European Commission

NWRM

Natural Water Retention Measures

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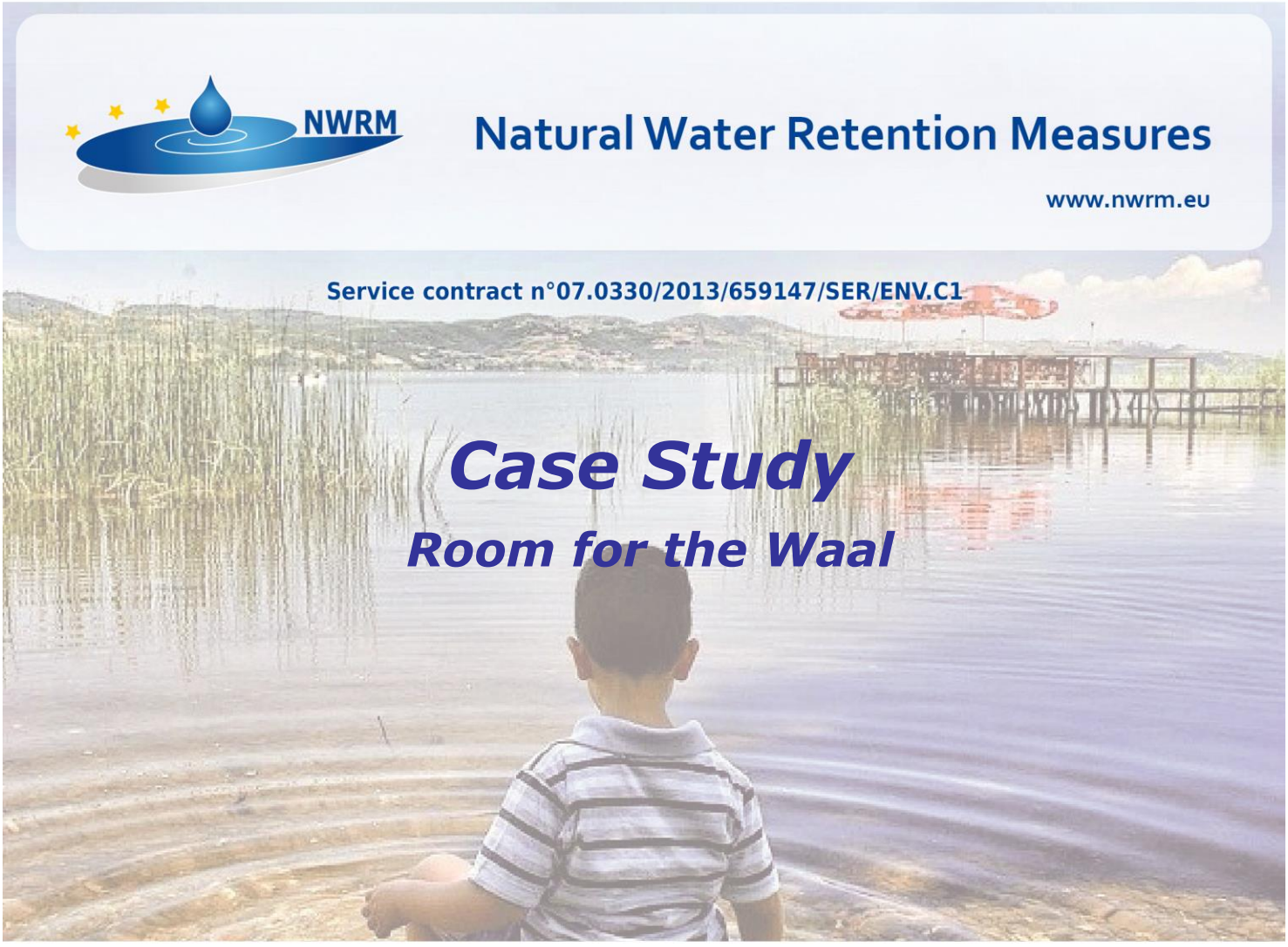

Case Study

Room for the Waal

Environment

This report was prepared by the NWRM project, led by Office International de l'Eau (OIEau), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water (Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK) under contract 07.0330/2013/659147/SER/ENV.C1 for the Directorate-General for Environment of the European Commission. The information and views set out in this report represent NWRM project's views on the subject matter and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this report. Neither the Commission nor any person acting on the Commission's behalf may be held Key words: Biophysical impact, runoff, water retention, effectiveness - Please consult the NWRM glossary for more information.

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I. Basic Information

Application ID	*Netherlands_01*			
Application Name	**Room for the Waal**			
Application Location	Country:	Netherlands	Country 2:	
	NUTS2 Code		*NL22*	
	River Basin District Code		*NLRN*	
	WFD Water Body Code		NLGW0003	
	Description		*Near the town of Nijmegen, in eastern Netherlands*	
Application Site Coordinates *(in ETRS89 or WGS84 the coordinate system)*	Latitude: 52.3855		Longitude: 6.4906	
Target Sector(s)	Primary:	Urban		
	Secondary:	Agriculture		
Implemented NWRM(s)	Measure #1:	*N3 Floodplain reconnection*		
Application short description	In the bend of the River Waal between the towns of Nijmegen and Lent, the dyke preventing flooding from the River Waal is being moved back from the riverbank. In the new area of floodplain, a second river channel will be dug. This will create an artificial island in the Waal. The new channel is intended to always be filled with water, and will flow along with the River Waal in extreme weather conditions.			

II. Policy context and design targets

Brief description of the problem to be tackled	Addressing the risk of flooding from the River Waal, particularly following flooding events in 1993 and 1995. This is part of a national programme of work by the national government to make 'Room for the River'.		
What were the primary & secondary targets when designing this application?	Primary target #1:	Flood control and flood risk mitigation	
	Remarks	*The NWRM is being combined with a city development project.*	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	**4.1.1 Physical alteration of channel/bed/riparian area/shore of water body for flood protection**
	Pressure #2:	Floods Directive identified pressure	*Blockage / Restriction*
	Remarks	Currently a bottleneck exists in the sharp bend of the river, which will be remedied moving back the dyke and the digging of a parallel channel inside the reconnected floodplain.	
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	*Altered habitats due to hydrological changes*
	Impact #2:	Floods Directive identified impact	*Rural land use*
	Remarks	Rural area in the area between the current dike and the town of Lent will be affected as the channel will be dug here and the area will be completely reformed, leaving no room for previous uses.	
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-mitigation of significant pressure	*Bottleneck at a location with high population density will be solved*
	Requirement #2:	WFD-achievement of good ecological status	*On the new island there will be room for nature development*
	Requirement #3:	Floods Directive-mitigating Flood Risk	*The NWRM will significantly reduce the flood risk, reducing water levels up to 27 centimeters during extreme weather situations.*
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	The Planologisch kernbesluit (PKB) Ruimte voor de Rivieren forms the overall impetus for this NWRM. The PKB identifies roles and responsibilities for 30 individual NWRM related projects to reduce flood risk of the entire river system.		

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	*231*
	Secondary land use	
	Other important land use	

Climate zone	cool temperate moist	
Soil type	*Clay*	
Average Slope	nearly level (0-1%)	
Mean Annual Rainfall	600 - 900 mm	
Mean Annual Runoff		
Average Runoff coefficient (or % imperviousness on site)		
	Remarks	
Characterization of water quality status (prior to the implementation of the NWRMs)	No major changes to the water quality to be expected, the channel will be filled permanently.	
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	*Positive way: The availability of open space in between the current river bank and the town.*	
	Negative way: It has to be closely monitored that no additional groundwater seepage will occur in the area around Lent (an area that already experience a lot of seepage)	

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	*Creates an entire new district of the city*
Time frame	Date of installation/construction (MM.YYYY)	*2013- 2016*
	Expected average lifespan (life expectancy) of the application in years	*Permanent when maintained*
Responsible authority and other stakeholders involved	*Name of responsible authority/ stakeholder*	*Role, responsibilities*
	1. Rijkswaterstaat	Overall finance
	2. Gemeente Nijmegen	Direct overall project responsibility.
	3. Ministerie van Infrastructuur en Milieu	Involved directly in planning and execution of infrastructural changes.
	4. Staatsbosbeheer	Involved in the planning and development of recreational and nature aspects on the future island.
	5.	
The application was initiated and financed by	Rijkswaterstaat (the national water authority)	
What were specific principles that were followed in the design of this application?	The main principles were increasing water safety (reduced risk of flooding) within an integrative planning framework. The measures are incorporated with an area of urban development that will provide aesthetic and recreational benefits, together with an enhancement of the spatial quality in the area.	

Area (ha)	Number of hectares treated by the NWRM(s).		*70*
	The 70 hectares only applies to the area where the dike will be moved back 350 meters.		
Design capacity	The design capacity is at such a level that the water level in the River Waal will locally be 35 centimeters lower during flooding events than without the measure (without adversely impacting upstream water capacity and with beneficial circumstances further downstream)		
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase		*Reference*	*URL*
	1.		
	2.		
	3.		
	4.		
	5.		
Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?	The main factor that influenced the choice for this NWRM was the possibility to combine the NWRM in to a larger city redevelopment project. The creation of a district on the other shore of the Waal, together with a revitalization of the shore at the old city center made the creation of this river park that will be in the center of the city in the future possible.		

V. Biophysical impacts

Impact category (short name) Select from the **drop-down menu** below: ⇩	**Impact description** (Text, approx. 200 words)	**Impact quantification** (specifying units)	
		Parameter value; units	% change in parameter value as compared to the state prior to the implementation of the NWRM(s)
Runoff attenuation/ control	*n/a*		
Peak flow rate reduction	*The dyke relocation and new channel will provide additional capacity for flood flows in the River Waal, leading to a reduction in peak flood levels*	*cm*	*-35 cm compared to baseline*
Impact on groundwater	*The North side of the river bent has always been subject to substantial seepage. Starting principle of the entire NWRM was that the seepage could not get any worse as a consequence of the NWRM. Therefore a seepage screen, in combination with a water girth were integrated in the project. If it is deemed that this will turn out to be insufficient, more actions will be taken.*		
Impact on soil moisture and soil storage capacity	*n/a*		
Restoring hydraulic connection	*Hydraulic connection between the river and part of its floodplain is being restored by moving the dyke backwards by 350m, and developing a new channel within the floodplain that will always contain water and will provide additional flood capacity.*		
Water quality improvements	*No information*		
WFD Ecological Status and objectives	*On the island there will be a new development area for nature. No ecological valuable area was lost or altered during the NWRM.*		
Reducing flood risks (Floods Directive)	*Local water levels will be up to 35 centimeters lower compared to previous situation during extreme weather circumstances, effectively reducing the flood risk.*	*35 cm*	
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	*n/a*		
Soil quality improvements	*n/a*		
Other	*n/a*		

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	- Flood risk reduction in the lower Waal - Creation of new permanent aquatic habitat - Urban development with a strong blue-green connection		
Financial costs	***Total:***	*351 Million €*	
	Capital:		
	Land acquisition and value:		
	Operational:		
	Maintenance:		
	Other:		
Were financial compensations required? What amount?	*Was financial compensation required: Yes*		
	Total amount of money paid (in €): unknown		
	Compensation schema:		
	Comments / Remarks: Financial compensation was required for owners of land and people living in the area between the existing and new location of the dyke.		
Economic costs	*Actual income loss:*		
	Additional costs:		
	Other opportunity costs:		
	Comments / Remarks:		
Which link can be made to the ecosystem services approach? *Hint: The actual benefits of improving nature's water storage capacity are essentially linked to an improved provision of some of the following ecosystem goods and services:* - *Freshwater for drinking.* - *Water provision to deliver water services to the economy both for drinking and non-drinking purposes.* - *Water security (reliability of supply and resilience to drought).* - *Health security (control of waterborne diseases).* - *Flood security and protection.* - *Storm surge protection.* - *Biomass production.* - *Amenities (associated to habitat protection): fish and plants, tourism, recreation, and others.* - *Benefits of improved coastal water quality and ecological status for a sustainable commercial production of shellfish with human health and*	Flood security and protection. Amenities and social benefits relating to housing provision, recreation, greening cities.		

welfare values.	

VII. Monitoring & maintenance requirements

Monitoring requirements	
Maintenance requirements	
What are the administrative costs?	

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	Hydraulic modelling has been carried out to assess the impact of the scheme on flood levels in the River Waal, comparing before and after.
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	
How cost-effective are NWRM's compared to "traditional / structural" measures?	A traditional approach may have been to increase the flood defenses of the existing channel of the Waal.
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	This type of measure is suitable for rivers with permanent flow where the capacity to flow out-of-bank is currently restricted. There are no specific basin characteristics that are necessary, as the measures could be applied in a range of situations.
What is the standard time delay for measuring the effects of the measures?	No delay: immediate benefit for flood management.

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	The main barriers identified were: - reluctance of those directly affected by the NWRM - concerns from the public towards the financial risk Nijmegen is taking with the ambitious "Nijmegen omarmt de Waal"-project – although the NWRM-part of the project is founded by the national government.
What were the main enabling and success factors?	The main success factors thus far include: - the existing expert knowledge available in the Netherlands - the positive cooperation between different levels of authorities and the associated top-down sharing of knowledge - public understanding that measures had to be taken after the 1993 and 1995 floods
Financing	The entire NWRM project was financed by Rijkswaterstaat as part of the Room for the Rivers program.

Flexibility & Adaptability	The current NWRM did not only aim to meet current peak water levels historically measured, but the Ruimte voor de Rivieren program as a whole aims to be able to handle an increased flow rate to 16,000 m^3/s (from 15,000 m^3/s) (across the main distributaries of the Rhine); this in anticipation of future more extreme weather circumstances caused by climate change.
Transferability	The measure here is being applied to a large river near the bottom of a very large transboundary river basin. However similar measures could also be applied on a smaller scale. In a NWRM that is being combined with a city redevelopment project, it is important that there is an actual demographic/public demand to attract future private investment in the newly developed housing area and recreational activities.

X. Lessons learned

Key lessons	- Large-scale flood risk management provides opportunities for much wider benefits and incorporation with other development plans or aspirations - Good cooperation from national down to local levels of government and other stakeholders is necessary for this scale of project to be successful - National coordination of the programme and measures development allows measurable benefits to be achieved at the national scale.

XI. References

Source Type	*Project Report*
Source Author(s)	Andersson Elffers Felix
Source Title	¾ Evaluatie ruimte voor de Rivier
Source Weblink	http://www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2013/03/26/3-4-evaluatie-ruimte-voor-de-rivier.html
Source Type	*Website*
Source Title	Ruimte voor de Waal
Source Weblink	http://www.ruimtevoordewaal.nl/nl/home/

XII. Photos Gallery

Overview picture of future end-state of the river bend (source: www.ruimtevoordewaal.nl)