

Comparison of flood characteristics within the Mark / Dommel catchments and those occurring in sub-catchments (like the Mümling catchment) of the Rhine.

The Mümling catchment (Investment no. 4) is a typical sub-catchment of the Rhine located in the low mountain range. The hilly topography (up to 500 m asl) has great influence on the generation of floods. Floods occur in summer as well as in winter or spring. In both latter periods snowmelt can have an aggravating effect on peak discharges. In addition to that anthropogenic changes have an effect on the hydrological regime of the Mümling. In contrast to the Dutch Investment projects (Investments no. 1 – no. 3) the Investment no. 4 is directly located in the area where high peak flows are generated. Infrastructure is located along the river, little natural retention volume is available. Therefore flood storage basins are means to activate and increase natural retention volume in order to store peak flows.

In contrast to the low mountain range catchments the Mark / Dommel / Aa river basins (Investment no. 1 / no. 2 / no. 3) are rain-fed river systems and the duration of peak flows is limited to several days and they generally occur in winter. In summer the upper-parts of the river sometimes dry out. Partly this is due to former canalisation of the river. Furthermore tidal influence has an impact on the hydrological regime. The topography can be characterised as plain. Flood damage prevention is composed of the protection of areas by dykes and the activation of natural floodplains. The intensive urbanisation in the area of the 3 Investment Projects makes great requirements on spatial planning. Due to climate change higher peak discharges are expected in future.

5.1 Investment no. 1: Mark- Vliet river basin / Provincie Noord-Brabant (The Netherlands)

This Investment is designed for both ecological development of the Mark-Vliet river basin and for flood damage prevention. The Mark and Vliet rivers form a unique river landscape in the province of Noord-Brabant. The system is a connection between major national and transnational nature areas as the Volkerak-Zoommeer, the Biesbosch and nature reserves on the sandy soils near the Belgian border and in Belgium. It is also a green connection between the western part of the Netherlands, Breda in the south of the country and Antwerp in Belgium. Such areas are called Ecological Connection Zones. The river basin area also comprises many cultural historical monuments or relicts.

The water board of Brabantse Delta, in close co operation with the towns, nature organisation, farmer's organisations, has developed a master plan/vision for the enhancement and management of the hydrology and the nature of the Mark-Vliet River Basin (ToekomstVisie Plus Mark en Vliet). The plan covers the area located between flood dikes of the Mark and the Vliet rivers that covers around 2000 ha. The area should become a very robust connection between major nature reserves in Brabant, the Western part of the Netherlands and Belgium.

The plan will also contribute to the relieve of high water problems around the city of Breda, and storage and reduction of increased river discharges as a result of climate change and hydrological changes in the upstream areas. The project will also create

facilities for water-oriented recreation. Moreover there will be opportunities for the restoration and conservation of cultural-historical monuments.

Farmers will carry out management of the nature and flood land. For that purpose so-called Blue-Green-Service contracts will be developed.

The design is based on the construction of a green-blue corridor, inter-connecting many small and some large nature areas and the application of multi-functional land-use, combining a large variety of usage in one particularly area (nature, agriculture, recreation, flood protections, water conservation, cultural-historical values). The plan will develop clusters (basic units), stepping-stones and corridors (zone).

Clusters are comprehensive and sturdy ecological territories. These basic units will consist of valuable nature areas and flood lands along the river.

Stepping-stones are areas with promising conditions for nature, that presently are not a component of the large ecological territory. By acquisition and appliance of solitary areas with a sufficient size (5-30 ha), they become an essential part of the ecological zone.

The stepping-stones and basic units will be connected by a system of ecological corridors, that will complete the total ecological development of the 'Vliet' river system. The corridors will have a width of 10 - 25 m, lining the river over approximately 10 km.

Steenbergsche Vliet Cluster

The Steenbergsche and Roosendaalsche Vliet are part of the Mark-Vliet river system. The Vliet used to be a tidal river being connected to the Oosterschelde estuary. However following the great flood of 1953 the connection with the sea was closed and consequently tidal influence on the Vliet River ended.

Presently dikes along the river protect the adjacent land against floods with a recurrence of once per 50 years. Two developments make that flood prevention and water storage require extra attention. Higher discharges of the Rhine and Maas River will be temporarily stored in the Volkerak-Zoommeer. Consequently the water level there will temporarily rise and block the discharge of the Vliet River into the Volkerak-Zoommeer. Secondly, the National Water Agreement prescribes an increased flood protection for urban areas with a recurrence of 1/100 years. For the Roosendaalsche and Steenbergsche Vliet this refers to the towns of Steenbergen and Roosendaal. Climate change and the increased flood protection require more attention to be paid to flood protection along the Mark-Vliet River. The increase of temporary storage of water along the river has to be given special attention and appropriate measures have to be taken.

Along the river 'Steenbergsche Vliet', the construction of several types of natural riverbanks with reed, groves, floodplain grasslands and marsh vegetation is foreseen. The site of restored area will be about 60 hectares. The plan will comprise development of water storage, swamplands, ecological embankments, riparian forest

and recreational facilities. The development will be realised over a length of 15 km. No fixed planning and design have been made yet. The approach is to develop and implement the plan through an open planning process. Development and implementation will be done in close co operation with local town communities, nature organisation, farmers and other users of the area. During this process also agreement on the future management of the lands will be achieved.

The development of the plan will start in January 2004 and construction will be completed in 2008.

The cluster Steenbergsche Vliet (K2) comprises 5 subprojects (K2-1, K2-2, K2-5, V7 and V10). For the NOFDP project a distinction will be made between the open planning process and the actual implementation process. The open planning process for the whole cluster K2 as the most innovative part will be in the NOFDP project. This will comprise design and detailed design, consultation of inhabitants, legal procedures and the development of Blue-Green Service contracts with the farmers for the future management.

The minimum targets for NOFDP till June 2008 are set to be for the individual subprojects:

K2-1	total area / length: 40 ha	minimum target: 10 ha
K2-2	total area / length: 4 ha	minimum target: 4 ha
K2-5	total area / length: 5.5 km x 25 m	minimum target: app. 25 %
V7	total area / length: 4.5 km x 10 m	minimum target: 0 %
Total Project	total area / length: 62 ha	minimum target: 17,5 ha

The partial implementation of the subprojects K2-1, K2-2 and K2-5 will also be part of the NOFDP. This will cover the construction of all the developments resulting from the above mentioned processes. Also the implementation process will be partly open leaving opportunities for adaptation of the plan to new development or insights.

Spatial planning in the region is the responsibility of the province of Noord-Brabant and the town of Steenbergen. Both intensively participate in the open planning process. The developments along the Roosendaalsche Vliet river are also incorporated in the provincial plan for the development of the rural areas in the province and will be incorporated in the urban and rural spatial plans of Steenbergen. Representatives also participate in the discussion on the plan for the area. Due to the participation of the Provincie Noord-Brabant as well as the Water Board Brabantse Delta in NOFDP the proper involvement of the planning authorities is ensured.

Transnational impact and relevance of investment no. 1:

Characteristics of the development of the Steenbergsche Vliet are the open planning process and objective of multifunctional land use. Planning processes will be adapted

to this approach. The approach will require flexible and interactive modelling, design and implementation.

The instruments and results will form an input in the IDDS and after testing and verification, the IDSS will be a useful instrument for developments of other similar river systems in Europe. The Mark-Vliet river system, which also includes the Steenbergsche Vliet, has its source in Belgium. The new approach can also be applied to the Belgian part of the Mark River leading to improvement of flood control development and of ecological values through an open planning process and multi-functional land use.

For partners in the NOFDP the development of the Steenbergsche Vliet may be an important input in the IDSS, and during the planning process it offers the opportunity to test and develop the models on flood control and ecological development in the project. Developments along the Steenbergsche Vliet will also be an important reference for the other IP's in the NOFDP. It will contribute to the development of ideas and approaches in other projects.

The innovative character of the project is multifunctional land-use aiming at flood damage prevention, restoring and improving river ecology and water quality, facilitating recreation and preserving or restoring culture-historical values. Also the open planning process in which water boards, nature organisation, farmers, towns co-operate is a new development that will be worked out in the project.

Agriculture will be important in managing, maintaining and enhancing the improvements made under the project. Farmers will be the keepers of the landscape. Green-blue service contracts will be developed aiming at a long-term maintenance of the ecology of the river system and water control / flood damage prevention along the river.

5.2 Investment no. 2: River de Aa / Provincie Noord-Brabant (The Netherlands)

During the first part of the last century the River De Aa was changed into a river where most meanders were straightened and natural banks and streams disappeared. In addition to these changes water was pumped out from the whole area during 80 days a year, mostly during wintertime. The only aim of this was to improve the area for agriculture.

The shipping canal "de Zuid-Willemsvaart" is located in the valley of the River De Aa and its planned new diversion east of the town of 's-Hertogenbosch will cross with the River De Aa. This crossing will be done with a siphon in which the river flows underneath the canal.

This crossing shall dam up the water system, so we have to choose between strengthening the dikes or deal with the water system in a totally different way. Strengthening the dikes would be contradictory to the aims of present day water management, so this option has not been followed.

In the alternative “Dynamic River Basin” the dikes along the river will be removed. By doing this the river will have access again to the natural floodplains and the resilience of the system will be restored in a sustainable way.

This solution offers possibilities for different functions of the river basin in an integral approach:

- Along ca. 7 km the meanders and other morphologic features of the river system will be restored. The river has a summer bed about 20 m broad and has been deepened considerably. The winter bed is about 100 to 150 m wide.

- A 100 hectares wetland zone of annually inundated wet grasslands will give enough room for an ecological connection zone between the wildlife areas “De Wamberg” north of the project and “Het Wijboschbroek” that lies in the south-west of the project area.

- At the lower frequency of once every 10 years the inundated area will increase to 200 hectares. Certain valuable agricultural areas and areas with archaeological or ecological values will be protected from inundation, if necessary with small dikes and drainage.

- In extreme situations, once in a 100 years, 400 hectare will be flooded. Then there will be 2.5 million m^3 of water stored in the floodplain. Again in this situation certain areas will not be flooded through the protection with small dikes and drainage. In particular the areas that contribute little to the storage of flood water will be kept dry.

- All these measures will lead to much lower peak flows. The peak flow of once in a 100 years will be brought down with 12,5%.

This proposal concerns only the first upstream 1,5 km of the whole of the project. That includes the restoration of the meanders and other morphologic features. This will create 15 ha wetland zone of annually inundated wet grassland for an ecological connection zone. In case of more frequent floodings (once in 10 years) 80 ha will be inundated. Valuable agricultural area and areas with archaeological and ecological values will be protected, if necessary with small dikes and drainage. In extreme flood situations, once in 100 years, 150 ha will be inundate d (500.000 m³ of water stored in the flood plain). Again certain areas will be protected by dikes and drainage.

The planning authorities are the city council Sint-Michielsgestel, city council Bernheze and the Province of Noord-Brabant. Province Noord-Brabant is NOFDP Project partner and therefore it is ensured that there is a strong integration between the Investment, the respective planning authorities and NOFDP. Furthermore the planning authorities will participate in NOFDP Supervisory Board Meetings and other NOFDP activities. It is expected to finish the preparations for the plan and the negotiations about the Blue-Green Service provided by the agricultural sector in 2004. The implementation shall be done in 4 or 5 stages. The implementation of the first stage is expected to take place in 2005.

Transnational impact and relevance of investment no. 2:

This investment we will contribute to the development of the IDSS by integrating the data and relevant experience in this international model. The project contributes knowledge and experience for the project partners and other NWE projects about increasing the implementation speed of water projects in cases where governments cannot or do not want to expropriate.

Beside the information about hydrological models in use for this investment and ecological working methods in the development of the IDSS especially the experience with the Blue Services will be very valuable for other investments of the project and for projects within the NWE community. This project can rely on experiences already shared with other waterboards in the Netherlands. In the scope of transnational co-operation of this project the exchange of the experience with the former partners will be simplified and for the development IDSS.

Beside this the IDSS can be used to improve the design of the other stages of the Dynamic River Basin De Aa, which will be carry out in the years 2006 till 2010.

Innovative for this investment is the planned application of Blue Services. Since September 2003 negotiations with the owners of the land in this area about the way their land can be used for water storage. The intention is to buy the area that is inundated every year. In the area that is flooded once in 10 to 100 years possibilities to work with compensation in case of flood damage are investigated and subject of negotiation.

In the intermediate area, which is flooded with a frequency from once a year to once in 10 years, it is intended to set up Blue Services. This is the most innovative part of the project.

This approach should increase the implementation speed of this project and increase the scope for the plan for the land owners in the project area. The public procedure for changing spatial planning will take several years as expropriation is not in use for water projects.

There has been considerable theoretical development on the subject of Blue Services, but no worked out plan has been started yet. The meaning of this plan is that in advance a form of compensation will be worked out for delivery of services such as:

- The temporary storage of water.
- Not using certain crops in favour of the landscape (for instance; corn because you will not be able to see the river if anyone plants corn).
- Not using pesticides and manure and fertiliser.
- Remove the debris that stayed behind after a flood.
- If necessary destroying the first cut of grass after inundation
- Change the crop and crop cycle in accordance to the changed water level.

The compensation can be an annual payment that could be evaluated every 5 or 10 years, permission for the extensive use of parts of the annually flooded areas or

revoking current restrictions for the farmer to increase the economic development of his farm. Compensation payments are not a part of the NOFDP project budget for which the ERDF-funding is asked. At the moment the Blue Services are in study. The investigations which shall be carried out concern to legal means that are affected if realising the investment project without buying large amount of land which can be used only a few days once every 10 years. Co-operations takes place not only with the relevant city councils, the province but also with the national government (the Ministry of Land use, Nature and Food Quality Business (LNV). An exchange of knowledge with NOFDP partners and Associated Group of Partners shall take place, in particular with the Project partner “Water board Mümling” that also envisages compensation payments.

The experience in the first stage can be used to test the effectiveness of the Blue Services and learn and improve their use in future stages of this (and other) project(s) and improve the IDSS as well.

5.3 Investment no. 3: Dommel catchment / Tongelreep project (The Netherlands)

The catchment area of the River Tongelreep forms a part of the Dommel catchment and reaches from the northern part of Belgium to the south of Eindhoven where it ends in the River Dommel. The project area is located eastern of the village of Valkenswaard, circa 10 km south of the city of Eindhoven. The project is located near the small hamlet Driebruggen towards the northern border of the municipality of Valkenswaard.

In the catchment area of the Tongelreep several participants (water board, local government, regional government, nature conservation organisations and land owners) have agreed to invest in a sustainable environment in the main part of the Tongelreep catchment area. For this reason they developed a programme of action for this specific region (“Gebiedsprogramma Tongelreep”). The programme contains an integrated approach to several aims and intentions. One of the integral projects that underlines the programme is the reconstruction of the Tongelreep.

For this specific project a project-team is formed in which the following government authorities participate:

- the waterboard “De Dommel”
- the municipality Valkenswaard
- the (national) organisation for nature & landscape-conservation “Staatsbosbeheer”
- the (regional) organisation for nature & landscape-conservation “Brabants Landschap”

To ensure that these authorities are properly involved and to guarantee the successful implementation of the project a contract shall be signed by these authorities. The link between planning authorities and NOFDP is increasingly reinforced by the involvement of the water board “De Dommel” as well as the Provincie Noord-Brabant as Project partners.

One of the integral projects that underline the programme is the reconstruction of the Tongelreep. The reconstruction of the Tongelreep is split up into three phases. The described investment project is the first phase of the total reconstruction. The second and third phase are located up- and downstream the project area.

Characteristic elements in the project area are the fish basins (ca 150 ha) along the Tongelreep. Most of them are not natural, but constructed by man for breeding fish. The basins are filled with water that is withdrawn from a few kilometres upstream of the River Tongelreep and is transported by small canals. Because the oldest fish basins originate from more than hundred years ago, these basins represent a large cultural historical value. Above all the values for nature of the basins are very high i.e. a lot of special species of flora and fauna are present in these basins. These high values for nature are the result of long-lasting unchanged use of the basins and stillness (the area is closed for the public). The special species and habitats are protected by the EU-Fauna-Flora Habitat Directive. Since January 2002 these fish basins have no longer been used exploited for fish breeding. The end of the fish breeding makes further ecological development possible.

Downstream the project area near the River Dommel, ca. 13 ha suffer from floods at frequencies of once every 10 years. In the urban areas of the cities of Eindhoven and ‘s Hertogenbosch this can cause severe damage. This problem is the result of the canalisation of brooks (i.e. the Tongelreep) and the increase of the drainage of the agricultural and urban areas. For this reason the Water Board of the Dommel wants to realise areas to buffer and store peak discharges. For the total catchment area of the Dommel the waterboard has to create circa 2000 hectares of waterstorage. The reconstruction of the Tongelreep contributes to solve this problem and will be a part of the total system of storage-areas that is needed.

The Water Board and the province of Noord-Brabant confer with Flemish authorities in the Cross-border Commitee of the Dommel on a regular basis. An important subject of the consultation is the creation of storage-areas in Belgium.

On one hand the River Tongelreep suffers from peak discharges, on the other hand the brook frequently runs dry during summer months, due to the withdrawn water for the supply canals to fill the fishbasins. Both situations have an adverse effect to the ecological development of the Tongelreep. The present water quality of the Tongelreep restricts the ecological development of the basins.

The aims and measures of this investment project are:

- Reduction of the peak discharges in the Tongelreep by flooding and using 10 ha of the fish basins for floodwater storage.
- Increase of the discharge of the Tongelreep during dry situations by dividing the available water between the Tongelreep and the fish basins.
- Along 5 km the meanders will be restored, peak discharges will be buffered and delayed. Ca. 15 ha of the fish basins will be used for re-meandering.
- Reduction of dehydration in the project area by shoaling the bed line of the Tongelreep and so, increasing the drainage base.

These measures will lead to a decrease of the peak flow of more than 10%. This will solve the inundation problems in the urban areas of Eindhoven and contribute to the overall goals of flood damage protection for the total catchment area of the River Dommel.

- The quality of water that flows through the fish-basins will be improved by implementing a settling basin in combination with helofyte-filters.
- Conservation of the cultural values of the fish-basins in the new hydrological situation.
- Improvement of the natural values of the area by preservation and development of biotopes for rare species of plants and animals (like the tree-frog).
- Open the area for the public.

Transnational impact and relevance of investment no. 3:

This investment project contributes knowledge and experience for the project partners and other NWE-projects on how to consider hydrological aims and ecological / cultural-historical values and how to deal with the EU-Fauna-Flora-Habitat Directive in this kind of integral projects.

The Tongelreep project contributes important input for the IDDS. It is a very integral project, dealing with a lot of sectoral aspects and a lot of partners that are involved. All of these partners have their own interests. Because of these varied aspects and points of interest the decision making process will be very worthfull as input for the IDDS. Otherwise the output of the IDDS can help the decision makers in this investment project.

Innovative in this project the first time use of a nature area for water storage by the relevant water board. Mostly agricultural land has been used to locate areas for water storage. By giving new functions (water storage) to the former fish breeding basins, the cultural-historical values of the total water system (consisting of brooks, supply canals and basins) can be durably maintained. The usage of the nature area as water storage will be combined with the ecological development of the River Tongelreep and the basins and the recreational development of the total area.

5.4 Investment no. 4: Investment Retentionvolume Zell / River Muemling (Germany)

The River Mümling is a tributary of the River Main which flows into the River Rhine. The average discharge is about 3 m³/s with a total catchment area of 360 km². In 1993 and 1995 two severe flood events occurred, which caused severe damage to the infrastructure located along the river. Along a 17-km section downstream to the location of the planned dam (max. height 5.80 m, width 240 m) the 1995 flood damage was estimated to be around € 6.5 Mill. In 1999 the regional Water Board Mümling commissioned a preliminary study for the construction of a flood storage reservoir to prevent future flood damage. The dam will provide 200000 m³ total storage volume. The catchment area of the flood storage reservoir is about 200 km². It will be operated without permanent backwater. According to hydrological calculations it will reduce the downstream maximum flow from 34.2 m³/s to 29.1 m³/s

in case of a 50-years flood event. The maximum inundated area will be around 10 ha and ends 1200 m upstream. That includes 6.7 ha grassland, 1.5 ha farmland, 1.8 ha forest to be developed considering multi-sectoral as well as multi-objective planning approaches.

Within the planned retention area and on the upstream reach the present status of the River Mümling must be classified as ranging from a moderately to heavily modified water body according to the GESIS information system (http://www.hmulv.hessen.de/umwelt/wasser/gesis/_fr_ges.htm). Downstream the river can be classified as nearly being in a good ecological status.

At the moment the area upstream of the dam is agriculturally used. 350 m upstream a natural floodplain follows, which is intersected only by a railroad line and a small path. The sinistrally located pasture farming impacts the natural status of the floodplain here and there. Downstream a pond is located that provides a habitat for local flora and fauna and will be integrated into the overall design. In addition to the competent authorities, other authorities and institutions (e.g. the German railway company Deutsche Bahn AG) being affected by the construction of the Investment were informed and involved in the pre-planning process. Farmers owning the land within the area to be inundated were contacted. This area will not be purchased, a solution for the payment of compensation will be elaborated together with the farmers. Local nature protection and conservation organisations have been contacted with respect to ecological aspects. The Regional Board Darmstadt is in charge of the co-ordination of the blueprint and approval planning.

In the Federal State of Hesse the locations of natural and potential retention areas are stored in a GIS- based retention register (RKH). This project was launched in 1992 and comprises about 350 Hessian rivers with a total length of 4000 km. In addition to existing retention areas / flood storage reservoirs the RKH particularly shows areas with potential retention capacity that can be activated in order to reduce flood damage. This is how the RKH contributes to the concept of flood damage prevention by combining spatial planning aspects. The RKH is already an exemplary concept for the entire NWE-region with respect to flood damage prevention. NOFDP envisages to use the information stored in the RKH in order to supplement the concept of flood damage prevention by ecological aspects. The GIS-based RKH will be integrated into the IDSS functionality in order to ensure a more sustainable development of river corridors.

This innovative approach will be first demonstrated by means of the realisation of this IP using the IDSS to evaluate local ecological effects due to the temporal backwater and those being generated further downstream. The NOFDP partnership will elaborate a comprehensive study for the ecological improvement on the local (location of the retention storage basin) as well regional (Mümling catchment) scales. A high degree of public participation is desired.

Transnational impact and relevance of investment no. 4:

The partnership as a whole will benefit from the integration of this particular IP into the NOFDP project. The flood reducing effect is limited to regional scale, but the

overall characteristic of this particular investment project are representative of the entire low mountain range within the River Rhine catchment area.

These catchment areas are densely populated, several villages are located close to the river. The consequence thereof is a high, often immobile flood damage potential located within the natural floodplains. The activation of the remaining natural floodplains is not sufficient to guarantee a high degree of flood protection. Technical measures are necessary to increase the retention potential and are always part of a network of measures located within the catchment. The system as a whole has to be considered in order to assess the ecological effects and further ecological development on local as well as on regional scale. The usage of the RKH in the realisation of this IP is exemplary for the entire NWE-region. Expanding a similar system (IDSS including RKH functionality) to other catchments will develop a transnational data base, combining information about potential / existing retention areas, ecological parameters and spatial development.

The integration of this IP into the NOFDP partnership shall contribute experience in German planning and decision making procedures for future transnational co-operation. Therefore the gained knowledge will help to assess possibilities and difficulties for co-operation in transnational projects.

As mentioned above this investment project brings experiences with the German planning and decision making procedures to non-German NWE-partners. Furthermore the investment is exemplary for flood damage prevention projects in river basins located in low mountain ranges. The presentation of the RKH broadened by ecological aspects to the NWE community is innovative and an important benefit for the partnership as a whole that also could be applied to other catchments. Due to strong interactions between the DG and IG there is a high degree of participation of all project partners. The benefit of this particular investment project is the application of the IDSS to this project with respect to its special characteristics (catchment characteristics, German planning and decision-making procedures, RKH). Outcome of this investment project is a paradigm for flood damage prevention (increasing the potential retention area by flood storage reservoirs without permanent backwater) with equal consideration of technological, socio-economic and ecological aspects.

6 The NOFDP partnership

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