# Water Framework Directive
# &
# Case Amsterdam-Rhine canal

The implementation of the WFD on the ecology of canals in EU-Member States and in The Netherlands

**Thesis report**


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University of Twente
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# European WFD & case ARC

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**Thesis report**


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# Acknowledgement

**"Practice, the master of all things."**
***Augustus Octavius***

This MSc thesis forms the completion of my study Civil Engineering and Management at the University of Twente, The Netherlands. The European policy Water Framework Directive and the case Amsterdam Rhine Canal are discussed by this report. The project is carried out at Directorate General for Public Works and Water Management Utrecht at Nieuwegein.

I am very grateful to some people, who supported me during my thesis activities. I thank Rene van den Heuvel and Gerard Rauwerda for their helpful suggestions and constructive feedback. Moreover, I would like to thank Maarten Krol (University of Twente) and Denie Augustijn (University of Twente) for their supervision.

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This report is dedicated to my father Leo Baijens. Also during this thesis I have lost some dear persons, namely Cees Kuyvenhoven and Elly Peper. The good memories live on. At least I will thank Medicort practice and its physiotherapeutic for the good support during my rehabilitation after a knee operation so my thesis could go on. This graduate period was not in the least quiet, but nevertheless also this time will be concluded.

Marloes Baijens
Deventer, April 2007

# Abstract

The EU policy Water Framework Directive 2000/60/EC (WFD) is known to have significant influence on water management through whole Europe. It establishes a new, integrated approach to the protection, improvement and sustainable use of European's rivers, lakes, estuaries, coastal waters and groundwater.

The result will be a healthy water environment achieved by taking due account of environmental, economic and social considerations. The river basin management plans (RBMP) defines how this should be achieved through the establishment of environmental objectives and ecological targets for water bodies. The WFD sets up a six-year cycle of planning and action with the production of the first RBMP required by the end of 2009.

The goal of this thesis is to understand how the official WFD, CIS reports and other translations are used in Member States and in The Netherlands and what the consequences are for the ecology of artificial water bodies, mainly for the case Amsterdam Rhine Canal (ARC) in The Netherlands.

The CIS guidance MEP-GEP for artificial water bodies which defines the WFD implementation process has been written by a European workgroup (CIS) and is one of the fourteen reports to make the WFD policy workable. The MEP-GEP Guidance for AWB (level 2) is basically a step-by-step plan. It can help water management authorities to implement the Water Framework Directive (level 1) on a transparent way. The guidance is made to get insight in the development process of ecological aims, give a methodical approach and grip, information and get insight in politically space and process of policy and decision making. The CIS guidance MEP-GEP is suited to the Dutch situation by RIZA and STOWA and named Dutch MEP-GEP Guidance (level 3). Unfortunately those reports and approaches are still difficult to use and during national meetings there was a lot of incomprehension about the way to fill in the WFD process.

In the Netherlands the WFD implementation process is in full pace. In other Member States is more priority to implement the WFD on rivers or other water systems and not immediately to artificial water bodies. Just research institutes in the UK (SNIFFER & UKTAG) and in Ireland (SNIFFER and EPA) are started in 2006 with a research project about the way to implement the WFD on artificial water bodies, especially canals. The process is still in development so there is little specific information available.

The participants of the Dutch meetings agreed with the objectives and ideas of the WFD, but the translation into reality is not feasible. Furthermore the Dutch MEP-GEP guidance just describes the process and has free room of interpretation and how to use it. That led to that the Netherlands in 2005 wrote a different method to implement the WFD, Praagmatic approach, which should be better to use in practice. It has mostly the same steps as the Official WFD process, but some in a different order.
Nevertheless, it has also some difficulties to use it in reality. Mainly the definitions of significant, disproportionate, irreversible and the class boundaries of the biological quality elements to assess the current situation are unclear. The 'December nota 2006' should have had given answers, but there is still not any solution. So till now also the new approach ensures more communication instead of more grip on the WFD implementation process.

The working group canals had the task to use the MEP-GEP guidance on the twelve Rijkswateren, canals in the Netherlands. The Directorate General for Public Works and Water Management Utrecht, a participant of the Dutch workgroup canals, is, by using the Dutch MEP-GEP guidance, focused on the artificial ARC. They started in July 2006 and will present the official report in April 2007. A concept version shows that the whole Dutch MEP-GEP guidance has a lot of own interpretation and that also the working group has difficulties by using the MEP-GEP Guidance for artificial water bodies. They must invent the wheel on its own which resulted in a combination of the Official WFD text and the Praagmatic approach. Also that combination did not give more grip to define the objective MEP or GEP.

Brussels is still unclear about the requirements, but DSW has made a list of requirements to which Brussels could become satisfy. That suggests that the WFD implementation is just for

Brussels while there a lot of opportunities for the countries itself. Brussels will judge the RBMP on efforts and not on results at the end. However, the process ensures that the objective work method between the water managers nationally and internationally could be compared.

The first steps of the MEP-GEP guidance show what can be done. The last phase of the MEP-GEP guidance is still a political discussion about what will we do. The effects of the measures are thereby a gamble. It gives no new (innovative) ideas in measures and possibilities to improve the environment of a canal. One positive thing of the WFD is that it ensures a more objective way of defining objectives for the water systems.
Monitoring shows that the situation near the Amsterdam Rhine Canal is not reaching the objective good ecological potential, so there should be taken action. The working group canals do not define a vision about what the level of the GEP should be, but there are measures determined. The costs to improve the ecology by making the already known fish passages and nature friendly banks (NFB's) will be extremely high (70 million euro's).

The Dutch institute WL Delft supports the WFD by making a tool to make the effects of measures on a water body visible. The tool 'WFD explorer' could be very handsome to make the effects of measures visible to politicians without much technical knowledge is required. That tool is still in development.

A threat of the effective realisation of the WFD in 2015, 2021 or 2027 could be the inaccessibility in practice of the whole WFD procedure. Furthermore, it is a fact that some countries should do more than others, but the main thing is that there will be an integral view to river basins which ensures a better way of protection, improvement and sustainable use of the environment. This new water legislation is taken the interests of actors into account in an integral approach. And the (social-economic) conflicts between the functions of a water will be still a conflict in the future, but one thing is clear, more reverses of, for example the ecology are not permitted any more..

Shipping function is the most important so hardened banks

AND/OR

a combination of a function and environment is important, for example nature friendly banks near canals

# Table of Contents

# 1 Introduction

This first chapter gives an overview of the Water Framework Directive process with a focus on its implementation for canals. The global introduction results in a problem formulation and the research questions addressed of this thesis. After that the research method will be discussed.

## 1.1 Objectives of Water Framework Directive

The EU Water Framework Directive (WFD), which came into force on 22 December 2000, establishes a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. It is minimal fragmented in nature and will have more progress with regard to its implementation than the older water legislations. The WFD pays attention to the ecology and chemistry to get an improvement and sustainable use of the environment realized. The Water Framework Directive has five key objectives:

1. to prevent further deterioration and protect and enhance the status of aquatic ecosystems and associated wetlands;
2. to promote the sustainable consumption of water;
3. to reduce pollution of waters from priority substances;
4. to prevent the deterioration in the status and to progressively reduce pollution of groundwaters; and
5. to contribute to mitigating the effects of floods and droughts.

These objectives are frequently in conflict with the functions of water bodies. In canals the main function is often shipping which has in general a negative influence on ecology. Shipping and environment is just one example of water management conflicts in The Netherlands (see text box 1). It highlights the need to improve coordination for better integrating water policies and strategies in The Netherlands and Europe to prevent further deterioration of the environment.

*Shipping versus ecology in case Amsterdam-Rhine Canal*

*The Directorate General for Public Works and Water Management Utrecht (DUT) is managing the Amsterdam Rhine Canal in the Netherlands. The canal is very important for transport. 100,000 ships annually use the canal connecting the river Waal, Nederrhine, Lek and Amsterdam. Other stakeholders are the agriculture, drinking water companies, industry, nature and recreation. Every stakeholder is using the water of the canal in his own way. The ecological environment is negatively influenced by the several users of the canal. In the current situation the Amsterdam Rhine canal is constructed with hardened banks which have a negative impact on ecology or prevent ecology to emerge. As a consequence, in the canal are almost no animals or plants. Furthermore, the canal is dividing a nature area in two parts so migration is not possible.*

*Textbox 1- Example of shipping versus ecology*

The Water Framework Directives use the term artificial water body for a canal. The WFD tries to get a better ecology and water quality, also in an artificial water body, but with taken the interests of actors into account. The result of the WFD implementation will be a healthy water environment achieved by taking due account of environmental, economic and social considerations.[1]

## 1.2 Water Framework Directive definitions for canals

To get the objectives of the WFD realized the process is described specificly in the policy. The WFD process is divided in three main phases:

1. the characterization phase (2000-2004)
2. the defining of objectives in a River Basin Management Plan (2005-2009)
3. the realisation phase (2010-2015)

This thesis describes the implementation of the first two phases of the Water Framework Directive process with specific focus on artificial water bodies and Amsterdam Rhine Canal as a case study. In this paragraph the WFD characterization and defining of objectives phase and its contents will be discussed shortly.

### 1.2.1 Water Body characterization

In order to implement the WFD, the concept of "water bodies" has been introduced in WFD Article 1 [2]. The Directive requires Member States of the EU to identify water bodies as part of the analysis of the characteristics of the river basin districts.
Each surface waterbody should be classified as natural, heavily modified or as artificial, see table 1. It should be emphasized that the identification of a water body is a tool and not an objective in itself [3]. Instead, the objectives are, to attain good ecological and good chemical conditions for all surface water bodies.

*Heavily modified water bodies (HMWB) are bodies of water which as a result of physical alterations by human activity are substantially and irreversibly changed in character, for example by canalisation or water level management.*

*Artificial water bodies (AWB) are defined in article 1 of the WFD as surface water bodies, which have been created in a location where no water body existed before, and which have not been created by the direct physical alteration, movement or realignment of an existing water body. This classification is used for the Amsterdam-Rhine Canal (ARC).*

*Table1- classifications and objectives of surface waters*

| ***Categories of surface water bodies*** | ***Examples*** | ***Objectives*** |
|---|---|---|
| Natural | Lakes, rivers, transitional waters, coastal waters | Good Ecological Status& Good chemical status |
| HMWB | | Good Ecological Potential & Good chemical status |
| AWB | canals | |

Waterbodies classified as natural will be compared in the WFD process with natural references to get the objective maximum ecological status known. The WFD process leads to a nivellation so the objective Good Ecological Status could be reached. Artificial and heavily modified water bodies are a specific water body category with its own classification scheme and objectives, because it is difficult to compare these water bodies with natural references.[4] The classification for The Netherlands was completed by 22 December 2004.

The procedure for designation of a water body as an AWB or a HMWB is set out in the WFD and further explained in a Common Implementation Strategy (CIS) Guidance Document which proposes a stepwise approach to the identification and designation of AWB and HMWB.[5] The Member States could use the CIS reports as a guideline and translate it towards its own policies.

### 1.2.2 River Basin Management Plans

The WFD requires that all inland and coastal waters within defined river basin districts must reach the objectives ultimately by 2027. The Directorate General for Public Work and Water Management is the manager, in compliance with the requirements of the EU Water Framework Directive WFD 2000/60/EC.
The River Basin Management Plan (RBMP) should describe how the WFD requirements will be achieved through the establishment of environmental objectives and ecological targets for surface waters; program of measures and a monitoring plan. The WFD sets up a six-year cycle of planning and action with the production of the first RBMP required by the end of 2009. They are subject to ministerial approval. Figure 1 shows the obligated River Basin Management Planning Cycle that allows for implementation of the WFD requirements.[6] In 2015 a first full evaluation of the effect of measures for achieving the WFD objectives has to be performed.

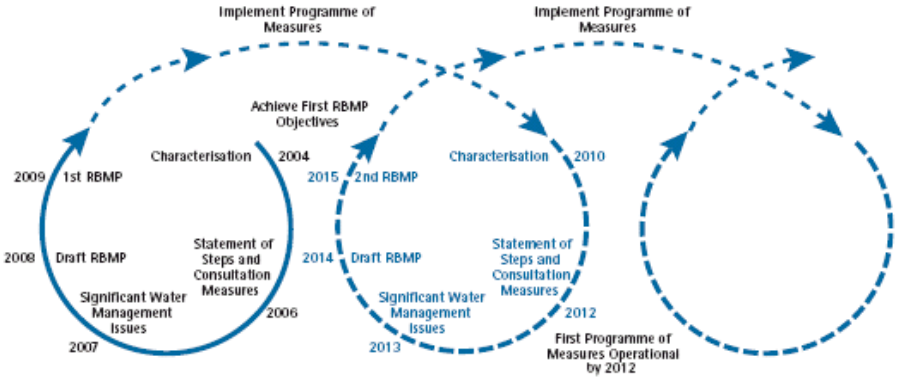
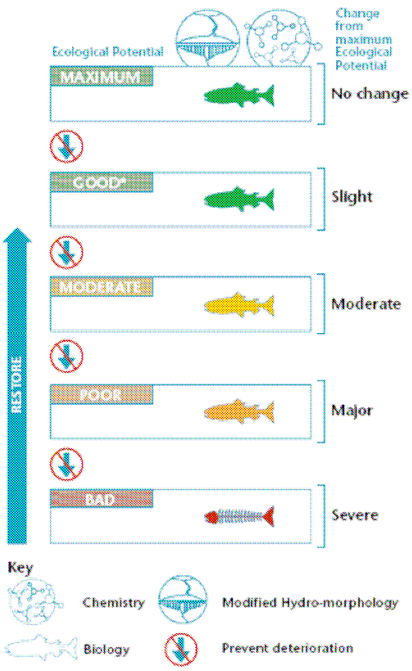



*Figure 1- RBMP planning cycle*

The main objective of a river basin management plan is to establish a balance between the existing natural functions of the water system and societal functions such as industrial use, recreation, shipping and agricultural use. The detail of what needs to be included in a RBMP is set out in Annex VII of the WFD.

The environmental objective for AWB is Good Ecological Potential (GEP) versus a "good ecological status" as for natural water bodies, which is a "slight" deviation from Maximum Ecological Potential (MEP). MEP is defined as resulting from the artificial characteristics of the water body, once all mitigation measures have been taken to ensure the best approximation to ecological continuum. A table in appendix I summarised the environmental objectives, "exemptions" and "minimum requirements" which are mentioned in Article 4 of the WFD to achieve MEP.




The WFD process contains a separate classification scheme for artificial water bodies to define the GEP. It represents a more realistic, although no minimal stringent, ecological standard. The GEP has to be achieved by 2015. Designated water bodies must also achieve the objective of good chemical status, which again has to be achieved by 2015. The goal is to get a better ecology and deterioration of the current situation is not allowed. Figure 2 shows classification scheme for HMWB and AWB. The symbol Fish translates the quality of the biology. The current situation could be moderate and the objective could be to reach a good ecological potential, which is a level higher. The objective will be defined through the described WFD process in the MEP-GEP Guidance [7]. The objective is the outcome of the step-by-step plan.

In order to achieve the specific objectives (i.e. good ecological potential), for heavily modified and artificial water bodies WFD Article 4 §3 contain elements of comparing the consequences of achieving the 'good ecological potential' to a number of aspects including economic considerations. Moreover, the assessment of "good ecological potential" is linked to the possible mitigation measures. Thereby, mitigation measures must not have a significant adverse effect on the specified use and environment.

## *1.3 Implementation of WFD*

In the implementation of the WFD three official levels can be distinguished. The official WFD (first level) is interpreted by international workgroup Common Implementation Strategy (CIS)

(second level). The CIS report no 4 [8], for AWB, results in a translation to a Dutch work document called 'Guidance MEP-GEP for AWB [9] (third level) to suit the WFD to the Dutch situation. Besides this there is the Praagmatic approach, a variant of the third level. These translations will be mentioned in this section.

### 1.3.1 Common Implementation Strategy (CIS)

The Common Implementation Strategy (CIS) for the WFD was established by recognition that an integrated approach to river basin management throughout Europe is crucial for the successful implementation of the Water Framework Directive. The purpose of the CIS workgroups is to develop a common understanding and approach to the implementation throughout the Member States of the EU. Other tasks of CIS are to provide informal technical guidance, and share experiences between Member States to avoid duplication of effort and to limit the risk of poor application of the requirements of the Directive.

The main outputs of the CIS workgroups up to October 2005 include 14 Guidance Documents and numerous Technical Reports on the various aspects of the Directive. The CIS Guidance documents are informal, non-legally binding documents. These are intended to provide an overall methodological approach, but these should be suited to specific national circumstances. Guidance documents which are related to artificial water bodies [10] are briefly summarized in appendix I.

### 1.3.2 Dutch MEP-GEP Guidance for artificial water bodies

The purpose of the Dutch MEP-GEP Guidance is to provide a working, clear and practical instrument to derive ecological targets for the twelve artificial water bodies and develop a set of measures to reach these targets in The Netherlands.

The MEP-GEP Guidance is a step-by-step plan. It can help water management authorities to answer three key questions:

1. How should we designate a water body as heavily modified or artificial in the River Basin Management Plan 2009? (Answering this question has already been finished in 2004)
2. How should we work out ecological objectives for these water bodies?
3. What sort of measures should we consider?

The CIS report applying to the Dutch situation, resulted to the Dutch MEP-GEP Guidance. Besides this a separate approach was followed in The Netherlands. The Praagmatic approach is a different interpretation of the WFD process. This new approach is bottom up instead of top down, which is the official WFD approach. It should make the implementation process more workable in practice.

## *1.4 WFD and the Amsterdam Rhine Canal*

The morphology of water bodies is in many cases the product of extensive socioeconomic use. For example, rivers are truncated, riverbanks are built up, water is diverted into canals, and dikes are built for protection purposes. Larger rivers are used by commercial vessels and power generation, and locks are built, and floodplains are for the most part segmented by dikes.
The example in textbox 2 highlights the situation in the Amsterdam-Rhine Canal (ARC). Although waterway transportation is the most environmental friendly transport solution, it constitutes also a threat to the water environment. Both transport and environment play an important role in the socio-economic development of a country. The 'best' inland

*The water system of the ARC has been created by man and has been strongly influenced by human activity. Upstream innumerable barriers and modifications have been made to influence flow patterns. The majority of the water system is strictly controlled in order to protect millions of people against flooding. The ARC, such as each water body, has several functions, but the main function of this canal is shipping. Recreation, cooling water and drinking water supplies are secondary functions.*

*Textbox 2- typical problem for AWB*

waterways for navigation are the deepest, straightest and with the strongest banks to reduce erosion and the need for dredging. Unfortunately, these are the opposite of optimum aquatic biodiversity conditions. The common transport policy looks for sustainable ways to cope with the challenge of growing traffic, while environmental policy aims to protect Europe's environment for the next generations. It became clear that inland shipping on rivers and canals does not necessarily conflict with an environmental protection policy if certain conditions are met. Anyway, several users of the canal will negatively influence the ecological environment.

Furthermore, EU environmental legislation such as the Habitat and Bird's Directives [11], the Environment Impact Assesment Directive [12] and the progressive Water Framework Directive demand that future plans for improving the navigability of Europe's rivers and inland waterways take full account of potential ecological impacts and that everything is done to prevent them from happening in the first place. It is possible to meet the new environmental standards and maintain effective shipping networks.[13] The use of technological solutions, such as redesign of ships to suit the river and not the other way around, together with effective participatory planning processes can be applied to establish sustainable water transport in Europe. Apart from transport and environment, water supply, flood protection, and recreation are carefully examined. The added value of an integrated policy is to achieve win-win situations and that is what the Water Framework Directives tries to get. The WFD is a transparent approach to improve the ecology of water systems through whole Europe without harming the several stakeholders of a water body.

## *1.5 Research objective*

Many choices have to be made to use the WFD policy in practice. Directorate General for Public Works and Water Management Utrecht wants to know how to use the WFD policy and its reports and what the consequences are for the Amsterdam Rhine Canal, to assist in a strategy in reaching targets of the WFD in 2015.

The problem is that it is not entirely clear how the official WFD and CIS reports are translated to the national report Dutch MEP-GEP Guidance and which specific choices are made by using the reports on artificial water bodies. The Master thesis includes two parts. The first part contains an analysis of the implementation of the WFD related to artificial water bodies in several European countries. The second part of this thesis will focus on the implementation of the Dutch MEP-GEP Guidance for artificial water bodies and the Praagmatic approach on 12 canals in The Netherlands, especially on the case Amsterdam-Rhine canal, northern part.

### 1.5.1 First part, objectives and research questions

The first part of this thesis had the aim to analyse the interpretations of the official WFD for AWB in other EU Member States and The Netherlands. The comparison of the WFD interpretations between Member States gives information about the different perspectives. It shows what the differences are between approaches in Member States, and where it is based on. So it gives a better understanding of the decisions, knowledge and ambitions related to the WFD in different Member States.

The translation of the WFD and CIS reports into the Dutch MEP-GEP Guidance and the Praagmatic Approach will be compared with the Official WFD. It is the first step to get a better understanding of the Dutch WFD translation into 'MEP-GEP Guidance for artificial water bodies' and why the alternative praagmatic approach is developed. The analysis shows what the shortcomings are in the reports, how they are filled in and the consequences of the own interpretations.

This gives the following central research questions:

*A* *How are other European countries interpreting and implementing the WFD, to artificial waters, and more specifically canals?*

*B* *What does the WFD require and how is the official WFD text interpreted into the Dutch document, 'MEP-GEP Guidance for artificial waters, canals?*

Chapter 2 contains research question A and chapter 3 gives an answer on research question B.

### 1.5.2 Second part, objectives and research questions

In the second part the process for deriving MEP-GEP for 12 AWB in The Netherlands will be analyzed. This process is performed by the working group canals which is composed of the involved water managers and consultancy Witteveen+Bos. The workgroup had the choice between the prescribed WFD approach as worked out in the Dutch MEP-GEP Guidance of the Praagmatic approach. Important is that the process is transparent and objectives and set of measures well motivated. The WFD explorer, which is in development in The Netherlands, could be an usefull decision support tool, but it is not obligatorily.

The aim of this research with a case study is the implementation of the 14 steps of the step-by-step plan in the 'Dutch MEP-GEP Guidance' on Amsterdam Rhine Canal in The Netherlands. Consultancy Witteveen+Bos designs the measures to reach the good ecological potential in the twelve 'national waters' (Rijkswateren) canals in The Netherlands. The measures for the Amsterdam-Rhine canal, northern part will be analysed in this thesis. A consideration is to integrate other linked policies (EHS, WB21, Natura 2000) or not. All these legislations influence the current situation. Thereby, the ambition of Directorate General for Public Works and Water Management (RWS) by implementing the WFD is playing an important role.
A better understanding of the criteria and decisions that lead to the most effective measures makes it easier to carry out the last realisation phase and get support from Brussels and support from stakeholders what should be achieved before 2009. So this part makes clear if the Dutch MEP-GEP Guidance for AWB itself is an useful methodology or the Praagmatic approach is necessary; and if the WFD could be combined with other legislations.

In the second part of this thesis, the possibilities for and the results of the WFD implementation, mainly on the Amsterdam Rhine Canal (ARC), northern part, are analysed.

Research questions part 2:

C *How is the working group canals using the Dutch MEP-GEP Guidance, to derive the objectives MEP-GEP and measures for 12 artificial waterbodies in The Netherlands?*

*D What are the possibilities in the Amsterdam-Rhine canal to reach the WFD ecological aims (GEP) for artificial waters and what is the usefulness of the tool WFD-explorer?*

Chapter 4 contains research question C and chapter 5 answers research question D.

## *1.6 Method and outline of the research*

The thesis is divided in two parts and each part has its own research questions and objectives. The first part is more scoping and a consideration of literature and questioners. The input of the first part is not depending on the results from the consultancy or workgroups. The second part is almost not based on existing literature and more my own research. The input of the second part depends on results from the consultancy Witteveen&Bos and WFD explorer workgroup.

The material used for this research exists of Official WFD reports, CIS-reports, WFD Literature, Article 5 reports, Dutch MEP-GEP Guidance for AWB, tool WFD explorer, national workshops, question forms for water managers, information from consultancy Witteveen&Bos and RIZA and the library of RWS Utrecht. Each chapter answers one research question and describes the several phases which will lead to a conclusion. An overall view of the framework of this thesis is given in figure 3.
The thesis consists of two parts and four research questions. The report starts with an introduction and the objectives of this research. Chapter 2 and 3 contain the first part which is mainly the analysis of the WFD in the EU-Member States. Chapter 4 and 5 are the second part of this thesis and deals with the implementation of the WFD methodology on the case study

Amsterdam-Rhine Canal. Each chapter contains conclusions which are compiled and discussed in chapter 6. The final chapter gives the conclusions and recommendations of this research.

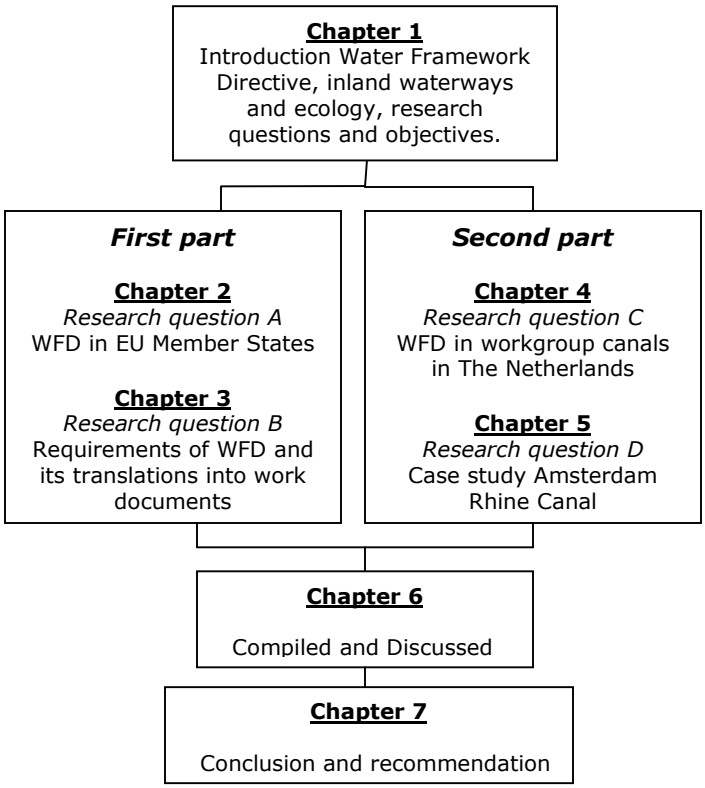
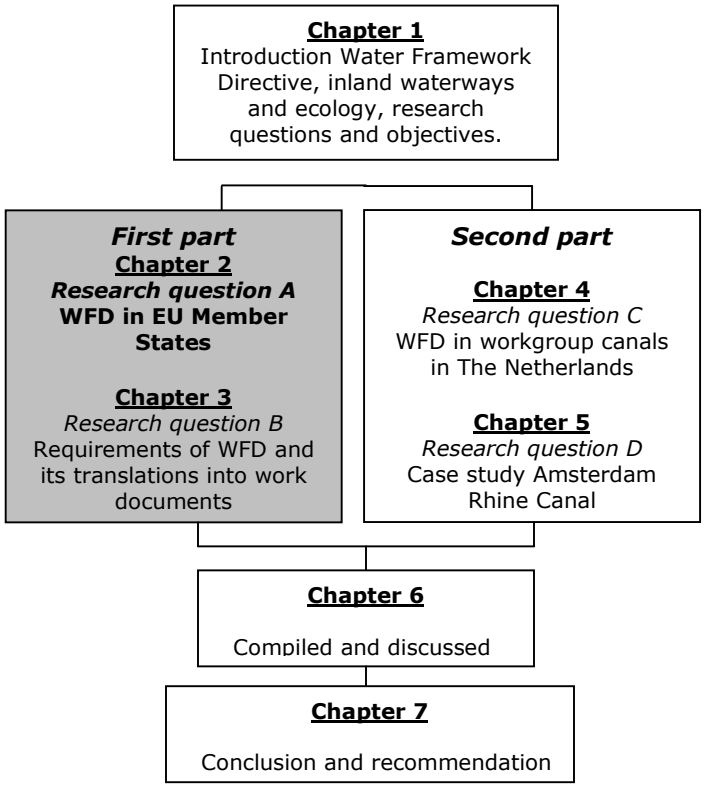



*Figure 3- Framework thesis report*

First part: Water Framework Directive and artificial water bodies internationally.



# 2 Status of WFD implementation in EU Member States

This chapter describes the characterisation phase and derivation of MEP-GEP for canals in several Member States. There is more information, but only Ireland, England, Scotland, Germany and Austria are discussed in this chapter.

## *2.1 Information from Member States*

The European Commission has a site to inform the concerned people [14]. There are several links to WFD sites and reports of differ Member States. The WFD pages of each Member State [15] contain mainly general information but do not have specific information about canals. Some sites contain the Article 5 characterisation reports of the River basins in the Member States. The WFD article 5 characterisation of the River basins in Member States, which has been finished in 2004, mainly deals with natural water bodies. The artificial water bodies are sometimes mentioned, but not always specified as a canal. Those reports also mention contact persons. They were approached by e-mail to get more information on the process for canals. It became clear that there is little information about the WFD implementation on canals. Nevertheless, the available information is analysed and discussed in this paragraph.

Appendix II contains the references of several institutions and organizations who were contacted by e-mail to get information about the WFD process for canals in that country. Also the pilot projects and international river basins to inland waterways, navigation, water management and environmental institutions in Europe were analysed to get an impression, contacts and information about how the countries are dealing with the WFD. The text boxes show some citations from e-mail. If there was a reaction from the approached persons by e-mail, the answer was most of the time that there is no information about the WFD for canals in that country; canals have no attention at this moment or the WFD process for a canal is just started or in development. Nevertheless, many links were given where perhaps some information was available. There was one e-mail with a positive reaction, namely from the British Waterways. In the UK is a research institute working on the WFD implementation and also on a specific canal project. This project is still in progress so it can be said that in general there is no specific information available about the WFD implementation process for canals in Member States, even though there were so many attempts to get information.

The international workgroups who are working on pilot projects [16,17,18] are easy to find and to approach. National workgroups who will do a part of the WFD are more difficult to find. In the Netherlands too many workgroups are working on the implementation of the WFD, but it is difficult to find information about the products of those workgroups, mainly because the reports are not yet public or the process is just started.

A reaction of Dr Garrett Kilroy from the WFD Research Fellow Environmental Protection Agency and Trinity College Dublin:

> *The ecological potential of AWBs and HMWBs is very much a live issue for all Member States. Most of the classification tools for intercalibration have only concerned natural water bodies. In Ireland we are involved in a SNIFFER project (www.sniffer.org.uk) research project to develop a classification tool for canals. This project is at early stage of development.*

A response from Grahame Newman who is programme Manager, Water Framework Directive, British Waterways:

*A project is underway to develop a separate ecological classification tool for UK and Irish canals.*
*The EC's Common Implementation Strategy (CIS) for the Water Framework Directive set up a project last year to deal with emerging issues relating to hydromorphology. One of the issues being discussed is the difficulty in defining the ecological objectives for Heavily Modified and Artificial Waterbodies (i.e. Good Ecological Potential) using the current CIS methodology). They have proposed an "Alternative Approach" based on defining Mitigation Measures, and the UK and Irish inland waterways sector is currently considering funding some research on this. I attach a copy of a briefing note and research specification from UKTAG that provides more detail. UKTAG (UK Technical Advisory Group are the body providing the technical development of standards and processes for the WFD in the UK.*

A reaction from Belgium by John Emery

*I can not inform you about the approach to define MEP and GEP for artificial water bodies, because the activities are just started.*
*The link gives you some European guidances:*

*http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents&vm=detailed&sb=Title*

A summarized reaction of Gerard Broseliske, also on behalf of, Geilen, Noel (RIZA); Buijse, Tom (RIZA); Ohm, Marieke (RWS ZH); Wijk, F.J. van (Frederike) (DON); Molen van der, Diederik (RIZA); Berg van den, Marcel (RIZA)

*There are just European coordinated methodology descriptions (in an abstract way; indicate the process to reach MEP/GEP). Specific approaches for artificial water bodies are in the Member States in development (consolidated methodologies are still not available). In the international river basins the discussion has started how the bank states, which share an international river basin, define the MET/GET/MEP/GET. This is basis for "syntheses" which forms the basis for harmonization/coordination in the international river basin commissions.*

*Textbox 3- Reaction by Member States, process is in development, just started or see internetpages*

Table 2 shows the information sources of the different Member States. Appendix II lists the links of the national WFD sites of Member States. The countries discussed in this chapter are given in bold.

*Table 2- Overview of responses*

| | **Countries / RB** | **e-mail contact** | | **Site WFD-info** | **Site with info WFD for Canals** |
|---|---|---|---|---|---|
| | | **reaction** | **no response** | | |
| 1 | **Ireland**[19] | X | | X | X |
| 2 | Belgium | X | | X | |
| 3 | **Germany** | X | | X | X |
| 4 | Czech Republic | | | X | |
| 5 | Denmark | | | X | |
| 6 | Netherlands | X | | X | X |
| 7 | France | | X | X | |
| 8 | **United Kingdom** | X | | X | X |
| 9 | Greece | | | X | |
| 10 | Hungary | | | X | |
| 11 | **Austria** | | | X | |
| 12 | Italy | | X | | |
| 13 | Finland | | X | | |
| 14 | Poland | | | x | |
| 15 | Portugal | | | X | |
| 16 | Spain | | X | X | |
| 17 | Roemenia | | | X | X |
| 18 | Cyprus | | X | X | |
| 19 | Odra River | | X | X | X |
| 20 | Tisza River basin | | X | X | |
| 21 | Meuse | X | X | X | |

| | | | | | |
|---|---|---|---|---|---|
| 22 | Danube | | X | X | |
| 23 | Rhine River | X | | X | |
| 24 | Scheldt | | X | X | |
| 25 | Ems | X | | X | |
| 26 | Elbe River | | | X | |
| 27 | Mittellandkanal | | X | | |
| 28 | Main-Donaukanal | | X | | |
| 29 | Albertkanaal | | X | | |
| 30 | Zuid-Willemsvaart | | X | | |

Although the WFD Article 5 reports and the contact persons gave a lot of information, it hardly deals with artificial water bodies. There seems little attention on canals in most countries. When the Member States started with the WFD, natural water bodies have the main priority. The priority to artificial waters came later. The implementation of WFD to artificial water bodies has just started. Next paragraphs give an overview of the current status related to the WFD objectives for canals in five countries for which some information was available.

## *2.2 WFD approach in Ireland*

Department of the Environment in Northern Ireland is responsible for leading the implementation of WFD [20] and Environment and Heritage Service (Northern Ireland) is the competent authority [21] The research Institue who is working on the WFD is SNIFFER and a response by e-mail from that institute is mentioned in texbox 4.

> The response from Gina Martin research coordinator of Scotland and Northern Ireland Forum for Environmental Research (SNIFFER):
> *Further to your query below SNIFFER is also currently running a research project to develop a canal classification tool for the UK and Republic of Ireland to support WFD implementation for UKTAG.The project is due for completion in the next couple of months and the report will be available to download free from our website.*

*Textbox 4-Response by coordinator from research institute SNIFFER*

### 2.2.1 General description and Article 5 report

The Inland Water Association of Ireland (IWAI) includes in its scope all the inland waterways of the island of Ireland. Those are canals, navigable rivers and lakes, other rivers, lakes, fens, bogs and watercourses. The Inland Waterways of Ireland will be protected, preserved and developed for the use and its enjoyment. Canals play an important role in Ireland's River Basin Districts (RBD) [22,23]. The RBD boundaries will not influence the ecological potential of canals, however for reporting purposes they will result in further subdivision of canals to allow for discrete water body reporting by each RBD to the European Commission.

Thirty-six canals were identified as artificial water bodies during the characterisation and analysis of Ireland RBD's for WFD Article 5 [24] Given their artificial nature a typology like that applied to natural rivers or lakes cannot be readily extended to canals. This is a problem for all Member States. It is not clear how Ireland handled this problem.

### 2.2.2 MEP-GEP process

Research institute SNIFFER (Scottish Northern Ireland Forum For Environmental Research) is working on the WFD implementation process for canals, so there is nothing to say about how Ireland defines the objectives MEP-GEP at this moment.

### 2.2.3 Projects related to the WFD

There is a SNIFFER research project to develop a WFD compliant canal classification tool.[25] EPA and Waterways Ireland are co-funding this project along with British Waterways, Scottish Environment Protection Agency (SEPA) and Environment Agency (EA). Outputs from this project include monitoring protocols and a classification tool which will influence how canals are managed for WFD in Ireland.[26]

Monitoring of most canals [27] is currently carried out by the Central Fisheries Board (CFB) on behalf of Waterways Ireland (WI), the owner of most of Ireland's canals, for their maintenance programme. Initial discussions between WI, EPA and CFB set out the anticipated additional work required to make the programme WFD compliant.

Ireland made a start with the implementation of the WFD on artificial water bodies, canals. The classification of canals is already mentioned in the WFD Article 5 report. The way Ireland handled with the WFD process and made choices is not described in that report. The organisations EPA and SNIFFER are nowadays developing the process of implementation and so on the WFD will get some boundaries about how to use it. So till now is not much known, just the canals are defined and there are some ideas about the monitoring programme.

## 2.3 WFD approach in Germany

In Germany, there is no central authority dealing with the WFD implementation. The 16 Federal States (= 'Länder') are responsible for the general water management issues along lakes, streams, rivers and canals - which include the implementation of the WFD. The Federal Ministry of "Environment, Nature Conservation and Nuclear Safety" (BMU) fulfills a co-ordinating role and has to take over responsibility for a successful German WFD-implementation towards the EC.

### 2.3.1 General description and Article 5 report

The article 5 report [28] and it contains the whole water body characterization in Germany [29]. Approximately 9,800 surface water bodies have been delineated in Germany. Approximately 2,250 water bodies (23%) have been provisionally identified as "heavily modified" and 1,400 (14%) have been identified as "artificial". This accounts for nearly 37% of all surface water bodies that have been assessed to date and translates into 30,000 km of streams, rivers and canals in Germany that have been provisionally identified as heavily modified, and an additional 10,000 km that have been designated as artificial waterways.

An aquatic atlas of the Federal Republic of Germany [30] shows that only 10 % of German water bodies are unmodified or only slightly modified. 30 % of water bodies are moderately to significantly modified, whilst the remaining 60 % are classified as structural quality class 5 or worse which means heavily, very heavily and completely modified.

A reaction of Dutch person Mr. Tolkamp who is active in international workgroups, (Waterschap Roer en Overmaas)

*In North Rhine Westfalen is meanwhile clear that one the classification natural vs. strongly changed will be whole reconsidered and will follow the approach much more such as Netherlands that has done. Try to contact with the responsible persons at the ministry of Umwelt etc (munlv) in Dusseldorf, There is still no concerning information about the mep/gep treatment for canals in Germany.*

*Textbox 5- Reaction from international workgroup about implementation in Germany*

### 2.3.2 MEP-GEP process

The way how to deal with the MEP-GEP for canals is not yet defined in Germany, so the approach in Germany can not be compared with the approach in Ireland or with an other Member States approach.

### 2.3.3 Projects related to the WFD

Länderarbeitsgemeinschaft Wasser (LAWA) [31] has elaborated a classification system that allows for the assessment of water body morphology. Of 33,000 km of watercourses assessed, only 20% are in a nearly natural state (ecomorphological classes 1, 2 and 3), while 33% are in a heavily modified state (ecomorphological classes 6 and 7). The morphology of water bodies in urban and intensively cultivated areas has been most drastically changed.

Germany has also to do with international river basin districts, an internationally commission to implement the WFD on the Rhine is: International Commission of Protection if the Rhine

(ICPR) [32] Also the catchement Ems-Dollars cross over the Germans boundaries on the side of The Netherlands. The catchment of Ems River basin is 18,000 km$^2$. The River Basin District Ems-Dollars has an area of 482 km$^2$. Important canals in that catchments area are Dortmund-Ems-Canal, Mittellandcanal, Küstencanal en Eemscanal. Six of the 235 water bodies (3%) is assignated as artificial in Nordrhein-Westfalen. That are parts of the Dortmund-Ems canal and of the Mittellandcanal. In the river basin of Niedersachsen are 102 of the 282 water bodies assignated as artificial, also the navigation canals.[33] More information than just the classifications in this catchement can not be found.

## *2.4 WFD approach in Austria*

Austrian territory discharges to three international river basin districts: Danube, Elbe and Rhine.[34] About 96% of the area is located in the catchment of the Danube (pilot project) and empties into the Black Sea, about 3% empty via the Rhine to the North Sea, approx. 1% empty via the Elbe into the Baltic Sea.

### 2.4.1 General description and Article 5 report

The network of running waters comprises some 100,000 km; a little fewer than 2,200 running water bodies have a catchment area of more than 10 km². There are more than 25,000 stagnant water bodies with a size exceeding 250 m². 2,142 of these water bodies have a size of more than 1 hectare, of which 38% have developed naturally and the remaining 62% were created by man.

First results of the identification of water bodies show that the relatively high share of "candidates for heavily modified water bodies" is on the one hand due to the intensive use of water power, on the other hand a consequence of the flood control measures required in alpine areas. Within the framework of the EU WFD Austria's water bodies were examined for the risk not to comply with the requirements of the WFD in the year 2015. 17% of the running waters were assigned to the category "no risk" and 41% to "at risk". For 42% of the running waters a risk classification was not possible. They were assigned to a third category ("risk not classifiable"). Austria is trying to comply with the ecological requirements of the European Union without questioning the utilisation of hydraulic power or flood control.

In the Article 5 report [35] and in other reports [36] nothing was mentioned about artificial water bodies.

### 2.4.2 MEP-GEP process

There was no information gathered about the MEP-GEP process for artificial water bodies.

### 2.4.3 Projects related to the WFD

The EU Water Framework Directive pertains to practically all fields of water management. Until 22 December 2003, the Directive has to be incorporated into national legislation, which will be done in Austria by amendment of the Water Act 1959. The key element of the "new" water law is the preparation, evaluation, and further development of water management planning to achieve and maintain environmental quality objectives for waters.
Moreover, first implementation steps made have already disclosed new challenges. Soon after the beginning of the discussion, it turned out that more precise definitions than supplied the WFD were needed. Particularly the present lack of data and information on the implementation measures to be taken contributes to a legal and investment uncertainty. In Austria, the WFD naturally hits the hydropower sector most strongly. Due to the considerable share of hydropower in power generation in this country, this sector demanded again a special status in the identification of water sections as "heavily modified water bodies" – last but not least for reasons of flood protection. A further need for coordination has occurred due to diverging developments in the interaction of the EU Water Framework Directive with the European climate protection objectives, the guideline for renewable energies, and the directive for the safeguarding of power supply. [37]

## 2.5 WFD approach in Scotland

The Scottish Executive's 2002 policy paper 'Scotland's Canals: an asset for the future' sets out their aspirations for Scotland's waterways. It considers canals to be a vital part of the country's future, which, through their full and sustainable development, should deliver benefits for the widest possible range of people. The Scottish Executive [38] is responsible for leading transposition process in corporation with the Scottish Environment Protection Agency (SEPA) [39]

### 2.5.1 General description and Article 5 report

The Industrial Revolution in the 18th and 19th centuries the need to transport coal and raw materials cheaply around the country led to that the river navigations being extended with the construction of artificial canals. However, with the coming of the railways just a few decades later, the network started to fall into decline. It was only in the second half of the 20th century that its recreational, heritage and environmental value was recognised and the decline arrested and restoration started. Nevertheless, this lack of past investment has led to the preservation of the unique cultural heritage of the waterways. The rich cultural heritage now underpins the waterway system as one of the most important recreation, leisure and tourism resources in the country.[40]

Mainly the pressures are worked out in the characterisation report of Scotland [41]. A clear distinction between natural, heavily modified and artificial water bodies could not be made at this moment. More information about the next step, monitoring the classified water bodies is still little known. The British Waterways (BW) and the SEPA are working on it, to ensure the WFD will be implemented in a correct way.

### 2.5.2 MEP-GEP process

The MEP-GEP process is still in development. It is assumed that SEPA will use their new licensing powers to regulate the use of water so that the water body meets its ecological objectives. This will have a significant cost impact on BW in terms of licence fees, environmental appraisal, mitigation, and monitoring and control. The impact of the new regulations is being discussed with SEPA so costs are not yet known. The cost of BW measures to meet the new ecological objectives will not be known until the objectives are defined. Until then, costs have been estimated based on scenarios.

### 2.5.3 Projects related to the WFD

British Waterways (BW) has a statutory duty to maintain its waterways in a navigable and a safe condition. This involves maintaining water levels within strict limits – a minimum level for navigation, and a maximum level for safety to avoid banks overtopping. Maintaining a minimum canal level requires feeding water from BW's water supplies when demand exceeds supplies from uncontrolled sources. This is normally the boating season (Easter to early November). [42]

Activities involving significant morphological alterations to water bodies include:

- maintenance (dredging, bank protection, aquatic weed control, dewatering, channel relining) provision or modification of customer facilities (online moorings and wharves, offlinemarinas)
- provision or modification of operational structures (weirs, barrages, intakes, outfalls, feeders, reservoirs)
- restoration of abandoned waterways and construction of new waterways.

Furthermore, boat traffic can affect ecological status through:

- erosion of banks by wash
- sediment disturbance and mechanical damage by the propeller
- turbidity arising from the above.

BW's water use in the context of the WFD is set out in the following table. [43]

*Table 3- British waterway's use in context of the WFD*

| WFD definition | BW water use |
|---|---|
| Water transfer and diversion | Water management |
| Significant morphological alterations to water bodies | Engineering operations |
| Other significant anthropogenic impacts | Boat traffic<br>Intensive fisheries |
| Abstraction, impoundment, storage, treatment and distribution of surface water or groundwater | Water sales |
| Waste water collection and treatment facilities which subsequently discharge into surface water | Drainage and waste water reception |

Of the categories of BW water use identified in Table 3, the use by boat traffic will be the most important. In recent years, the waterway network has been extended through the re-opening of a number of derelict canals. The most notable Scottish example is the Millennium Link project, which restored the navigable link between Glasgow and Edinburgh across the central belt via the Forth & Clyde and Union Canals in 2002. The Lowlands Canal system has only recently been restored to navigation. So the function shipping is the most important of canals.

## *2.6 WFD approach in England*

The Secretary of State for Environment, Food and Rural Affairs known as DEFRA has ultimate responsibility for implementation of the WFD [44] Furthermore is also the environment agency [45] using the WFD and are institute SNIFFER and UKTAG working in the UK to implement the WFD.

### 2.6.1 General description and Article 5 report

Britain's inland waterways [46] are extremely diverse and comprise a wide variety of natural and artificial watercourses[47]. Most of the system is non-tidal and consists of canals, and rivers which have been made navigable. About 70% of BW's waterways in Britain are canals. These are mostly artificial cuts, sometimes comprising sections of canalised river. Artificial canals have no natural catchments and are supplied with water using a system of reservoirs, natural lakes and river transfers. The remainder of the waterways is river navigations. They are natural rivers made navigable by the construction of weirs and/or channel reprofiling to provide a navigable depth. There are some tidal waterways, mainly naturally navigable rivers and their estuaries.
At present there are approximately 5100 km of fully navigable inland waters in England and Wales, about 450 km of which are tidal. The role of most non-tidal waterways has changed radically over the last 30 years. Having once been used mostly for freight transport, these waterways are now used chiefly for leisure and amenity. They are an important part of the country's heritage.[48]

### 2.6.2 MEP-GEP process

The British waterways WFD programme manager Mr. Newman had some difficulty finding others in Europe to discuss the WFD implementation for canals. Nevertheless, specific for England there are SNIFFER and UKTAG working on the WFD implementation. [49,50] They are also using the documents from the EC's Common Implementation Strategy (CIS) for the Water Framework. Projects are underway to develop a separate ecological classification tool for UK and Irish canals. The current situation how the country is dealing with the MEP-GEP process is unknown.

### 2.6.3 Projects related to the WFD

The WFD-UKTAG is the United Kingdom Technical Advisory Group (UKTAG) who is supporting the implementation of the European Community (EC) Water Framework Directive.[51] It is a partnership of the UK environment and conservation agencies. It also includes partners from the Republic of Ireland. UKTAG agreed priority sectors for the development of mitigation measures in January 2006. The sectors included: hydropower, water supply, flood defence,

navigation (canal) and ports. They have proposed an "Alternative Approach" based on defining Mitigation Measures, and the UK and Irish inland waterways sector is currently considering funding some research on this. Appendix II contains the headlines from research specification from UKTAG which was received by e-mail of Mr. Newman. These headlines give the following information in comparison with The Netherlands process:
Besides The Netherlands the United Kingdom research is executed on the implementation of the WFD on artificial water bodies. Summarized, it looks that the UK and The Netherlands are at the same stage to get the WFD approach implemented on canals. Unfortunately it could be possible that the Netherlands and the English researches are doing the same without knowing it of each other. They are inventing their own wheel on the way of implementing the Water Framework Directive. UKTAG wants to know the differences in outcome of the WFD process by the official or alternative approach by using it on several case studies. That could be also useful information for The Netherlands.

## 2.7 Discussion/conclusion

*How are other European countries interpreting and implementing the WFD to artificial waters, and more specifically canals?*

Unfortunately there is hardly any information available about the WFD implementation approach for artificial waters, canals in other Member States. Some research institutes have just started with projects related to canals. The classification of the artificial water bodies in countries is available from the Article 5 reports, but not always specific reference is made to canals.
The responses to the e-mails are mostly negative. The countries who reacted, refer to the official WFD site, have just started with the WFD process or there is no information at all. However the WFD site is containing no particular info of the WFD implementation process on canals.
Besides for The Netherlands there is some information found about the WFD implementation process for awb in the England, Ireland and Scotland. It is still too little for answering the research question. The process is still in development and the researches have just started so there are not yet reports available in how they want to use the WFD policies. The researches institutes who are investing for the WFD implementation on canals are still in the initiation phase.

Maybe, the relatively large effort of The Netherlands about how to comply with the WFD for canals, can be explained by the lack of natural water bodies and/or by its history in water management[52]. Other countries of the EU may learn from the working method from the Dutch and English; otherwise there is a short of time to implement the WFD on artificial water bodies, because the determined deadlines by the EU are soon.

# 3 WFD implementation in the Netherlands

The Water Framework Directive is introduced as one policy document, but it is not readily accessible to the users. There are many reports at different levels [53] with a lot of information. The user should read a lot before they are familiair with this whole new approach and process before they could implement the WFD on their own water bodies. The described WFD process is felt to be complex, can be interpreted in different ways and contains many aspects that require further elaboration. Moreover, implementing the WFD requires a lot of international co-ordination, and therefore a common understanding of its provisions is needed. For all these reasons, the European Commission and the Member States decided in May 2002 on a "Common Implementation Strategy" for the WFD. The guidance documents offer some guidance, but they need to be elaborated further for application within the specific national context. In this chapter several reports will be analyzed in relation to the Official WFD text to make clear what the WFD requires for artificial water bodies (AWB). The first paragraph is a continuation in more detail of chapter 1 with the River Basin Management Plans (RBMP) requirements related with the WFD Articles.

## 3.1 RBMP requirements and Guidances for the WFD process

The official WFD contains many tasks for the Member States, starting in 2000 and ending in 2015, 2021 or 2027. The planning cycle of the development of a RBMP is already shown in figure 1. It is a long process what should lead to a better aquatic environment across Europe. The EU commissions in Brussels are judging the results of the WFD process in a RBMP for the ecology of artificial water bodies on the contents of:

I the characterisation process required under WFD Article 5;
II the summary of significant pressures and impact of human activity on the status of surface water;
III a map of monitoring networks established for the purposes of Article 8 and Annex V and a presentation in map form of the results of the monitoring programmes carried out under the provisions for the status of surface water (ecological and chemical);
IV a summary of the programme or programmes of measures adopted under article 11, including the ways in which the objectives established under Article 4 are thereby to be achieved;
V description of disproportioned costs.

*Table 4- Planning of the main elements of the implementation process of the WFD*

| RBMP contents | Action | 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 |
|---|---|---|
| I | River Basin characteristics | |
| II<br>III<br>IV | Intercalibration<br>Setting the objectives<br>Monitoring<br>Design programme of measures | |
| V | RBMP<br>Implementation of measures | |

Each country should have submitted a RBMP in 2009, which satisfies the above WFD-related summarized action points. What has to be done is one thing, but to fill in the process to get the results is more difficult. The EU distributes reports guiding the implementation of the WFD. It improves the understanding of the policy and what the WFD process means. Figure 4 shows the different levels in which the WFD is worked out to understand the WFD process. Level 1 is the official WFD itself. The second level is the translation of the official WFD text by CIS workgroup and the third level is the Dutch translation of the CIS reports into the Dutch MEP-GEP Guidance. There are several appliances made to get a better implementation of the Dutch

MEP-GEP Guidance. Besides the MEP-GEP Guidance, derived from WFD and CIS The Netherlands also followed a separate approach, the Praagmatic Approach. Besides these reports STOWA and RIZA wrote in The Netherlands also assistance documents. The 'working group canals' in The Netherlands is using the Dutch assistance documents, but that will be discussed in chapter 4 and 5.

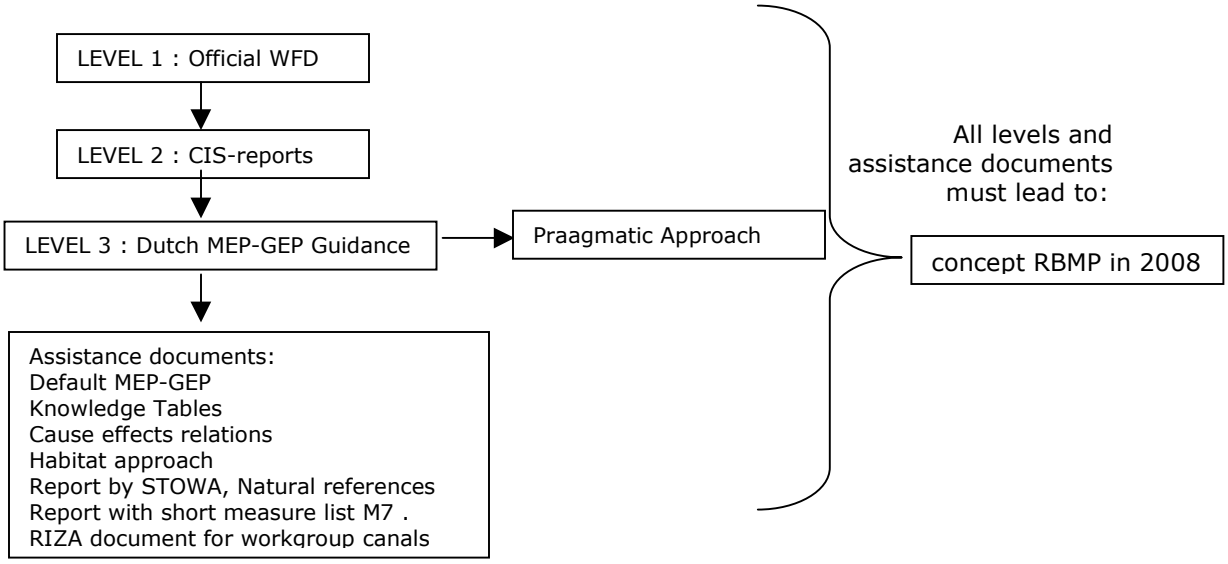



*Figure 4 – WFD reports [54] to produce a RBMP for AWB*

## 3.2 Official WFD text translated into CIS reports

The analysis of the relevant WFD reports starts with an overview of the official WFD articles and the CIS reports which water managers could use to work out the WFD process for an artificial water body. The WFD and CIS reports contain specific information, which could be used for producing a RBMP. The WFD articles and annexes will be compared with the CIS reports. The aims of it and what it means will be discussed.

### 3.2.1 Requirements to a RBMP & WFD articles & CIS reports

The official WFD framework is aiming all kind of water bodies. The results of the WFD process should be described in the RBMP in 2009. The WFD process started in 2000, but in 2003 and 2004 the characterization phase has been described. WFD Article 5 is useful for the start of this WFD implementation process. That is also the first requirement of what a RBMP must contain. Table 5 on the next page shows the requirements of a RBMP with the necessary WFD articles and the CIS reports, which can be used for artificial water bodies. The CIS reports are written by the Common Implementation Strategy workgroup to translate the official WFD text into minimal theoretical, but more practical way.

First the relevant RBMP requirements are discussed by means of the WFD articles and the translation of it in the CIS reports and their objectives. The CIS reports must be suited to the own situation in Member States. The analysis is to find connections but also to find differences between the reports of level 1 and level 2.

*Table 5 – RBMP requirements and WFD Articles and CIS reports*

| **RBMP requirement** | **Official WFD Level 1** | **CIS report Level 2** | **Dutch MEP-GEP Guidance Level 3** |
|---|---|---|---|
| I Characterization | WFD article 5 and Annex II, III | No. 2 Identification of Water Bodies (2003) No. 4 Identification and Designation of HMWB and AWB [55] | Describes RBMP requirement I, II, IV, V and VI in one framework, based on Cis report no 4, Identification and Designation of HMWB and AWB. |
| II significant pressures and impact of human activity on the status of surface water; | WFD article 5 | No. 3 Analysis of Pressures and Impacts Impress (2003) [56] | |
| III a map of monitoring networks; results of the monitoring programmes ; | article 8 and Annex V | No. 13 Overall Approach to the Classification (2005) [57] No. 7 Monitoring (2003) [58] | |
| IV the ways in which the objectives established | article 4 | No. 4 (2003) and No. 13 | |
| V summary of programmes of measures | article 11 | | |
| VI description of disproportioned costs. | | | |

The Official WFD is a document, which contains the general objectives. The CIS reports can be used as work documents. These reports are much more detailed and contain a lot more information about how to use the policy in practice. The following paragraphs are discussing first the differences between level 1 and 2, and furthermore the differences between level 3 and the Dutch translation of it into the Praagmatic Approach.

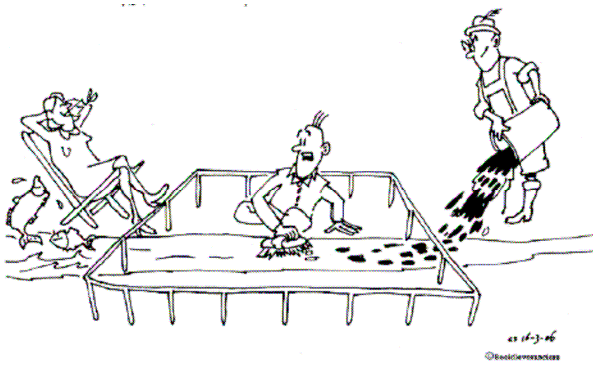


*Fig. 5- Example of the pressures on water body*

### *3.2.1.1 RBMP requirement I & II*

The RBMP requirements I and II lead to the river basin characterisation of the Official WFD and are described in Article 5 and annex II and III. The informal CIS reports no 2, 3 and 4 translates the policy to practical use and will be discussed shortly.

<u>Article 5 (undertaken 2003-2004) (key terms: characterisation, type, pressures and impacts analysis)</u>

River Basin Characterisation required by Article 5 of the Directive is an important early part of the WFD process for each RBD, it requires the following:

- An analysis of waterbodies characteristics;
- A review of the impact of human activity on the status of the water bodies within the RBD;
- An economic analysis of water use.

This article is already implemented by the Member States. The most attention goes to natural water bodies such as rivers, lakes, coastal zones and transitional waters in the Article 5 reports which have been made for Brussels in 2004. Unfortunately, canals which belong to AWB are hardly discussed.

Annex II and III
These annexes give some information about the characterisation. For artificial water bodies the most comparable natural surface water reference should be used. There is no further information about how to fill in Article 5.

CIS no 2 Identification of water bodies
The guidance gives an idea how to identify the water bodies, but it is very short for AWB's. There is just mentioned: "*Heavily modified and artificial water bodies must be (at least) provisionally identified during the characterization of surface waters*"[59]. And it contains a reference to annex II of the official WFD. An attention line in the report is: The methodology from this CIS Guidance Document must be adapted to regional and national circumstances. It should be clear that the identification of water bodies must be consistent and coordinated within a river basin district. In particular, international river basin districts need to develop common approaches for the whole river basin.
So it does not add concrete guidelines for implementation to the formal WFD text.

CIS no. 4 MEP-GEP Guidance for HMWB and AWB
The starting point of the MEP-GEP Guidance is: the ecological objectives for HMWB and AWB will be designated by regions on a uniform way. That means that the process must be clear, transparent and verifiable for citizens, EU and other participants.

The MEP-GEP Guidance could be a useful document to understand and to produce the requirements of a RBMP. The MEP-GEP Guidance for AWB describes a stepwise procedure which can be followed. The process of the guidance contains 14 steps. Step 1-9 is mainly characterization and defining water body and type. RQ C in chapter 4 and appendix III describe the several steps specific.

This report is a lot more specific than just the WFD Article 5. Annex II described more specific the definition of artificial water bodies, but not the whole designation process in steps as in the CIS report. The Netherlands designate and work out the process for AWB where the CIS report no 4 can be very useful for. The advantage of using the MEP-GEP Guidance is that it is translated to practice and easier to use (more feasible) than the official WFD text. It gives indeed more grip to the process of defining water bodies. The process is described in detail, but there is still room for own interpretation about how to use the definitions. For example the definition significant can be interpreted in several ways.

CIS no. 3 Guidance Analysis of pressures and impacts
The Official WFD text does not specify the required format or detailed content of the summary reports and publications on the pressures and impact analyses. However, the aim should be to promote consistency and transparency of implementation across Europe, encourage the active involvement of all interested parties and provide useful information for water managers and water users. To this end, this CIS report gives some examples of reporting and tried to define some key elements, for example significant pressure. So this gives more information to get a better use of the WFD.

#### *3.2.1.2 RBMP requirement III*
The third requirement of the RBMP asks for a monitoring programme. The CIS reports, which can help by implementing WFD Article 8 and Annex V, are CIS no 13 Overall Approach to the Classification of Ecological Status and Ecological Potential and CIS no 7 Monitoring under the WFD. These will be not discussed here, because these are not relevant for this thesis.

#### *3.2.1.3 RBMP requirement IV*
The next step is Article 4. This is related to how the designation of an artificial waterbody takes place. This RBMP requirement, the MEP-GEP process, is the most important for this thesis and will get more attention in the next chapters.

Article 4 artificial water bodies
Article 4 of the WFD sets out various requirements for making the programme of measures operational as specified within river basin plans for surface waters, ground water and

protected areas. This includes the ability to set alternative objectives to that of achieving 'good potential' by 2015 for individual water bodies by using a process of exemptions or the setting of minimal stringent objectives. Some objectives, which are set out in Article 4 of the directive are:

- Prevent deterioration in the status of all bodies of surface water and groundwater.
- Protect, enhance and restore all artificial and heavily modified bodies of surface water with the aim of achieving good ecological potential and good surface water chemical status by 2015.

Article 4(3) states that Member States may designate a water body as artificial. It is clear from the text of the Directive that the designation tests of Art. 4(3) apply to AWB as well as to HMWB. However the interpretation of Art. 4(3)(a) in relation to AWB is problematic. The restoration measures which must be identified to deliver GES is not possible for AWB. They were created in a location where no significant water existed before and therefore the HES natural condition would be dry land and a sensible GES could not be derived. Consequently it should be assumed that test 4.3a does not apply to AWB.

The second "designation test 4(3)(b)" does not impose interpretation difficulties when applied to most AWB and should be used as a designation test. Consequently, when designating AWB, it should be considered whether there are "other means" which can deliver the beneficial objectives of the AWB.
It should be noted that the application of the "designation test 4(3)(b)" for AWB does not aim at considering whether water bodies are artificial or natural (or HMWB). The designation test is applied in order to see whether there are "other means" to achieve a significantly better environmental option for example resulting in an improvement of the condition of the water body.

Cis guidance no 4
This guidance will also be used by Article 5. It describes the whole process to classify designation and produce a programme of measures for AWB in 14 steps.
The objectives of the MEP-GEP Guidance are:

1 insight in the development process of ecological aims
2 methodical approach and grip
3 information
4 insights in 'politicians' berths' and process of policy and decision making.

Step 7 and 8 of this guidance filled in the designation test for HMWB and AWB.
By step 10 and 11 the objectives MEP and GEP will be defined which results by step 12 to tests the possible measures. Step 13 and 14 ensures the effective and feasible measures which will be finally mentioned in the RBMP.

The framework of the designation process is not so clear that designation test 4.3.a not can be used for AWB. There are some examples of the term other means mentioned which can be used by test 4.3.b. This guidance shows all WFD articles together which must be used for the RBMP requirements. The huge amount of not relevant information for AWB in the WFD is omitted in this CIS guidance so it gives more clarity about what must be done for an AWB. The process for AWB is described totally in a step-by-step plan with the relevant designation tests of WFD articles. It gives more grip and a better understanding of what the WFD asks for AWB.

WFD CIS Guidance Document No. 13
Overall Approach to the Classification of Ecological Status and Ecological Potential
Generally, the assessment of whether a HMWB or an AWB is at MEP should start with an assessment of whether the condition of the hydromorphological quality elements is consistent with the condition expected for them if all mitigation measures were taken to ensure the best approximation to ecological continuum.
For HMWBs and AWBs, the values of the relevant biological quality elements at MEP, reflect, as far as possible given the MEP values for the hydromorphological and associated physicochemical conditions, those of the closest comparable surface water body type. For MEP, the hydromorphological conditions are consistent with the only impacts on the surface water

body being those resulting from the characteristics of the HMWB or AWB once all mitigation measures have been taken to ensure the best approximation to ecological continuum, in particular with respect to migration of fauna and appropriate spawning and breeding grounds.

For an HMWB or AWB to be classified as being at GEP there must be no more than slight changes in the values of the relevant biological quality elements as compared to their values at MEP. WFD Annex V, Section 1.4.2 (i, ii) requires that the ecological status/potential classification for a body of surface water be represented by the lower of the values for the biological and physico-chemical monitoring results for the relevant quality elements as indicated in Figure 2.

The indication of the relative roles of biological, hydromorphological and physico-chemical quality elements in ecological potential classification is according the normative definitions in WFD Annex V. The two upper classes MEP and GEP are combined for reporting purposes to good and above potential. (see figure 6) The monitoring results for the physico-chemical quality elements must therefore be taken into account when classifying surface water bodies. In the artificial waterbodies the hydromorphology is more important than the biological quality elements where the framework for all natural water categories starts with. The reference MEP for AWB is intended to describe the best approximation to a natural aquatic ecosystem that could be achieved given the hydromorphological characteristics that cannot be changed without significant adverse effects on the specified use or the wider environment. The definition significant is unclear in this document, there is referred to WFD CIS Guidance document No 4. Also with that document the term significant is still difficult to use in practice.

The WFD requires that Member States achieve an adequate level of confidence that water bodies are assigned to their true status. The level of confidence achieved must be reported in the RBMP's. If a water body is insufficient on an ecological quality element the classification scheme is one-out, all-out at the level of quality elements. The water manager must take action. Experiences are necessary to do it purposeful and effective. Unfortunately, stress factors are playing an unpredictable role in the ecology.

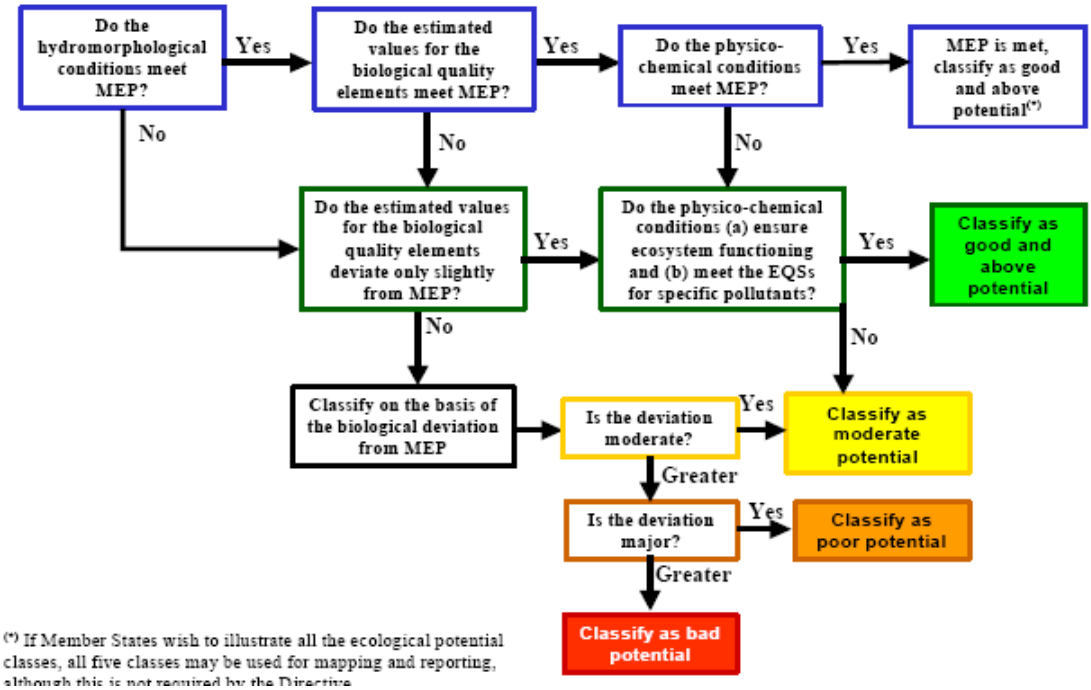



*Figure 6- Defining ecology in five classes for mapping and reporting*

The overall approach to the classification is necessary to understand the official WFD text. There is a lot of interaction between both reports. The CIS guidance gives examples and

makes clear that for AWB several exceptions have been made. The quality elements that must be used for classifications of AWB is comparable with rivers or lakes. This thirteenth report puts several reports together, but unfortunately also this document contains a high theoretical value with unspecified terms.

### *3.2.1.4 RBMP requirement V*

This requirement of the RBMP results in a summary of the programme of measures which will be mentioned in the RBMP finally.

Article 11 (key terms: Program of Measures, River Basin Planning)
Under Article 11 of the WFD, from 2006-2012, Member States will need to develop the Program of Measures (POMs) for each River Basin District (RBD). A Program of Measures will need to be developed for each River Basin District taking into consideration the results of characterisation and pressures and impact assessment. This work will be taken subsequent to river basin district planning.

The programme of measures will ensure that the respective environmental targets can be achieved. The selection of these measures should take account of cost-efficiency considerations, in order to find the least expensive way of reaching the WFD objectives.

CIS guidance no 4
Step 10 and 11, establish of MEP and GEP, of the CIS guidance no 4 gives an interpretation of the Official WFD text. It translates the Official WFD text into a process which is described by a framework which should be passed through.
The steps 10 and 11 are not part of the designation process. However, they are relevant to HMWB and AWB only and are therefore covered in the CIS MEP-GEP guidance document. They concern the definition of reference conditions and the setting of the environmental quality objectives for heavily modified and artificial water bodies. In step 10 the reference condition for HMWB and AWB, the Maximum Ecological Potential (MEP), is defined. Based on the MEP, the environmental quality objective, the Good Ecological Potential (GEP), is defined (step 11). Figure 7a shows one way of defining MEP and GEP.

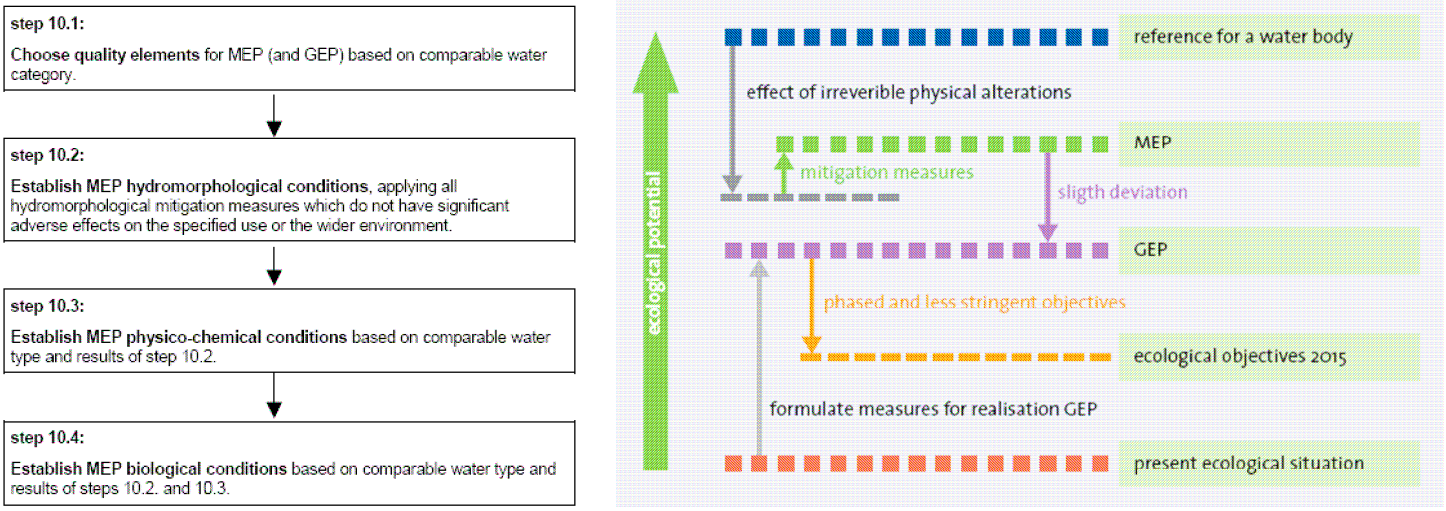



*Fig. 7a & b- Process for defining MEP (step 10 in CIS guidance no4) and overall scheme*

Figure 7b shows the overall scheme to define MEP and GEP which is filled in by CIS. In the case of artificial water bodies, the concept of 'physical alterations' is irrelevant. An artificial water body is one that has been created by man in the first instance and reversing any alterations will not restore it to its natural condition. They are therefore regarded as irreversible by definition. However, the authority must still seek to identify mitigation measures before the MEP can be established. The problem is that some artificial water bodies, like ditches and canals, are not really comparable to any kind of natural water body. In their

case, the reference condition can be taken to be that of the best ditches and canals. The term slight deviation is not defined. The overall scheme is also mentioned in the Dutch MEP-GEP Guidance. The Netherlands make even of this Dutch guidance document a new document with its own interpretation, named the Praagmatic approach.

### 3.2.2 Differences between the Official WFD and CIS reports.

There are many reports made by CIS to make the Official WFD text and its Articles feasible. The CIS reports focus itself on a separate component but contain also a lot of references to the Official WFD Articles and annexes. The focuses are still of high theoretical value with not specified terms. The CIS reports are not easy to deal with, because the formal describtions, thickness of the reports and many links to the Official text. Nevertheless, the CIS reports are useful for a better understanding of what the WFD is meaning and what it requires. Unfortunately, all these documents are focussed on rivers, lakes, coastal zones and transitional zones. There is just one report, Cis no 4, which is specially made for HMWB and AWB. The Official WFD text is translated into a framework with 14 steps (see table 6). The processes for AWB is correctly described in CIS document no 4, but the link to other CIS documents is unknown, for example monitoring. Just one natural reference for the biological quality elements of an AWB can be used by the implementation of the several CIS reports. A disadvantage is that it is not comparable with the real situation of a canal and mostly there is little monitoring data on canals available. The other water body types are more important and there are more possibilities to improve their aquatic environment. The WFD should be firstly correct implemented on natural water bodies (rivers, lakes, coastal and transitional zones), because Brussels is still working on what specific should be done for AWB.

## *3.3 Cis report no 4 translated into Dutch MEP-GEP Guidance*

The CIS guidance no.4 is suited to the Dutch situation and resulted in the Dutch MEP-GEP Guidance. That Guideline has been drawn up by representatives of regional and national water management authorities, provinces, and the relevant ministries (Transport, Public Works and Water Management; RIZA;, STOWA; Spatial Planning and the Environment; and Agriculture, Nature and Food Quality).

The Dutch MEP-GEP Guideline stipulates that the MEP must only take account of mitigation measures which are genuinely relevant and likely to have a substantial effect. This will ensure that ecological objectives are both feasible and achievable. It will frequently not be necessary to implement all the measures. The authority should identify the optimum combination of measures affecting physical characteristics. It should then determine the priority to be given to each measure and the level of scale at which it will be most effective (ranging, for example, from individual water body to complete river basin).

The decision to adopt a particular package of measures should be based on an assessment of the socioeconomic pros and cons. This will naturally allow considerable scope for political choices. If measures are not achievable, or are not regarded as affordable, the member state can apply 'exemptions' which allow the GEP to be achieved at a later date or minimal stringent objectives to be adopted. Once you know the GEP, you can decide whether the water body is already fulfilling it. Or, better still, whether the GEP will be achieved by 2015, based on expected developments in the area and the measures to be taken. If so, this only needs to be properly explained in the preparation report for the River Basin Management Plan 2009. After 2009, however, the reasons for designating the water body as 'AWB' have to be reviewed every six years.

## *3.4 Several levels of WFD translations*

The official WFD policy is a theoretical document with some space for own interpretations. This policy appoints new requirements to RBMP. The workgroup CIS made several CIS reports to make the implementation of the WFD much easier for the policy makers who must write the RBMP. The space for own interpretation in the defined framework ensures some flexibility during the WFD implementation process. Instead of just using that space, The Netherlands made another approach to improve the implementation process more than the CIS workgroups has done. The Praagmatic approach is yet not approved.

The alternative approach was proposed during a CIS Workshop on hydromorphology and the Water Framework Directive held in Prague in October 2005.[60] The Praagmatic approach is defined by WFD SSG WFD&hydromorphology and by ECOSTAT. The new approach should be more transparent and will be easier to explain to managers. Nevertheless the role and description of the ecology is still difficult.

### 3.4.1 Official WFD Approach and Praagmatic Approach

The Netherlands presented the Praagmatic approach, where the starting point is the current situation instead of a reference. The advantage is that the difference between the current situation and the MEP is exactly the effects of all possible measures. Designation of GEP is possible through top down and bottom up approach. The top-down approach is outgoing of a natural reference and outgoing of the current situation is the bottom up approach.
The measures, which could be taken, are in both methods depending on the fact if they have negative influence on the functions and if they effect the environment negatively. In the first place the possibilities are not depending on the costs. Figure 8 and 9 shows the approaches.

Both approaches are not different between just top-down and bottom-up, but more between theoretical and practical approach. Starting from the present biological situation and add up the effects of measures is easier to use for every water body. It could give minimal amount of work, but the ambition and the MEP-GEP should be still the same.

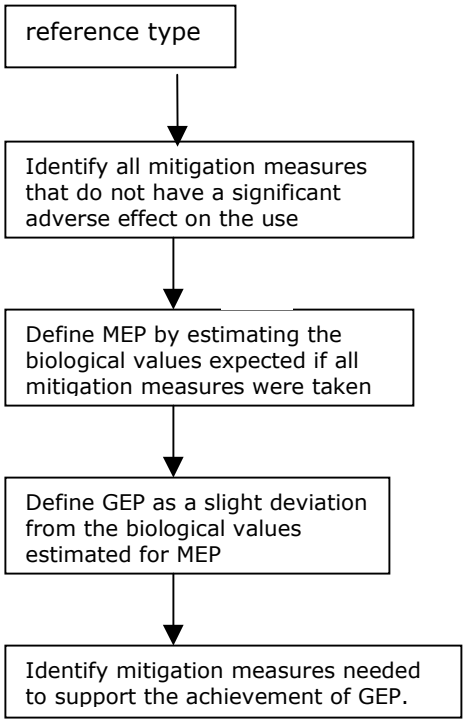



*Fig. 8 - Official WFD approach*

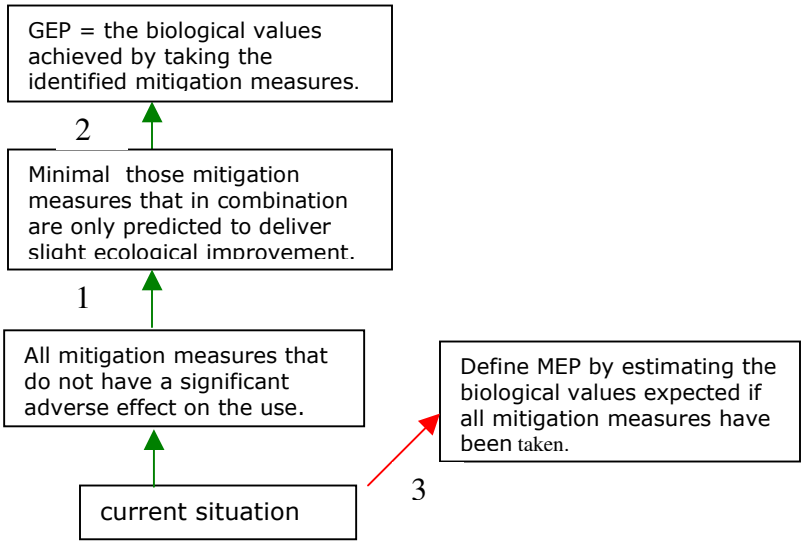



*Fig. 9- Nature of Praagmatic approach*

### 3.4.2 Comparision of the steps in level 2, 3 and variant level 3

All the translations of the Official WFD text produce a new step-by-step plan. Table 6 shows the steps in the CIS guidance report, in the Dutch MEP-GEP guidance and in the Praagmatic approach.

*Table 6- Overview of steps in the WFD Guidances level 2, level 3 and variant level 3.*

| **Level 2, CIS no 4 MEP-GEP guidance [61]** | **Level 3, Dutch translation, MEP-GEP guidance [62]** | **Variant level 3, Praagmatic approach** |
|---|---|---|
| Water bodies<br>1 identification water bodies<br>2 identification of AWB | Water bodies<br>1 Bordering,<br>2 test on artificial,<br>3 reference for water body | Characterizing<br>1 Bordering and grouping<br>2 Analyse functions and pressures<br>3 (hydro, fysical-chemical, biological) effects of pressures |
| 3 description of hydromorphology changes<br>4 significant changes in hydromorphology<br>5 estimation of GEP, risk assessment<br>6 likelihood of failing GEP identification | Interventionss<br>4 Inventorise interventions<br>5 Test on restoration measures<br>6 Test on other means | Measures<br>4 Analyse all measures ( establishment, management and emissions)<br>5 Select on non significant side effects<br>6 Assess effects of the selected measures |
| 7 designation test<br>8 designation test<br>9 designation as AWB or HMWB | Classifying status<br>7 Test on mitigation measures<br>8 Derive MEP<br>9 Derive GEP | Classifying Status<br>7 Designation test on AWB<br>8 Test on feasibility GET<br>9 designation as AWB or HMWB |
| 10 Establishment of MEP<br>11 Establishment of GEP | Measures<br>10 Social-economical feasible measures<br>11 Test to GEP<br>12 Derogation | MEP-GEP<br>10 Derive MEP<br>11 Derive GEP<br>12 Designate norm for physical-chemical quality elements |
| Draft RBMP | 13 Policy variants/objectives<br>14 Draft RBMP | 13 Policy variants/objectives<br>14 Draft RBMP |

The official WFD text (level 1) is translated in a Dutch work document 'Guidance document MEP-GEP for artificial waters' (level 3). The implementation process is defined in that document by 14 steps. During the first try-outs it was difficult to use the top-down approach, where the Dutch servants made a different approach. They specified and interpreted the CIS report (level 2) and official WFD (level 1) on its own way to a Praagmatic approach (variant level 3).
Mainly the order of steps is changed by that new approach which makes it easier to use the approach in practice. The suggested Praagmatic approach aims to AWB:

- minimise the amount of work involved in the designation of AWB; and
- ensure that the purpose of the WFD in protecting and enhancing the water environment is delivered.

So a different method, "Praagmatic approach", has been made in 2005 to get a better understanding of the process. In both methods almost the same steps will be made, but some in a different order. Mainly step 10 and 11, define measures to achieve GEP, are different in the Praagmatic approach. Both approaches should lead to a definition of Maximum Ecological Potential and Good Ecological Potential, the most optimal ecological situation. The 'Praagmatic' approach is not an official method; the EU in Brussels does not yet approve it. The difference between the two methods can be described as follows:

1. Official WFD approach (top-down)
It starts with defining MEP from a natural reference. Thereby the effects of irreversible hydro morphological interventions from the past and convalescence and mitigating measures will be worked out in this process.

2. Praagmatic approach (bottom-up)
It starts with describing the current situation from which the MEP will be derived. In the process to define the MEP, the effects of all possible measures without negative effects on function and environment will be taken into consideration.

These are two different methods for defining the MEP-GEP. The second approach has no preset ambition level, but is more targeted on the practical feasibility instead of the theory. The

second method is easier to use for artificial water bodies, because there is no natural reference. Starting from the current situation instead of a fictive natural situation is more realistic for canals. The difference between the present situation and the MEP is the same as the effects of all possible measures (institution, management and emissions) without a negative effect on the function and environment.

Two different approaches do not ensure the coherence between the several Member States. Besides that, the Member States may have different ambitions, which could lead to different results. Nevertheless, by means of the RBMP's, the judgement of Brussels is based on the efforts instead of results. That is more realistic, because the effects of the mitigation measures on the ecology are uncertain and there could be minimal improvement while countries have done a lot. Nevertheless, the defined GEP should be reached in 2015, otherwise in 2021 or 2027. That suggests formulating a not very high level of MEP in a not too progressive RBMP whereon Brussels will justify regardless which approach wil be used.

### 3.4.3 Overall vision and discussion about Praagmatic Approach

The aim of the 'Praagmatic approach' is to simplify the process of identifying the ecological objectives (MEP-GEP) for artificial water bodies. The official WFD approach was: 'which interventions are reversible to get the referential value back'. While the currently Praagmatic approach is: 'what kind of measures could we carry out to get a better ecological environment'. An advantage of this approach is the minimal complicated way for formulating the objectives. It has also a more positive input: 'what can we do instead of what are we not going to do'. Thereby is the communication with the stakeholders easier and stays the ambition on the same level. That is because the MEP-GEP is still depending on the following management consideration [63-64]:

- "wider environment" would be significantly adversely affected by the restoration and management measures required to achieve good ecological status;
- Functions would be significantly adversely affected by the restoration and management measures required to achieve good ecological status;
- The possibility to fulfill the function in a different way.

These management considerations do not ensure the same objective GEP. First of all, two different approaches without having the same starting point will probably not have the same results. It is said that the resemblances of the official WFD approach and the pragmatic approach are [65]:

- the MEP-GEP (also the ambition) is the same
- testing the effects on the environment
- costs of measures is still in the phase by leveling the objectives.

Just by the first resemblance will be the marginal note: is that possible? In two tables below the MEP and GEP defining process by the Official WFD and Praagmatic approach is showed.

*Table 7- Process in the Official WFD Approach*

| Level 1 : Official WFD approach | |
|---|---|
| Most comparable natural reference for each indicator<br>Minus the irreversible physical alterations<br>Plus the mitigation measures | = MEP |
| Measures with no negative effects on function and environment | |
| Slight deviation | = GEP |
| Just cost effective measures in 2015 and phasing disproportionate costs | Policy target |

In the Netherlands a value of 25% will be used for the definition slight deviation from MEP to GEP and instead of choosing the most comparable reference, there will be used just one reference. The mention was to use reference M7, but that is not being to work out in detail any more (January 2007). So the natural reference M20 with the class boundaries from the STOWA report [66] must be used as a reference. There should be also a more realistic

reference for canals and not M20 should be used. The class boundaries of the biological quality elements of M20 will be very much too high for the current situation of artificial water bodies which results in bad or even poor potential. Even in the future it will very hard, almost impossible to reach the mentioned values of the M20.

*Table 8- Process in the Praagmatic Approach*

| Variant of level 3: Praagmatic approach | |
|---|---|
| Current situation | |
| All measures without negatives effects on function and environment | = MEP |
| Minus the measures with minimal influences | = GEP |
| Just cost effective measures in 2015 and phasing disproportionate costs to 2021 or 2027 | Policy target (levelling the objectives) |

The Praagmatic approach starts at the current situation which is bottom up, instead of top down by the official WFD. For a canal (AWB) it will be more realistic to start with the real situation instead of an unrealistic, fictive reference. As the gap between the natural reference and the reality is huge, it will be certain make sense which approach will be used. The official approach will be in that situation more strictly, have a harder, higher MEP than that will be reached by the Praagmatic approach. The defined objective GEP by Official WFD approach and the Praagmatic approach will not reach the same level.

## 3.5 National WFD implementation meetings

An impression of the international way of the WFD process for artificial water bodies is given in the previous part. This paragraph will discuss the Dutch way of handling the WFD and the mentioned reports in figure 4 related to an artificial water body.
The official WFD text and its translation in CIS reports and Dutch documents could be difficult to use. National meetings could help the users of the documents with the implementation on their own water body. There are meetings organized by STOWA, RIZA, WL Delft Hydraulics and some consultancies. Discussions and presentations during national meetings gave more information and a better understanding of the WFD. Furthermore, the obeservations give the impression that the WFD procedure is an entangled process and several reports are developed.

This kind of meetings are necessary to get the WFD policies implemented and keep the coherency between the several stakeholders. Also the enthusiasm and the attitude of the stakeholders in relation to the WFD become clear.

### 3.5.1 Findings from questionnaires by WFD congress June 20th

On 20-06-2006 RIZA and DHV organised a national meeting in Amersfoort with more than 100 attendents, from water boards, directorate generals, water managers and engineers. The participants filled out a questions form made by RIZA during that day. Appendix III contains that questionar. The questions were related to the WFD in general and not specific to artificial water bodies. Some questions are discussed in this paragraph to give an impression of the attitudes and overall idea of the implementation of the WFD and its experiences in the Netherlands.
The participants consider the water and pollution problems as international problems. They are prepared to make investments to improve the environment. The WFD must not seen as a duty from Brussels, it is for our own good. Most of the participants (56 %) agreed that an analysis of the costs effectiveness of measures to reach a good selection of measures is for their own benefit and not just for Brussels. In the beginning, the social and ecological effects of the measures are more important than the costs. The WFD finds it more important to first assess the measures on the base of having no negative effects both on function and wider environment. So the feasibility of measures will not be assessed on costs. The analysis of the cost effectiveness of the measures could be the final arguments to choose a variant. That will be mainly for the managers themselves to reach the best selection of measures.

The answer of a question where a report mark for the WFD process so far should be given was just a four on a scale of 10. Furthermore what the attendents annoyed the most was the harmonisation directorate general and region. These answers give a negative view of the recent process. The implementation of the WFD requires a very good communication between several participants. The water managers and other participants with other interests should cooporate to produce a coherent river basin management plan wherein the necessary parts of WFD are worked out.
The directorate should produce clear frameworks for the regions, while the regions and the directorates also want freedom for regionally situations. Furthermore, the Directorate wants that the region accepts the taken decisions about water policies. Too many obligations are not favourable for harmonisation, interaction is more desired.
The civil servants enjoyed the cooperation within the river basin the most (58%). So the integral approach leads to two views. One part is negative about the necessary harmonisation, while the other part is positive about the cooporation. The communication is an essential part of the WFD process. Several participants should work together to get one realistic RBMP.

The WFD asks other and specific information of a water body for the new river basin management plans in 2009. 44% of the participants believe that it will lead to more administrative difficulties, especially when different methods will be used; that should be integrated in one RBMP. The WFD has minimal engagement, but what is described in the RBMP, must be worked out. AN opnion is that it will be easier to implement the WFD when there is more flexibility for each region. The bottom-up approach is giving more possibilities and flexibility to a region. This approach is prefered for 66%. A consequence is that the coherency on national level could be lost.

### 3.5.2 Findings from observing workshop September 19th,2006

STOWA organises also meetings and coordinates the WFD implementation process[67] in the Netherlands. The first national meeting was on 14-02-2005. The second practice day on 19-09-2006 was observed to get an idea of the problems and current status of the WFD process.

Representatives of water boards, public authorities, provinces, regions and consultancies discussed the experiences of the Dutch guidance MEP-GEP and its applications with each other during this national meeting organized by STOWA at the Boarded Zuiderzee at Lelystad. The objective of this national MEP-GEP implementation day was to inform the participants, exchange knowledge and experiences and discuss problems of the WFD process. The morning part started with presentations to inform the participants about the Dutch MEP-GEP Guidance (level 3). In the afternoon there was a discussion forum.
In the morning part some presentations lead to discussion, which are interesting for this thesis. Mr. D. vd Molen (RIZA) discussed the choice between the official WFD approach and Praagmatic approach. The textbox contains a question with answer out of his presentation and a remark from the public.

'*Question*: Official WFD or Praagmatic approach?'
*Facts*: 6 water managers choose official WFD approach
2 water managers choose Praagmatic
2 water managers choose a combination of both
*Conclusion*: The opinions are divided.

Remark:Interpretation of Mr. vd Molen: It does not matter which approach you will use. Both should lead to the same level of MEP and GEP. The most important thing is that the process will lead to information for the RBMP and is requirements.

*Textbox 6- Information from sheet of presentation by someone from RIZA*

Furthermore the participants of this meeting reacted that the requirements have terms which are not filled in yet. Mainly slight deviation, disproportionate costs and the effects of the measures are still unclear. The term significant is unclear defined. Also it will already improve if there will be an expert judgement and not just by a politician.
The announcer Mr. vd Molen admit the problem about the undefined terms by classifying status and arguments for a kind of MEP-GEP level immediately. Perhaps for the slight deviation from MEP to GEP in the Official approach a percentage of 25% could be used. That

levels the unrealistic reference for an AWB. The advantage of Praagmatic approach is that the MEP is defined in an other way. Instead of a fictive reference the current situation will be used and just the possible measures leads to GEP. In the next step to define the measures the term disproportionate is be used. That is still a political discussion. Also the cost effectiveness of measures should be known, but this is difficult to predict. So it is unknown what the GEP with a package of measures will be exactly. Using the current mathematical calculations for the effects on ecology for each water body specific is too much work and has still uncertainties. In a general way it should be visible what the significant effects are of measures so also politicians understand the situation. There should be more information about the effects of measures for political discussions before clear arguments for the GEP and measures in a RBMP to Brussels can be formulated. It will improve the decision process. So defining MEP and GEP regardless which approach will be used has still a lot of uncertainties about if it would be possible to reach the objective GEP with the defined measures, but that does not mean that there can not be done anything. Nevertheless, as Brussels defines the terms more specific it could give more support on how to fill in the process.
Also during this meeting it became clear that communication between stakeholders is important for the process. Brussels is not given more information in a short time. The CIS reports and the Dutch MEP-GEP guidance with its appliances should be enough to work out the WFD process. The raised questions should be answered during those meetings and by the helpdesk. Thereby the water managers simply must start with one approach. During the process there could be some problems noticed, but not immediately in advance.

At the end the focus on the MEP-GEP will be minimal. More important will be the results of the measures and what it means for the environment. That the ecology actually will improve through the measures and the involved participants want to see result in its own surroundings. Just Brussels is interested in the first steps of the WFD process whereby the MEP and GEP should be defined. The discussion about approval by Brussles is unnecessary. The WFD allows own interpretations. So just take the first obstacles of the guidance, but ensure that there are arguments in a transparency way.

### 3.5.3 Conclusions from questions form and workshop

The impression from the questions form and the national workshop is that everyone has a positive attitude for the intention of the WFD to improve the environment, but the translation of the WFD to reality is hard and the amount and sizes of the reports makes it scaring. The documents could be theoritically correct, but are not useful in an easy way at this moment. An example: It was not clear for everyone that the costs are not the most important for the WFD. Costs are important in the phase to get from the objective GEP to the policy target. What counts for the WFD is that measures should have no effects on the functions and environment.

The WFD reports ask a lot of reading and doing it in practice. The WFD is all new to everyone so there is little experience, but meetings should improve the knowledge exchanges. Furthermore Brussels is not clear enough about some terms (slight deviation, significantly, disproportionate) in the WFD process. The participants did not know if there is just room for own interpretation or what is meant exactly by some definitions. Everyone is searching for its own about how to deal with the process, definitions and its uncertanties. It stagnates the progress of the process, but information and experiences could be exchanged during meetings. The attendants are learning by doing to get the WFD process implemented. Also the Praagmatic approach is still not clear enough to use in practice. Just like the Official WFD approach, the Praagmatic approach is a theoretical policy which leads to obscurities.
The second practice day ended with several recommendations for DWS, policy makers and attendents:

- Offer grip for explanation to policy makers and politicians.
- Make a general factsheet or checklist about what Brussels wants.

A possible checklist of Brussels made by DWS:
Designation status
Consideration of all measures
The process which leads to the definitive measures
Chemistry restricts not
Ecological objectives
Description of dispropriate costs

- Give clarity about 'slight deviation' and 'dispropriate costs'
- Give clarity about the Praagmatic method or the Official WFD approach, is it still without engagement or is a more national control in development?
- Communicate about international developments and interpretations
- Stimulate knowledge development concerning measures-effect relations.
- Make a mutual comparison or collegial test
- Improve the exchange of knowledge

These recommendations could improve the understanding and use of the MEP-GEP Guidance in practice. Some definitions of the WFD will be discussed in the 'Decembernota 2006'. Others are still not known. That should not be a reason for not starting yet with the WFD process, because the time for the whole process is already too short. The arguments and transparency of choices is most important. Brussels will control the whole process. They will be satisfied as the process carried out is transparent and the RBMP requirements are fulfilled. It is rather unlikely that Brussels will control every water body in the Member States in detail. The WFD is there for our own good and the recommended checklist could help to understand what should be produced through the WFD process.

## 3.6 Discussion and Conclusions

*Research question B: What does the WFD require and how is the official WFD text interpreted the Dutch document, 'MEP-GEP Guidance for artificial waters, canals.'?*

The WFD is a framework recognising that ecology cannot be managed using one fixed set of norms in a directive. The official WFD text is formal and short which makes it inaccessible to use in practice. It is translated into CIS guidances to make it useable in practice. The time period and the steps of the process have been decisively described.
The work documents made by CIS, describe the WFD process, but it still has a lot of room for own interpretations. Mainly for the development of measures and assessments. Some criteria and indications (cost effectiveness or disproportioned) are given, but these can be filled in its own way by each Member State. Figure 4 and Table 9 gives an overview of the translations of the Official WFD to make it workable and what choices are made during the several translations.

*Table 9- Translations of the Official WFD and its contents*

| **Translations** | **Contents** | **Comment** |
|---|---|---|
| Official WFD | Articles and annexes | Theoretical and short |
| From Official WFD to CIS reports | The terms and framework are defined and process is filled in, to implement the WFD in a situation.. | More useful in practice but very long guidances. And there must be worked with a natural reference, which will be difficult for AWB. |
| From Official WFD to CIS report no 4 MEP-GEP for AWB | Defined the process and put WFD Articles and Annexes together in one framework specific for AWB | Describes specific the process for AWB on a feasible way, but still terms are not defined. |
| From Cis no 4 to Dutch MEP-GEP guidance | The AWB framework and works with one natural reference for all biological quality elements (M7 and M20) and the term slight deviation is filled in with 25%. | The suited MEP-GEP Guidance to Dutch situations is still difficult to use in practice and what means 25% exactly? |

| | | |
|---|---|---|
| From Dutch MEP-GEP Guidance to Praagmatic Approach | The AWB framework with the current situation as starting point | A shorter and easier work method, Praagmatic approach, is introduced, but the terms significant and irreversible are still no filled in. The December Nota 2006 should gave clearity. |

Transparency in the MEP-GEP process is very important, because Brussels must understand the decision process. Some flexibility could be useful in practice because the artificial water bodies differ from each other. Unfortunately the current freedom is not stimulating the progress of the WFD process. If everyone makes its own translation the process is more fragmented and there is little coherency. While the target of the WFD is to get more progress by a strucured, minimal fragmented process than in the older water legislations.

The guidances will be difficult to use for managers and interesting organisations that are not familiar with the ecological measures. It described the whole process in detail, but how to deal with is for own interpretation. The Dutch MEP-GEP guidance has been following two ideas:

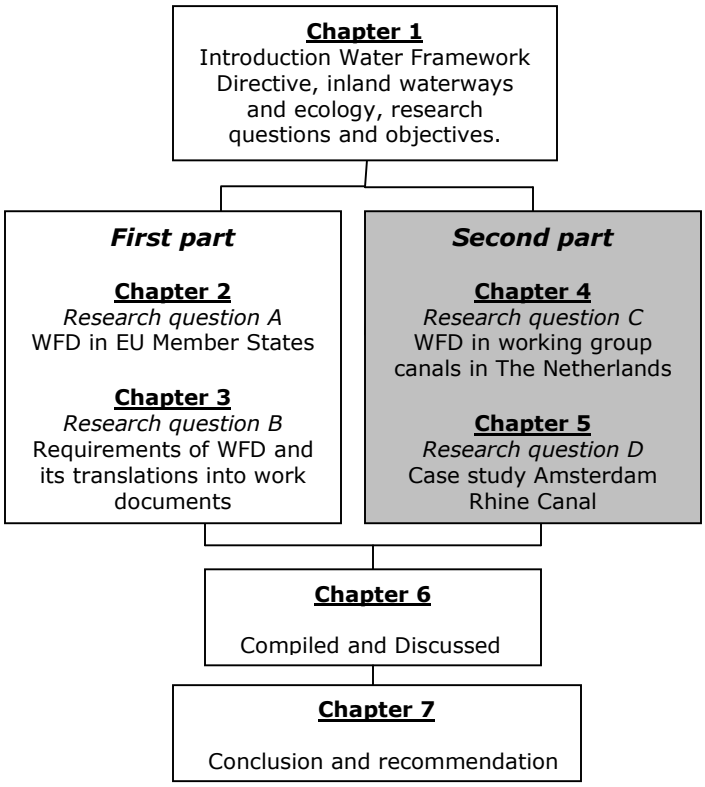
- to be specific
- open end with room for own interpretation (significant, slight deviation, disproportioned)

Despite the detailed step-by-step procedure the CIS Guidance no4, Dutch MEP-GEP Guidance and the Praagmatic Approach describe, the guidelines allow considerable scope for individual interpretation. The definition of the terms: main functions, significant, slight changes and disproportional could be different in each situation. Comparable or similar results could be difficult to reach with this open process.

Mainly the room for own interpretations ensures difficulties. Just by observing the workshops it became clear that even representatives do not understand the whole WFD process. The WFD process is described in detail and some examples are given in the CIS reports, but the interpretation of it is nearly entirely to own insight. There is already a separate interpretation in The Netherlands of the official WFD, CIS guidance no 4 and Dutch MEP-GEP Guidance, named the Praagmatic Approach. This approach should be easier to understand for a wider public and costs relatively little time. The Netherlands will use the Praagmatic Approach to implement the WFD. It is uncertain whether the same level of GEP will be reached as by the official WFD approach. Probably both approaches will not lead to the same objectives.

An advantage of the MEP-GEP process is it ensures that choices can be made on an objective way. The decisions are not just depending on the knowledge of ecological experts and their opinion. The WFD and the MEP-GEP Guidance stimulates thinking about the water system with several stakeholders in a transparent way. It will be easier to communicate with the public and politicians about the necessarity of some measures. but it should not become too bureaucratically. The official WFD and many CIS reports made it to be feel a complex process. Thereby, which approach will be used is just a choice. The main thing is to improve the ecology, water quality and quantity through whole Europe on a more objective way than in the past.

Second part: Working group canals to implement the Dutch MEP-GEP Guidance & Praagmatic Approach to Artificial Water Bodies nationally and Amsterdam Rhine Canal.



# 4 WFD process for AWB in The Netherlands

This chapter describes how the Dutch MEP-GEP Guidance for AWB is implemented on 12 canals in The Netherlands by members of the working group canals and consultancy Witteveen+Bos.

## 4.1 Working group canals

A very large number of water bodies will have to be assessed for possible designation as HMWB or AWB between now and 2008-2009. (Publication of the first draft/final RBMP). It will be important to ensure that the approaches and methods used for the designation process are practicable and comparable.[68] CIS report no 4 is translated and adapted on the Dutch situations by RIZA and STOWA and resulted in a Dutch MEP-Gep Guidance. Both reports are discussed in Chapter 3. As a variant on that third report is the Praagmatic Approach created and has RIZA made a fourth document to fill in the MEP-GEP Guidance process for canals. Figure 11 shows the framework where just the RIZA document is new, compared with Figure 4 in Chapter 3.

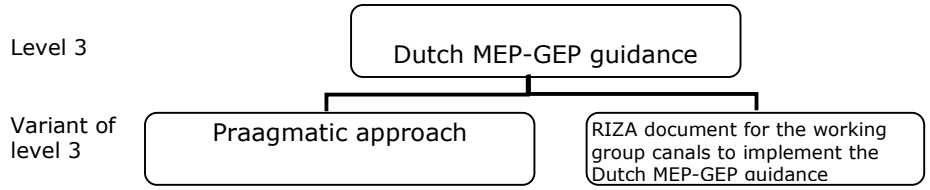



*Figure 11 Part of the framework of the WFD reports which are describing the WFD implementation process*

Each Regional Directorate for Public Works and Water Management [69] will be actively involved in the implementation of the WFD and could use all reports which are mentioned in figure 11 for their designation of artificial water bodies. The classifications of water bodies were made in 2004. The government classified water bodies as artificial, some of which are defined to describe canal (see appendix IV), and so the working group canals could be formed. The national WFD projectgroup asked all Directorates with a huge inland waterway to participate in a workgroup canals so all knowledge can be used and exchanged. The working group canals has the target to create together a MEP-GEP with coherency.

The working group canals implement the Dutch MEP-GEP Guidance process on twelve artificial waterbodies, canals in The Netherlands. Besides the managers of the water bodies is the consultancy Witteveen+Bos a member of the working group canals. The consultancy makes a plan of measures by using a step-by-step approach which will be presented and discussed in the working group. (appendix IV contains the order) In advance the Praagmatic approach will be used by Witteveen+Bos to implement the WFD to canals. The Directorate for Public Works and Water Management Utrecht is responsible for the application of the 'Dutch MEP-GEP Guidance for AWB' or 'Praagmatic Approach' on the Amsterdam Rhine Canal, which will be the main topic by Research Question D in chapter 5. The other artificial water bodies which will be discussed in the working group canals are mentioned in appendix IV.

## 4.2 WFD Approach by working group canals

The following paragraphs are considering the WFD into practice and shows how the working group canals and consultancy Witteveen+Bos are dealing with it.

### 4.2.1 Approach to define MEP - GEP for 12 canals

The steps of the MEP-GEP guidance to define a MEP are filled in by Witteveeen+Bos based on the Praagmatic Approach. The method to derive MEP, derive GEP and designate quality elements will be done on the way as table 10 shows in the third column. The WFD process to

define MEP-GEP for canals starts from the current situation. So instead of the Official WFD approach, the Praagmatic approach will be the starting point of the WFD implementation process for canals by the working group.

*Table 10 – Approach for implementing the MEP-GEP processby working group canals*

| REFERENCE | AMBITION | MEASURES |
|---|---|---|
| VGES<br>Most resembling natural WFD type. | MEP<br>GEP<br>Policy target 2015<br>Current situation | Measures with no negative effect on function and environment.<br>Measures slimmed with less effect<br>Just cost effective measures |

*Praagmatic = Starting point of approach of working*

## 4.2.2 RIZA document used by working group canals

The Dutch MEP-GEP Guidance has been used by RIZA as the input for its own step-by-step plan (see Figure 11 in paragraph 4.1 and Table 11), which the members of the working group canals must fill in for their own water body. The RIZA document tries to ensure the coherency in the implementation and interpretation of the Dutch MEP-GEP Guidance between the members of the working group canals. It is not exactly the same as the step-by-step plan in the Dutch MEP-GEP Guidance.

In general the steps 1-9 of the Dutch MEP-GEP Guidance (see Table 11) lead to deriving MEP of a water body. The process can briefly be described as follows: First of all the reference condition should be defined. The problem is that some artificial water bodies, like canals, are not really comparable to any kind of natural water body. In their case, the reference condition can be taken to be that of the best canals. After that, the water management authority must determine what physical alterations have taken place and which of these are irreversible. These physical alterations necessarily have an effect on the ecological status of the water body. They reduce its ecological potential. To allay this effect, the authority must look at what mitigation measures can be taken to restore ecological potential. The MEP will be the result of the effects of the physical alterations offset by those of the mitigation measures, while the GEP will be the result of this minus the 'slight departure' from the MEP that is permitted under the WFD.

In the RIZA document the several phases are not named by steps, but had other numbers and were called operations. The RIZA document is based on the Dutch MEP-GEP Guidance, but made some own interpretations. Different names ensure misfiring. Directorate General for Public Works and Water Management Utrecht changed the titles before using that general RIZA document so it should be the same as the Dutch MEP-GEP Guidance. The contents of the operations are discussed in chapter 5 where it has been used for the Amsterdam Rhine Canal.

*Table 11- Several ways of translating the official WFD*

| ***Level 3, Dutch MEP-GEP guidance*** [70] | ***Variant of level 3, RIZA document*** | ***Variant of level 3, Praagmatic approach*** |
|---|---|---|
| **Water bodies**<br>1 Bordering,<br>2 test on artificial,<br>3 reference for water body | **Waterbodies**<br>1.1borders operation 1<br>1.2 waterbody artificial operation 2a-c | **Characterizing**<br>1 Bordering and grouping<br>2 Analyse functions and pressures<br>3 (hydro, fysical-chemical, biological) effects of pressures |
| **Interventions**<br>4 Inventory interventions<br>5 Test on restoration measures<br>6 Test on other means | **Interventions**<br>2.1 overview of interventions operation 3<br>2.2 describe interventions operation 4<br>2.3 effect of interventions operation 5 a-b<br>2.4 waterbody significant change operation 6 | **Measures**<br>4 Analyse all measures (establishment, management and emissions)<br>5 Select on non significant side effects<br>6 Assess effects of the selected measures |
| **Classifying status**<br>7Test on mitigation measures<br>8 Derive MEP<br>9 Derive GEP | **Classifying status**<br>3.1 mitigation measures operation 7a-d<br>3.2 useful aim in an other manner operation 8 a-d<br>3.3 definitive classification operation 9 | **Classifying Status**<br>7 Designation test on AWB<br>8 Test on feasibility GET<br>9 Designation as AWB or HMWB |
| **Measures**<br>10 Social-econ. Feasible meas.<br>11 Test to GEP<br>12 Derogation | **Witteveen & Bos approach step 10 t/m14** | |
| **13,14 Policy variants/objectives** | | |

The RIZA document and Dutch MEP-GEP Guidance are based on the Official WFD, but it is not a one way recipe. Witteveen&Bos used the information from the RIZA step-by-step plan as the input of the process to designate the measures, step 10 and 11; while they want to use the Praagmatic Approach. So there are already in this small working group discussions about the methodology. The filled in RIZA documents by the members of the working group canals are the input for the mentioned first phase in the methodology plan from the consultancy Witteveen&Bos (see Table 12) .

#### *4.2.2.1 Twelve filled in RIZA documents as input to define MEP-GEP*

The products of the characterisation by following the RIZA document for the 12 water bodies are very small. The steps in the RIZA document were called different and were in a different order than the official WFD, CIS Guidance and Dutch MEP-GEP Guidance. That does not ensure the coherency. Because this first phase was mainly summarizing facts of the own environment, it does not matter which approach, mentioned in table 11, will be used. The basic information of the canal and its environment is described and they are still classified as artificial.

## *4.3 Process of Dutch working group canals*

The working group canals must work with the mentioned reports in figure 12. The work process of the working group canals exists of meetings. I have followed the whole process of the working group canals. The impression and results of the meetings of the working group canals in 2006 will be discussed.

The aim of the order for Witteveen&Bos is to define targets and ambitions for canals on a standardized and transparent way. The Praagmatic Approach will be used. The Witteveen&Bos process to get the MEP-GEP and measures defined for the twelve canals is divided in three phases and will end in December. That is the process which Witteveen&Bos will follow to get the WFD implemented on canals in a right way. Table 12 gives an overview of the meetings, their objectives and results.

*Table 12 – Overview of meetings by working group canals to fill in the MEP-GEP Guidance process ;*

| **Witteveen +Bos approach** | **Meetings/ workshop** | **Objective** *() steps in WFD process, table 11* | **Results** *() discussed in a paragraph* |
|---|---|---|---|
| *First phase* | July 2006 | Introduction Witteveen+Bos by members of the work group Presentation of the methodology and get opinion members clear. *(WFD step 1 and introduction)* | Everybody is familiar with the RIZA document. That must be filled in for each canal. (*meeting summary in section 4.2.1*) |
| | August | Field studies<br><br>*(step 1-9 of RIZA doc, variant of level 3, and step 4 of Praagamtic approach)* | Witteveen & Bos has an idea of the environment<br>It gives an impression of the possibilities and selection of measures for each specific canal from the whole measures list. |
| | September | RIZA documents and measures are discussed results so far. Also what the intention is of the next meeting/workshop *(step 1-9)* | Everybody knows what data was missing in the RIZA documents and why they should invite the water managers. (*findings from meeting working group in section 4.2.2*) |
| | | A questioner to get input for this thesis has been given to the members of the working group | A better view of the members' background and their attitude compared with the WFD. (*results in section 4.2.2.2*) |
| | October | In a workshop the WFD process is discussed with members of the working group and water managers; the corporate ambition for canals has been defined. *(related to step 8 and 9 of level 3 )* | Politicians are informed about the WFD and some choice moments are filled in. (*summary of observations in section 4.2.3*) |
| *Second phase* | December | a default version of the results of the implemented MEP-GEP guidance by e-mail<br><br>*(step 1-9 and 10,11 of praagmatic approach)* | Measures and its effects are defined. Variants will be compared with the objectives. The effects and costs of the selected measures will be assessed. |
| | January | Witteveen&Bos presents the results and default report of the WFD process and possibilities for the canals in January. | Members gave their opinion and a lot of discussion to improve the report (*results of concept report discussed in chapter 5*) |
| *Third phase* | April | The final report made by consultancy Witteveen&Bos | The MEP-GEP process and its results, objectives and possible measures are described in a report to all members of the working group. |

The last column will be discussed more specificly and be compared with the WFD process. In advance the several phases and meetings should fill the steps of the Praagmatic approach, mentioned in table 11. That table could be used as guideline.

### 4.3.1 Findings of observation 11 July,start meeting working group canals

The working group canals came for the first time together on 11 July 2006. The members discussed some general points before the consultancy Witteveen&Bos presentated the proposed methodology which was the main point of the agenda. The aim of this meeting was to discuss and determine the methodology.

The questions in textbox 7 (from the minutes of meeting made by RIZA) were used to get the opinion of the members and the methodology clear.

*What shall we do with the canals?*
Fact is that they are artificial and shipping is the most important function. Nevertheless , there must also be looked at the methodology in other working groups and at the already defined MEP and GEP for other water bodies.

*What is our ambition by defining the GEP?*
The canal will be considered as a barge with potentials. The main criteria are to tackle the 'partitioning' (ontsnippering) and involve the ecological main structure with the WFD. So a win-win situation will be created.
An outsider could have new ideas and solutions to improve the environment near canals. The members will not carry out measures, but will evaluate the measures advised by Witteveen&Bos.

*The official WFD or praagmatic approach?*
The praagmatic approach will be used, because this approach will be easier to use for canals.

*Should the process be applied to each water body separately or consider them together?*
There are only 12 water bodies. So the process is not too extensive to use the approach for each water body separately. Witteveen&Bos should gather all measures and define what the possibilities are for a MEP. It should be realistic, but also without negative effects on the function and environment.
However, it is easier to gather measures when the report Default MEP-GEP will be used. The document 'Default MEP-GEP' showed the effects of hydromorphological interventures by types and not a whole list of measures. The default does not have the same approach as the Praagmatic one.

*Textbox 7- Harmonious opinions of the Dutch canals working group in answer to relevant questions by RIZA*

Summarized, although the main function is shipping, there the ecology can be improved. The RIZA document is based on the official WFD approach and use a natural reference while the members want to use the Praagmatic Approach, because starting from the current situation is easier.

The assistence document Default MEP-GEP (see figure 4) gives examples for types, so a natural reference must be defined to use this report. The RIZA document is doing that and could give with the Default MEP-GEP already examples of measures for a defined type M7 or M20. Also the methodology of the consultancy was discussed, but there were hardly any other remarks on it. Basically the Praagmatic approach will be used, but the RIZA document should not be used in that approach. So the working group is already switching between the approaches.

### 4.3.2 Findings of meeting working group canals September

First some findings from the observation of the meeting will be discussed in this paragraph. The members of the working group canals received a question form made for the present study.

#### *4.3.2.1 Findings from observations of the working group canals*

The members of the working group canals have used the Dutch MEP-GEP Guidance for the characterization step by filling in the RIZA document, while they want in first instance use the Praagmatic Approach. The use of the Dutch MEP-GEP Guidance did not mean there was a coherent result. There were a lot of questions about the implementation. There was little understanding of the Dutch MEP-GEP Guidance steps in one working group canals.

Visiting the twelve canals gave a better understanding of the differences between the environments of the twelve canals. The twelve canals can be divided in three reference types (see figure 12). RIZA report [71] contains information about the possible measures for each classified type. However, for ARC classified as type M7, the information and specific measures for this type are not used. The general list of measures will be assesed by Witteveen+Bos, because the task for Witteveen&Bos was to apply the process of the guidance to each canal. There is just one global list with measures (see Chapter 5) used for the twelve canals

separately instead of clustering into four types and using the smaller measure list from that RIZA report. Witteveen&Bos preferred one measures list, so that for each water body all measures were examined and not just a small selection on forehand. That is because the classification of a canal is global and does not mean anything.

This means that there are different approaches for defining MEP-GEP. the approach where the RIZA characterization document is used and the water body type is known; results the clustering of water bodies into WFD types to a shorter measures list Witteveen&Bos is using the whole measure list for each canal specific which ensures more work. The members of the working group canals want to analyse each canal specifically and want to use the current situation as a starting point. From that starting point some identified mitigation measures could be carried out which could result in the Good Ecological Potential. (Praagmatic approach) Nevertheless , the transparency of the process is one of the main important things. This working group must choose its own way, there are no examples about the WFD implementation on canals in other countries, but they must follow an apporach which can be defensed by their own.

This meeting showed that the working group canals used several methods, while their starting point was the Praagmatic Approach. There are some different interpretations of the Dutch MEP-GEP Guidance for AWB. Witteveen+Bos prefers the Official WFD Approach and fill in the RIZA document step 1-9 for canals, but use the Praagmatic Approach to select measures.

#### *4.3.2.2 Findings from questionnaires*

Besides the questionnaire made for this thesis which was send by e-mail, there was also a questionnaire made by RIZA. Both will be discussed in this paragraph.

The question form of RIZA contains 10 questions which are divided by subject, ambition and measures. There is coherence between the 15 respondents. An overall view from the reactions:

> *In most cases the members of the working group want a uniform approach for the process of designation and identifying MEP-GEP for canals. They want to use a specific reference for canals instead of lakes or rivers. They believe that the functions of the canals should be most important. That is in line with the vision of the consultancy Witteveen+Bos. The ambitions for canals should not be too high. However, if there are opportunities to improve the ecology by taking measures (e.g. fish passages), it should be applied. Important is that by the choices for measures the whole water system and environment of the canal is examined.*

The questionnaire made for this thesis consisted of 45 yes or no questions and 18 open questions about the WFD in general, the MEP-GEP Guidance and process. Appendix IV contains the whole questionnaire, an overall view of the reactions from the 7 respondents:

The closed questions of the questions form give the following information:

> *Some members of the working group canals are not familiar with the WFD or STOWA site and CIS documents, while these sites could give important information to understand the WFD process. Also the MEP-GEP guidance is considered too difficult as a recipe book and there is not enough clarity about the WFD process. They expect that the different ambitions will play an important role, which will automatically lead to different MEP-GEP's.The MEP-GEP's for canals are not be seen as sociol-economially unrealistic. Everyone believes that the WFD process, also for canals is a challenge and not a threat, for example the function shipping. Furthermore, eveyone believes that the monitoring for the WFD is expensive, but important. So the WFD is not seen as an immediately threat but as a challenge, but the policy has too many ways of interpretation.*

The open questions were more related to the WFD policy. Some opinions will be discussed shortly:

> *There is a remark on the ecological potential classification scheme. Figure 6 in chapter 3 shows the scheme. The scheme with the identification of the relative roles of biological, hydro morphological and physical chemical quality elements should have a different order. The members of the working group have the opinion, that the physical-chemical*

*characters have more influence on the ecology than the hydro morphology. The scheme must start with physical-chemical questions instead of hydro morphological conditions.*

*The fact there is nowadays more attention for ecology and water is related with the increasing shortage of it. Water should be more and more an important factor in the new environmental design. Thereby a combination of the several functions is necessary to get an improvement of the ecology. There could be made investments with perhaps hardly any results. That does not mean it will be better to move it forwards and doing nothing nowadays. It is easier and cheaper to try to improve the ecology in the current situation, than in the future. It is yet not so far deteriorated. And a canal should not be an exception because it is an artificial water body. There could be attention for all water systems and its ecology in the environment.*

*Unfortunately there is no political ambition for ambitious measures. The effects of the measures are hard to define, which make the results of the investments uncertain. A combination of the measures with other projects could lower the costs in advance. That is what the members of the working group canals prefer. While in that case not specific for the WFD created measures will be invest so the investment will be higher than just the WFD asks.*

*The WFD explorer could be a good tool to inform and persuade the policy makers and members of the usefulness of measures. The members of the working group canals believe in the usefulness of that tool to convince the politicians.*

These questioners give the impression that the workgroup canals has a positive attitude for the intention of the WFD to improve the environment. Nevertheless, the workgroup canals expect that there will be little attention to canals while there can be done a lot to improve the ecology without harming the shipping. The available reports to implement the WFD are also difficult to use on canals. So the impression of the observations of the working group canals is comparable with the observations of the national MEP-GEP meetings.

### 4.3.3 Findings of the workshop by working group canals and water managers October

This meeting was more a workshop to inform the invited water managers from the Directions about the WFD and designate the corporate ambition for canals. Several presentations informed the guests about the WFD process.

#### *4.3.3.1 Cooporate ambitions of Directorate General for WFD implementation*

A discussion between the working group canals and the guests of this workshop makes clear that for a coherent policy an ambition should be formulated. The cooperate ambition will be a supplement to the Dutch MEP-GEP Guidance for Artificial Water Bodies.

Level A is the most important leading principle in the WFD process by the workgroup. The ambition of Directorate General for Public Works and Water Management is formulated as:

Level A — *Functions are leading. The functions should be leading in defining the ambitions and MEP. There is a differentiation between the importances of functions. On the first place safety, on the second place shipping, and on the third place discharge and drainage water.*

So the definition 'function' in the sense that measures may not have a significant influence on the function and the environment of the water body is filled in. The term significant is still interpretable by the members in their own way, while that could be exactly the cooperate ambition.

Level B — *River Basin District; A canal is part of a river basin district and its wider environment. One budget should be divided in several water bodies in a district. Effectivity of investments plays an important role to choose between water bodies in a River Basin District.*

The River Basin District gets more attention than just an artificial water body. Budgets will mainly be defied for the river basin districts and not specifically for canals. If the canal is not playing an important role in a river basin, there will be a chance that there is no money available for the measures to improve the ecology in a canal. Besides the costs may not be the guiding principle to define ambitions to MEP or GEP. The costs are just leading in the phase to get the GEP to the policy targets in the WFD.

Level C *Remaining targets; Besides the WFD targets, there could be interaction with the targets of Natura 2000 (VHR) and EHS*

At first there will be done nothing more than just the WFD is asking, but if there are already projects running, they could came together in one project.

Level D *Costs effectivity of measures. An analysis of the effectivity and the costs will be made in this level.*

That means that the cost effectiveness of measures will have influence on the deviation of the money between the twelve canals if there will be money available for canals. The report 'rijkswateren op orde' expects that there will be no obligations for the WFD for canals, but that there are possibilities to improve the ecology of canals. RIZA believes it will be good to invest in combination with the nature friendly banks and Ecological good structure projects.

The ambition is not very new and there are still some own interpretations left. Furthermore, not all levels could be used to define the objective MEP-GEP as the Dutch MEP-GEP Guidance or the Praagmatic Approach is understand well. So the made choices do not fill in the WFD process, it is more a sidepath. The aim of this side path was to get the ambitions defined, but it will not help to fill in the MEP-GEP process.

## 4.4 The result method to define MEP

The first phase (see first column of table 12) of the Witteveen&Bos approach is ended. This phase filled in step 1 to 9 (see table 11) based on the Dutch MEP-GEP Guidance and Praagmatic Approach as well. The previous paragraphs make clear that the working group canals is switching between the approaches. They want to use the Praagmatic approach as starting point, but are also using the Dutch MEP-GEP Guidance.

In accordance with the ambition there is made a methodology to define the objectives for the twelve canals. The canals are mentioned separately in appendix IV, but are clustered in figure 12. The figure shows the methodology which Wittveen+Bos want to use to define the MEP for the twelve canals. That is the same approach as the used approach of working canals. The clustering of the canals in this diagram is based on its function and its environment. Working group canals wants to define four MEP's with the report Defaults MEP-GEP as starting point.
The Default MEP-GEP Guidance works with references. Then they are clustering on reference types and using the Official WFD approach again instead of the Praagmatic approach.So this is in contrast with the way of defining the measures in the Praagmatic Approach, which Witteveen+Bos wants to use.
In the first meeting Witteveen+Bos wanted to analyse the measures for each canal separately, starting from the current situation. The advantage of clustering could be to get an easier and shorter process, but a disadvantage is probably that there will be not many measures instead it was analysed separately. On the other hand, clustering could perhaps result in more ideas through comparing the same type of canals, but if there will be started with just one overall measures list this advantage of more ideas is not valid any more.

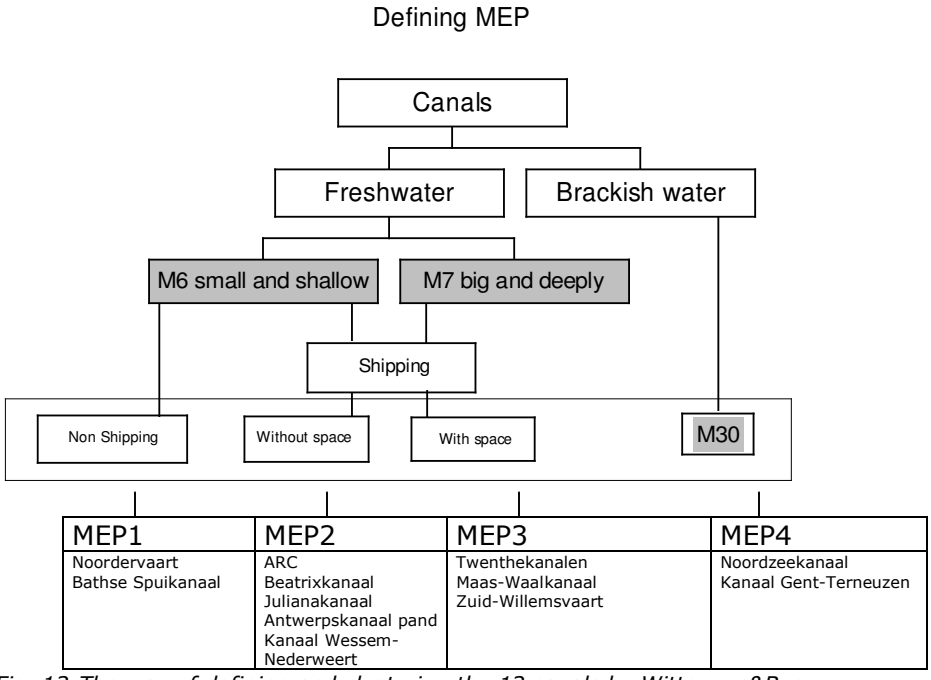



*Fig. 12-The way of defining and clustering the 12 canals by Witteveen&Bos*

The RIZA document which is based on the CIS guidance no 4 and on the Dutch MEP-GEP Guidance contains a lot more steps than the Praagmatic Approach. Both methods describe the process, but there is room for using it on its own way. The RIZA documents for 12 canals, assistence document for the Official WFD approach (see figure 4), showed the steps where is room for own interpretation instead of just summarizing facts. The RIZA document used on canals is mainly by operation: 5a define effect of hydro morphologic interventions, 8a identify other possibilities, 8c social and economical effects, 8d significant effects on environment; not just summarizing facts.

Chapter 5 contains the RIZA document in detail for the Amsterdam-Rhine canal for the reader who wants more information about the steps. That compared with the political choice moments in the Praagmatic approach results in the following table. The working group canals approach is marked. They started with the RIZA document and walked through the first colum of the political choice moments in table 13. After that they started almost again from the beginning and walked through the second colum of the political choice moments, so were following the Praagmatic Approach. Figure 12 with the clustering into MEP's mean a switch back to the Dutch MEP-GEP Guidance. So it is not the Official WFD approach or the Praagmatic Approach, but both methods are used by the working group. Generally both methods contains the same steps, but in a different order. However, Chapter 3 contains a discussion about if it is possible to reach the same objective GEP. That is not an issue any more as the working group is using both methods randomly. The little experiences and the uncerntainties in both approaches could result in combining both methods. If the working group it did not know, perhaps using both methods could give more clearity about how to fill in the procedure in a correct way. Learning by doing can be used by filling in the WFD process. Nevertheless, the approaches give not much grip so there is still not a vision about how high the level of MEP or GEP should be.

*Table 13-Political choice moments and way of the used MEP-GEP process by working group canals*

| RIZA general document, based on Dutch MEP-GEP guidance | Political choice moment | | Praagmatic approach |
|---|---|---|---|
| **1 waterbodies** | | | **Characterising** |
| 1.1borders | Y | Y | 1 Bordering and grouping |
| operation 1 | | N | 2 Analyse functions and pressures |
| 1.2 waterbody artificial | | Y | 3 (hydro, physical-chemical, biological) effects |
| operation 2a -c | N | | of pressures |
| **2 interventions** | | | **Measures** |
| 2.1 overview of interventions | | | 4 Analyse all measures (establishment, |
| operation 3 | N | | management and emissions) |
| | | Y | |
| 2.2 describe interventions | N | | 5 Select on non significant side effects |
| operation 4 | | Y | |
| 2.3 effect of interventions | Y | | 6 Assess effects of the selected measures |
| operation 5a | - | Y | |
| operation 5b | | | |
| 2.4 waterbody significant change | N | | |
| operation 6 | | | |
| **3 classifying status** | | | **Classifying Status** |
| 3.1 mitigation measures | | | |
| operation 7a | N | Y | 7 Designation test on AWB |
| 3.2 useful aim in an | | | |
| other manner | | N | 8 Test on feasibility GET |
| operation 8 a,c,d | Y | | |
| operation 8 b | N | N | 9 Designation as AWB or HMWB |
| 3.3 definitive classification | | | |
| operation 9 | N | | |
| **4 Measures** | | Y | 10 Derive MEP |
| 4.1 define MEP | Y | Y | 11 Derive GEP |
| 4.2 derive GEP | Y | Y | 12 Designate norm |
| **5 Programme of measures** | | | |
| 5.1 policy variants | Y | Y | 13 policy variants and objectives |
| **5.2** derogation | Y | | |
| **6 Monitoring and report** | N | N | 14 RBMP |

Furthermore Witteveen&Bos asked several times by mail and during meetings in a different lay out and in sheets for the same information which should be mentioned in the 12 RIZA reports. From that can be made up that the characterization report of RIZA, translated of the WFD, CIS guidance no 4 and Dutch MEP-GEP guidance was not detailed enough, or was not filled in correctly by members of the working group canals or the work method by Witteveen&Bos was not comparable.

The twelve RIZA reports meet almost the RBMP requirements I and II (see chapter 3). Arguments and a transparent decision moment is most important. With the output of the twelve characterisation reports the next phase of the process can be started, the designation of MEP and GEP. The next phase will be more difficult and ensures a lot more discussions.

Witteveen+Bos needed some more data before it could judge the current situation of a canal on the WFD biological quality elements. All data is not available or is gathered with other methods. Currently, there can not be made a classification of the water bodies. And that is not just because of the twelve small RIZA documents or incompleted steps. If an other approach was used, there was still not enough data. The monitoring must be started before the correct data is available and a judgment of the current situation on a natural reference can be made. That is part of the Dutch MEP-GEP Guidance and not a part of the Praagmatic approach.

So at the end there is still not defined a MEP. The working group canals used the Official and Praagmatic approach and several assistence documents. Also they tried to define a MEP by clustering. The output of this process are 12 filled in RIZA reports with step 1-9 and nothing more.

## 4.5 Conclusion

This chapter gives an impression of the effective use of the mentioned reports as posed by Research Question C. The targets of the guidance MEP-GEP for artificial water bodies are reaching similar manners to assess each system and to get coherency in the same process.

### *How is the working group canals using the Dutch MEP-GEP Guidance, to derive the objectives MEP-GEP and measures for 12 artificial waterbodies in The Netherlands?*

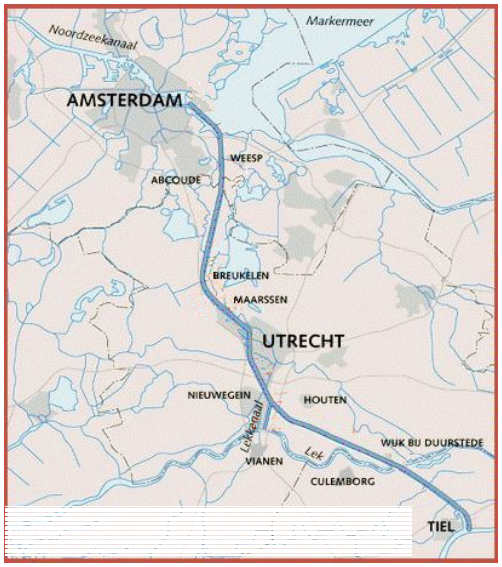
Consultancy Witteveen+Bos and the Regional Directorates General of Public Works and Water Management are members of the Dutch working group canals. The aim of this working group is to define MEP-GEP's and implement the WFD process on 12 canals. In advance Witteveen&Bos started the WFD process with the intention to use the Praagmatic Approach, but at the end they have been used the different approaches randomly.

The WFD process for artificial water bodies is translated into CIS Guidance no 4, the Dutch MEP-GEP Guidance, Praagmatic Approach and the RIZA document (see figure 4). It ensures more communication, but not a more concrete approach. There were still definitions open for definition by individual water managers. The steps define borders, check for AWB, effects of hydro morphology interventions, hydro morphological pressures and check for restoration measures are mainly technically substantive orientated. While there are political choice moments by the step analysing all measures and side effects, derive MEP and GEP and political variants.

The guidances mainly give information about what to do and minimal information about the way to do it. The meetings of the workgroup made the guidance workable/useful, because discussions could give answers and the cooporate ambition filled in some choices. Nevertheless the made choices, RIZA document and both approaches (official and praagmatic) did not give enough grip to fill in the WFD process to determine the level of MEP-GEP.

The questions forms made clear that water managers are positive about the intention of the WFD. There will be little freedom in the described process, but some freedom in how to fill it in. That resulted in a combination of the Offical WFD and Praagmatic approach, but with no result. There is still no MEP defined. A different ambition between several managers in the wokring group is possible. The most important thing is that managers must think about the situation, analyse the water body and walk through the WFD process on an objective way, which can be compared with each other. It is possible to reach an own target with low or high ambition and in the mean time it could satisfy to the MEP-GEP Guidance. The disadvantage of the wanted flexibility is that the process is changing several times and that stagnates the progress of the WFD process and that it made to be felt complex. An advantage is that there is room for own ambition during the application of the guidance in a transparant and objective way, because just the process is defined by the WFD.

# 5 Case Amsterdam Rhine Canal




The Amsterdam Rhine Canal (ARC) is a canal in the Netherlands that was built to connect the port city of Amsterdam to the main shipping branch of the Rhine. Figure 13 shows the map of the Amsterdam Rhine Canal (ARC). Appendix V contains an photo overview of the ARC. In this chapter the Water Framework Directive with its guidelines will be implemented on this case.

## 5.1 Current environment of ARC

The Amsterdam Rhine Canal is inaugurated in 1952, it has a total length of 72 km and four locks. It is considered to be the most heavily used canal in Western Europe, and it handles vessels of up to 4,300 tons' displacement. The canal's minimum depth is 5,5 m. Its course follows a generally southeasterly direction as it goes through the city of Utrecht towards Wijk bij Duurstede (ARC Northern part) where it intersects the Lek branch of the Rhine and then continues on to the Waal river near Tiel (ARC Betuwepand). There is also a branch, the Lek Canal, to the Lek near Vianen. The manager of these waterbodies is Regional Directorate General for Public Works Water Management Utrecht (DUT). In Utrecht are 3 water boards active (Water board Stichtse Rijnlanden (HDSR), Water board Vallei en Eem (WVE), Water board Amstel Gooi and Vecht)

The ecological environment is negative influenced by the constructed canal. The depth of the canal is approximately 6m so there could grow hardly anything in the water body. In the current situation the ARC is constructed with dam partititions at both sides.

*Table 14- Actors near the ARC [72]*

| **Functions and actors in the environment of the canal** | **Number of companies** |
|---|---|
| Pharmaceutical industry | 2 |
| Production and distribution of electricity | 3 |
| Concrete - and asphalt production | 5 |
| Warehouse and transhipment | 14 |
| Management areas and infrastructure | 8 |
| Recreation ports | 12 |
| Extraction and distribution of water | 1 |
| Recycling waste products | 1 |

The most important morphological processes in the canal are erosion and sedimentation which depend on the discharge and sediment load. In the northern part of the ARC is the specified discharge is maintained at 10 $m^3/s$, to prevent salt intrusion from the North [73]. There are several actors in the environment of the canal which are depending on the shipping. Table 14 gives an overview of the actors near the Amsterdam Rhine Canal.

The water quality is monitored at Nieuwegein and Nieuwersluis. The influence of river water reduces to the north, going from 100% by Wijk bij Duurstede to 20% river water in the north. This means there is much regional water discharge to the ARC. [74]

The sediment is mainly coming from the Lek [75]. The Amsterdam Rhine Canal gets water from the Lek via the Prinses Irene locks and Prinses Beatrix locks (see photo overview in apprendix V). The mean water level of the Amsterdam Rhine Canal northern part is NAP – 0.40 m and fluctuates under normal circumstances between NAP – 0.30 m and – 0.55 m. The Lek has the same water level as the Amsterdam Rhine canal Betuwepand, namely NAP + 3.00 m.
The canal divides a nature area in two parts so migration is not possible. In the canal are almost no animals or plants present. The phytoplankton in the ARC is dominated by 'diatomen' as monitored in Nieuwegein. The chlorofyl-a content fluctuates between 5 and 20 µg/l in

summer. Marine invertebrates and crawfish dominated the macrofauna in 1996. In the past 34 fish types were found in the ARC. Bream is the dominant one followed by perch, roach, white bream and zander. The average biomass in comparison with other Dutch inland waterways is low.

### 5.1.1 Characterization Amsterdam Rhine Canal

The specific waterbody should first be characterized to a WFD type before the Default MEP-GEP guidance, based on the official WFD, could be used. Textbox 8 shows the method how the Amterdam Rhine Canal has been characterized as type M7. Appendix V consists the whole STOWA framework.

*Surface water body: Amsterdam Rhine cannel northern part: category Lakes*

▼

*Length/latitude (not differentiating)*

▼

*Height (not differentiating)*

▼

*Saltinity (0-0,3 g Cl/l)*

▼

*Shape (straight)*

▼

*Geology underground (>50% siliceous)*

▼

*Average water depth (>3meter)*

▼

*Width (>15 meter)*

▼

*WFD-type:* ***M7 – huge deep canals.***

Textbox 8 -¯ defining WFD type for AWB

### 5.1.2 RIZA document filled in for ARC

The RIZA report for the Amsterdam Rhine canal filled in by Directorate General for Public Works and Water Management Utrecht will be discussed in this section. Table 15 shows the steps for the ARC with in the last column the remark; whether the steps based on facts or if there is a discussion point. The steps and the place of this document in the WFD process are discussed in chapter 4. This RIZA report ensures that the WFD requirement will be reached, but it do not help to fill in the WFD process to determine the MEP-GEP.

*Table 15 - RIZA document for characterization, Amsterdam Rhine Canal*

| **Steps in the RIZA document filled in for ARC** | | **Remarks** |
|---|---|---|
| 1 water bodies | | |
| | *step 1 Water body identification*<br>Operation 1 borders<br>The borders of the Amsterdam Rhine Canal are clear. It starts in Amsterdam and ends at the River Lek and Waal. The kilometer numbering starts in Amsterdam and ends also in the south. The discharge is in northward direction. | This step is enumerating facts |
| | *Step 2 is the waterbody artificial?*<br>Operation 2a test on artificial<br>The functions of the Amsterdam Rhine Canal and its pressures are very clear. This canal is made for shipping. Thereby it ensures discharge, drinking water supplies, cool down water for industry and recreation.<br>Operation 2b design origin type<br>The designation of its original status is not valid for canals, because it is construct specific for shipping.<br><br>Operation 2c define most comparable water type<br>The most resembling water body can be designated. The ARC has typology M7, huge deep canals. | This step is enumerating facts<br><br>The advantage of the praagmatic method instead of Dutch MEP-GEP guidance approach, is that there no reference should be designated in this characterization phase. |
| 2 interventions | | |
| | *Step 3*<br>Operation 3 overview of interventions<br>There are no changes in the hydro morphology during the time, because in the construction phase the artificial character has been already stipulated. The hydro morphological characters with negative effects on the ecology are the intake of drinking water, intake and drainage of water by industry, artificial discharge, bank protection and supply of water. | This step is enumerating facts |
| | *Step 4*<br>Operation 4 Describe significant changes in hydromorphology<br>This step 4 is part of the characterisation of surface waters as required in WFD Art. 5(1). The intake of water for drinking water is 157 M $m^3$/a year, intake for industrial water is 475.000.000 $m^3$/year. There are two locks and artificial water discharge by draining. The defined water level is between -0.30 and -.055 m NAP. | The description of the interventions gives a more specific quantified view of the mentioned pressures by operation 3.<br><br>facts |
| | *Step 5 Define effects of interventions*<br>Operation 5 a, design effect of hydro morphologic interventions<br>The whole canal is artificial and has effect the environment. The function shipping is most important. The unnatural bank environment and turbulence by shipping are most influencing the ecology. | The effects of the interventions which are mentioned by operation 3 and 4 could be a discussion point. Which pressure influences the ecology the most is difficult to designate. The effects that are not allowed any more are difficult to designate. |
| | Operation 5 b, test if GET is unreachable<br>- | |
| | *Step 6*<br>Operation 6 test if water body is significant changed<br>- | |
| 3 classifying status | | |

| | | |
|---|---|---|
| | *Step 7*<br>Operation 7a inventories functions<br>The main function is transport by shipping and water discharge.<br>Operation 7b inventorise restoration measures<br>-<br>Operation 7c test restoration measures on social-economical effects<br>-<br>Operation 7d test restoration measures on effects on environment<br>- | There is no doubt possible to describe the functions. |
| | *Step 8*<br>Operation 8a identify other possibilities<br>The shipping needs water in the canal; The current techniques of the industry needs intake and drainage water; The need for drinking water ensures the necessarity of the canal.<br>Operation 8b test on technical feasibility<br>The displacement of the canal is technically possible, but too expensive.<br>Operation 8c test on social and economical effects<br>It will be social and economical unacceptable and too expensive.<br>Operation 8d test on effects on the environment<br>It will be just replacing instead of a solution of the ecological problem. | This could be a discussion point.<br><br>That will be a political discussion |
| | *Step 9 Definitive designation as hmwb or awb*<br>The ARC is specific constructed for shipping and effected the original environment. There are no natural references so the GES could not be reached. Measures could improve the current situation and ensures that the MEP-GEP could be reached. | |

The characterisation by the RIZA document gives minimal information about the Amsterdam Rhine Canal. There was no more instruction about how to use the document. The Dutch MEP-GEP Guidance could be used, but the different names of the steps made it hard to use. The RIZA document is used by Witteveen+Bos as the input for the process to define the objectives and measures. Witteveen+Bos made also a field study in August 2006. It gives a better understanding of the canal and the current situation of its environment. Some knowledge of the situation makes it easier to fill in the WFD process.

## *5.2 Possibilities to improve the ecology*

Both experts at the Directorate General for Public Works and Water Management and consultancy Witteveen+Bos have their own WFD interpretation, knowledge and opinion about the possibilities for the Amsterdam-Rhine Canal. That will be discussed in this section.

### 5.2.1 Feasible measures

The task to designate the MEP-GEP and measures is boarded to Witteveen+Bos, but Mr.R. vd Heuvel, Mr. P. Kok and Mr. W. Schouten from Directorate General for Public Works and Water Management Utrecht are more known with the ARC and its environment. In a meeting the global list with measures was acquainted. Table 16 gives an overview of the measures which Directorate General for Public Works and Water Management considers as possible. These are marked in the first column.

*Table 16- Whole measure list which will be used by Witteveen&Bos in The Netherlands*

| **Source measures and liquids/pollutant discharges** | |
|---|---|
| Reduce pressures of nutrients by pollutant discharges | There ought to be an analysis (= objective of project 'blauwe knooppunten';blue nodal points) |
| Reduce chemical pollutant discharges (Ni, Zn, Cd, Pb) | Just Zn and Cu are problem substances |
| reduce/stop cooling water discharges | Reducing in a networkvision should be done by facilitating. |
| alternative water source better quality | Not to use |
| **System measures structures + flow** | |
| Deepen/ create silt catch (reduction of turbidity by silt partitions) | Not to use. The ARC will not be wider and at the begin of the water body is already a silt catch. |
| Elevate/ create shallow parts (development of submerse plants) | Not to use in the current profile. Perhaps outside the profile by ground purchase. |
| Water level regime (more natural level development) | Not to use, its limited useable and than it is just 20 cm, which is not enough to influence the ecology. |
| Flush out (shortening residence time) | Not to use. The quality will not improve. Just the energy centrals would get more freedom. |
| **Measures to effects + communities** | |
| dredging (prioritary substances of nutrients) | It is already available. Perhaps it is still a shifting problematical case (discharge shifting statement) |
| Cover bottom with sand (prioritairy liquids of nutrients) | It is not possible for the shipping to make the canal shallower. |
| Fish score supervision (Active Biological supervision + fishery) | One does not believe in actively biological management. In current institution it is not useful to put more fish in the canal. Perhaps only in northern part where the canal could be a migration route. |
| **Structures/establishments** | |
| Bank establishment (remove timbering or fade bank slopes) | Not to use. Perhaps just in the northern part, but there is still wave forces of the shipping. |
| Bank establishment (widening for vegetation) | One extra bank in front of the current bank could be an option by local widening. |
| Bank establishment (adapt supervision) | Not to use |
| Creation of pre banks (protection to shipping) | Near the Betuwepand is a Nature friendly banks(nfb) created, but it contains asphalt which influence the ecology negatively. |
| Creation of artificial marsh area (in or near the water body) | It depends on the location and in combination with the extra bank in front of the current bank. |
| **Migration provisions** | |
| fishmigration (removal of barrières or adaptations) | Not immediately for migration fish ('trekvissen'), but related with the EHS (Creation of lower parts, increasement of water plants) it could be useful. |
| Creation fauna provisions (for fallen animals into the water or near devices) | Not to use for WFD goals |

This table contains just information for the ecological, chemical, physical and hydromorphological situation. Just for the chemistry are source measures important.

The whole measure list is discussed and at the end there were some measures left. Thereby is already the whole list of measures used and not just the specific, very short measures list for type M7. (see fig. 4 in Chapter 3) The experts are seeing not many changes for the ARC, but are curious to the results of Witteveen+Bos.

### 5.2.2 Measures in the MEP-GEP determination

The working group canals had the task to implement the Dutch MEP-GEP Guidance on twelve canals in the Netherlands. The process is started in July 2006 and is discussed in paragraph 4.4. The working group canals must implement the WFD process by the Dutch MEP-GEP Guidance or Praagmatic method. The last phases of the designation of MEP-GEP to get measures for a water body will be discussed in this paragraph. The concept report with the possibilities to improve the ecology by Witteveen+Bos is presented by Mr. N. Jaarsma on January 16th 2007 [76].

The appliancation of the Dutch MEP-GEP Guidance, named Default MEP GEP, is not used. The whole measure list has been discussed for each water body specific instead of the list of measures for defined types. So the clustering to 4 MEP's is not used in this phase any more. Some criteria defined by the cooperate ambition are: the measures should not affect the safety, shipping, water supply and discharge, cooling water and drinking water. The whole measure list has been discussed on these topics and its relevance for the MEP by Witteveen+Bos during a meeting of working group canals in September and on its own in November 2006. After using these criteria some measures were rejected. Appendix V contains the table with the measures and effects. With that list each canal is discussed by consultancy Witteveen&Bos so they could produce a draft report in December 2006.

The realistic measures for all water bodies are related to migration barriers and the establishment of the more natural banks. There are two graphics made by Witteveen&Bos about the costs of these measures and the cost effectiveness for each canal.[77] (See appendix V) The costs for the measures for the ARC are almost 70,000,000 euros. Thereby the costeffectiveness of the nature friendly banks and fish passages is very low, see appendix V. The effectiveness is regardless of the objective. Measures can be very cost effectiveness, but it is possible that the GEP is already reached, so nothing has to be done.

The RIZA document and the analysis of the whole measures list with its costs effectiveness resulted in four packages. By using the Praagmatic approach Witteveen&Bos has designated four variants for the ARC, namely package:

- maximum (MEP could be reached)
- strong (just significant measures; GEP)
- limits (looks to connectivity in the whole environment)
- autonomous (bottom line).

These are viewed in table 17. It gives the band width and the direction for the meetings with other stakeholders. The concept report of Witteveen&Bos contains also two maps with an inventory of the ARC area and one with possible measures. These two maps are taken in the appendix V. These maps contain more information about the location of the possible measures than just table 17 with the packages, variants of measures.

*Table 17- Variants of packages of measures*

| **Package** | **Areal nature friendly banks (%)** | **Migration barriers** | **Water quality** | **Objective MEP-GEP, values of M20 class boundaries (column A of table in appendix V)** |
|---|---|---|---|---|
| maximum | 9.2 | none | Not restrictive | See marked column in table 19 with the class boundaries determined by Witteveen+Bos. |
| strong | 0.0 | none | Not restrictive | |
| Limits | 0.0 | none | Not restrictive | |
| autonomous | 0.0 | yes | insufficient | |

The remaining measures, which will be used, are just nature friendly banks and fish passages to improve the migration routes for fish. A requirement of the WFD is that the lowest level of the objective, standing still, is the minimum. The autonomous package gives no measures to improve the current situation.The package maximum will take every possible measure which results in more nature friendly banks and that there will be no migration barriers any more. The package could be implemented, but effects of the measures will be assessed in 2015. The judgement finds place on the class boundaries of natural reference type M20. The assessment on the reference M20 is part of the Official WFD and not a part of the Praagmatic approach, which the working group canals want to use. By the Praagamtic approach the effects of the measures will be counted on the current situation and that new level will be the GEP.

Table 17 with the packages, the map with the locations and the table in appendix V is the tool to designate the measure package for each water body specific. That last phase is customizing

and canal specific and also political related. Nevertheless, there is still not a level of MEP and GEP determined. Without a vision are the possible measures analysed. The methodology of the official WFD approach is to start with a target (reference level) before the measures will be analysed. The Praagmatic approach is defining the level of GEP by doing, by determining possible measures. And that approach has been used by the working group canals when the packages were defined.

## 5.2.3 Current projects near Amsterdam Rhine Canal

The WFD is a new policy, but there are already some policies to improve the ecology. These could be integrated with each other. The environment of the ARC is mentioned in the projects 'Restoration & Establishment' (H&I) and Ecological Main structure (EHS) [78]. The reports of those projects are analysed and discussed in this paragraph. Thereby several reports of monitoring the current situation which is done for the WFD will be discussed.

### *5.2.3.1 Dutch project restoration and establishment (H&I)*

The third 'Nota Waterhuishouding' from 1989 was the start for the programme 'Restoration & Establishment'.[79] The aim was to improve the sustainable development of water systems. There was 445 millions guilders available in the period 1991-1998. The fourth 'Nota Waterhuishouding' from 1998 gives a continuation of that aim. The target for canals is mainly to create 'nature friendly banks', because they have also the function of migration routes and not just a transport function. The target for the ARC in this programme is to create 10 ha of the planned 60 ha 'nature friendly banks'.

The development of the environment near water systems is getting more attention in the beginning of the 21e century, national and internationally. Broadening of the H&I programme is necessary through the development of several environment policies. (Policies: 'ruimte voor water', WB21, KRW, 5$^{e}$ nota RO, EHS, Vogel en habitatrichtlijn) Nevertheless, the core of the H&I programme can be the basis for the new policies. There are already several reports about nature friendly banks. One which will be discussed is a design by Nigtevecht.[80]

### *5.2.3.2 Example design nature friendly banks by Nigtevecht and Maurikse wetering*

The project 'Nature friendly banks and Amsterdam Rhine Canal' with the objective to improve the biological situation of the ARC began in 1994. The aim of this project was to create in totally 60 ha nature friendly banks, concerning 12 locations, before 2010.

The location Nigtevecht, approximately 6 ha, is one of them. This location is the only one which is worked out in a report. A problem is that the ground in the Randstad is very expensive because there are too many other stakeholders wanting that ground. The report "NFB Nightevecht" [81] contains the nature friendly bank in detail near Nigtevecht which could be created immediately, because the ground for the creation is already bought. The problem is the money for the whole project with 12 locations. That is why the project is standing still. Just in the ARC section Betuwepand is a nature friendly bank created. It is called the 'Maurikse Wetering' which has been created in 1998. Figure 14 gives an impression of the development of the Nature friendly bank near the ARC Betuwepand.

*Fig. 14- NFB situation August 2006 first part of NFB Maurikse Wetering [82]*

*Fig. 15 - Situation August 2006 second part of NFB Maurikse Wetering [83]*

The aim of this nature friendly bank (nfb) was to improve the fish score. In the monitoring reports can be concluded that the vegetation and the fish are well developed. Appendix V contains the results and figures from a monitoring report [84]. From those figures can be said that: the hardened banks in the ARC Betuwepand ensure a better environment for the aal than the Nature friendly bank. A nature friendly bank ensures a better environment for the roach in the ARC Betuwepand. Notable is that the branches are richer to types than the canal. The banks in the northern part of the ARC are favourit by aal (85%) while the Betuwepand is favourit by winde (57%).
The macrofauna and abiotic have changed a little by the nfb. The shipping should be taken into account in the environment of a nfb otherwise the nfb could catch a lot of silt. That is slightly the case at the Betuwepand. Thereby the bank at the waterside of the nfb is transphased with asphalt. It ensures more stability, but is not so natural.

A nfb is a local measure with perhaps little effect for the whole water body and do not reach a higher score on the biological quality indicators. The WFD requires just measures which could improve the score on these indicators. A nfb could have effect on the whole water body if the nfb area is more than 5% of the whole canal area. So the scope of the measures should be huge enough before it will affect the scores, but it will influence the costs negatively.[85]

#### *5.2.3.3 Plan to attack dividing by creating fauna-go out places*

Reports about the barrier functioning of the ARC [86,87] contains data about the pressures of shipping and the possibilities instead dam partitions. The Dipro results about the waves in ARC are mentioned in appendix V. It advised instead of a dam partition a talud of 1:2 with hardcore and a bank length of minimal 685 m. That is for the stability of the dam and the going out possibilities for animals.
So there are already ideas to create a natural environment and decrease the barrier function of the canal with its hardened banks.

These projects show that there is already a lot of information about the environment of the Amsterdam Rhine Canal and about what can be done for the ecology. The WFD could be combinated with these projects. The problem is that the WFD procedure consists assessments on indicators with classboundaries whether the measures will improve the ecology in the whole waterbody. And the mentioned measures in the current project have mostly just local effects and will be eliminated in the WFD procedure.

## *5.3 Current status of the ARC*

The Water Framework Directive asks for other information and data than the current projects can give. The Directorate General for Public Works and Water Management Utrecht has the task to monitor the Amsterdam Rhine Canal. There are two reports about the monitoring in the ARC which are done in 2003 and in 2005.
Aquasense has done a monitoring in the ARC conform the requirements of the Water Framework Directive. Just the biological quality elements phytobenthos, phytoplankton and macrofauna are assessed. The monitoring data is compared with the reference of natural water type M20 (lakes), because there was little known about the water type reference M7 (canals) [36]. The appraisal of the biological quality elements has been done on the basis of the indicators:

*Table 18- Score of ARC to reference M20 by Aquasense*

| biological quality elements | indicator | ARC to type M20 | Expert judgement | Remark |
|---|---|---|---|---|
| phytobenthos | type composition abundantie | Good to very good score | | Good score through the good oxygen household |
| macrofauna | type composition abundantie | moderate to bad score | reasonable good | *Adaptation of the reference required* |
| phytoplankton | Biomass (chlorofyl-a)<br><br>type composition abundantie | Bad score, while there is enough chlorofyl.<br>--<br>-- | <br><br>Positive indicators (sieralgen) --<br>Negative indicators (algenbloei) -- | Turbulence → floating substance ↑ → look through ↓<br><br>*Adaptation of the reference required* |

The class boundaries of the biological indicators which Aquasense has used are mentioned in table 18 and 19. It may be clear that the ecological potential of the ARC is not the same as natural reference type M20. The artificial banks of the canal ensure that the variation, community composition and diversity is not the same as lakes. The macrofauna and phytobenthos could be improved if there are banks of 'broken stones' instead of dam partitions and nature friendly banks created. There must be attention for the wave forces on the banks to ensure the stability, but more variety in the banks could improve the ecological quality.

Aqua Terra and Witteveen+Bos have done a monitoring in the ARC in 2005 [88], related with the implementation of the WFD. The Amsterdam-Rhine Canal is classified as type M7. The natural reference type M20 (moderate huge depth buffered lakes)[35] is the best comparable type of the ARC.

These two monitoring programmes were based on the requirements of the WFD. It gives an impression of the current situation of the biological quality elements fishes, macro fauna, phytoplankton and phythobenthos. A complete WFD monitoring programme should be operational in 2006 and should give an impression of the ecological and chemical quality over a long period. These data are necessary to judge the current situation and changes in the future on the WFD biological quality elements. First the adaptation to the biological quality elements by Witteveen+Bos will be discussed before the classboundaries of the biological quality elements in the different reports will be discussed. Thereafter is a assesment of the current situation of the ARC.

### 5.3.1 Assessment of current status

The working method by Witteveen+Bos from the concept report to design current situation contains adaptations to the original M20 reference. However the ecological situation will be still assessed on the five biological quality elements: fish, macrofauna, macrofytes, phytobenthos and phytoplankton.

At the drawing up of defaults for canals many attentive canal types has been assumed. Important certain factors for the ecology of canals are shipping and bank institution. On the basis of differences in shipping intensity and bank institution five canal types are distinguished. For each of these types an estimation has been made up to feasible ecological quality by each type. Thereby the references of the natural waters have been used as a main point. There are a number of differences with the references:

*Textbox 9 – Way of defining class boundaries of biological elements by Witteveen+Bos*

- fishes

| **Indicator** | **Replaced by** |
|---|---|
| Percentage bream | Percentage bream+carp |
| Percentage perch+roach | X (Has been expired) |
| Numer of types | X (Has been expired) |

- macrofauna

| **Indicator** | **Replaced by** |
|---|---|
| Positive Dominant | Just one indicator: characteristic and positive dominant taxa of all types. (because there are no characteristics sorts in canals because it is a combination of stationary and flowing waters) |
| Negative dominant | |
| characteristic taxa | |

- macrofytes and fytobenthos

| **Indicator** | | **Replaced by** |
|---|---|---|
| macrofytes | Abundantie | Still the same |
| | type composition | Replaced scores and just assessed on water plants and not on bank plants any more |
| phytobenthos | | Most comparable reference type |

- phytoplankton

There will be just the indicator abundantie, chlorofyl-a used. That is still the same as the reference. The others has been expired.

The type's composition of canals was too difficult and there is minimal experiences with fytoplankton and canals to design a MEP and GEP. Thereby it could not be relevant because the verblijftijd in canals is short, so there is minimal algenbiomassa.

Summarized, Defaults MEP-GEP has been made for the macrofauna and fish, because the references for natural water bodies are not useable on artificial water bodies. The reference for element fytoplankton does not work for canals and just the indicator chlorofyl-a concentration will be used by this classification. Just for element macrofyten and phytobenthos the references of natural water bodies are all right, but in some cases the class borders are adjusted. The test of elements macrofyten, phytoplankton and phytobenthos is carried out by the programme QBWAT.[89] These adaptations are necessary to make the guideline with its references useable for canals. Appendix V shows the indicator values of M20 for the MEP and GEP. The ARC should satisfy to column A, huge canals with a lot of shipping and steep banks.

### 5.3.2 Overall view class boundaries of biological elements

Four reports describe the current situation of the ARC following the WFD and natural reference M20. Nevertheless there is a gap between the ARC classification type M7 and the used classification M20. The ecological situation of a lake can not be compared with the ecological situation in a shipping canal. The measures for M7 would be developed, but that is cancelled. Till

January 2007 the consultancies have wait on the values of the references of M7, but there has been decided that they must work with classification M20 and suit this to their own situation.

The conclusions of Aquasense report is that the reference of element phytoplankton and macrofauna of M20 is not useable for the ARC and should be adapted. Furthermore, the report of Aquaterra and Witbo recommended an adaptation of the reference fish. Instead of using the natural type M20, the Default MEP-GEP M20 for artificial water bodies [90] by RIZA is made to level the gap between the reference and the real situation of a canal.

The concept report of the MEP-GEP process for canals by Witteveen&Bos recommended an adaptation of the element fish and macrofyten. It is unclear if that will be done. The score of the ARC with the values of the current Default M20 references is bad. Just the element phytoplanton, specifically the reference of indicator chlorofyl-a is reaching the GEP in the report of Witteveeen&Bos, while the $T_0$ monitoring of Aquasense classified it with bad. Nevertheless , the Official WFD allows correcting the class boundaries on the characteristics of a water body. The values in the table are specified for the ARC.

*Table 19- Overview of class boundariesof biological quality elements by several monitoring*

| *Class boundaries for Huge canal with shipping and steep banks* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Element | Indicator | | *Natural ref M20 (apr '06) [91]* | | *Witbo (jan '07)* | | *Aqua terra (just fish monitoring) (2005)* | | *$T_{0\ monitoring}$ aquasense Proposal (2004)* | | *Default MEP-GEP M7 (jul '06)* | Def. MEP GEP M20 (nov '05) |
| | | | *by STOWA* | | *Adapted to the situation of the ARC* | | | | | | by RIZA | |
| | | | MEP (VGES) | GEP (GES) | MEP | GEP | MEP | GEP | MEP | GEP | MEP GEP | MEP |
| *fish* | Bream+carp | Relative biomass (%) | - | - | 50 | 65 | - | - | | | <50 65 | - |
| | Plant mind fish | | 15-25 | 10-15 | 10 | 5 | 65-80 | 40-65 | XX | | >10 5 | 3 |
| | oxygen tolerant fish | (%) | 3-5 | 2-3 | 2 | 1 | 20-30 | 10-20 | | | >2 1 | 0 |
| | Numer of types | | 12-13 | 10-12 | - | - | | | | | | 13 |
| | Precentage bream | | 5-15 | 15-25 | - | - | 11-12<br>0.5-2 | 10-11<br>2-8 | | | | 5 |
| *macrofauna* | characteristic and positively dominant taxa | Absolute number | ? | | 20 | 10 | XX | | | | xx | |
| *Macrofyten* | Score type composition waterplants | (%) | (39-97) | (20-38) | 20 | 15 | XX | | | | xx | 61 |
| | | | 40-100 | 20-40 | | | | | | | | |
| | Score type composition bankplants | | 80-100<br>(41-51) | 60-80<br>(31-40) | 25 | 19 | XX | | | | xx | 51 |
| *Phytobenthos* | Test WFD reference | Score0-1 | | | 0.8 | 0.6 | XX | | 0.8 | 0.6 | | |
| *Fytoplankton* | Chlorofyl-a concentration | µg/l | 8.3 | 14.5 | 9.4 | 30 | XX | | 6.6 | 13.3 | | |

The calibration an validation phases will change the class boundaries every time. At the end of 2006 the type M7 has been not worked out any more so type M20 should be used for canals. The class boundaries of this type are already changed several times and that will be also in the future. Experiences should make the type M20 more realistic and comparable with the real situation of a canal. That is allowed in the WFD [92].
Although the correct values and class boundaries of the biological quality elements are unclear, there should be invest in the ecology to improve the environment of the ARC so the GEP could be reached.

## 5.4 Judgement of the current situation on the class boundaries of the biological quality elements defined by Witteveen&Bos

Consultancy Witteveen+Bos use the class boundaries mentioned in table 19 to judge the current situation of the Amsterdam Rhine Canal. Each sub paragraph shows a biological qualiy element.

### 5.4.1 Current situation of ARC assessed on element fish

The identified current situation is tested on adapted class boundaries of the biological quality elements from Witteveen&Bos. The test of the fish score in the ARC is viewed in figure 16. It shows that the ARC is just reaching the GEP for breams.

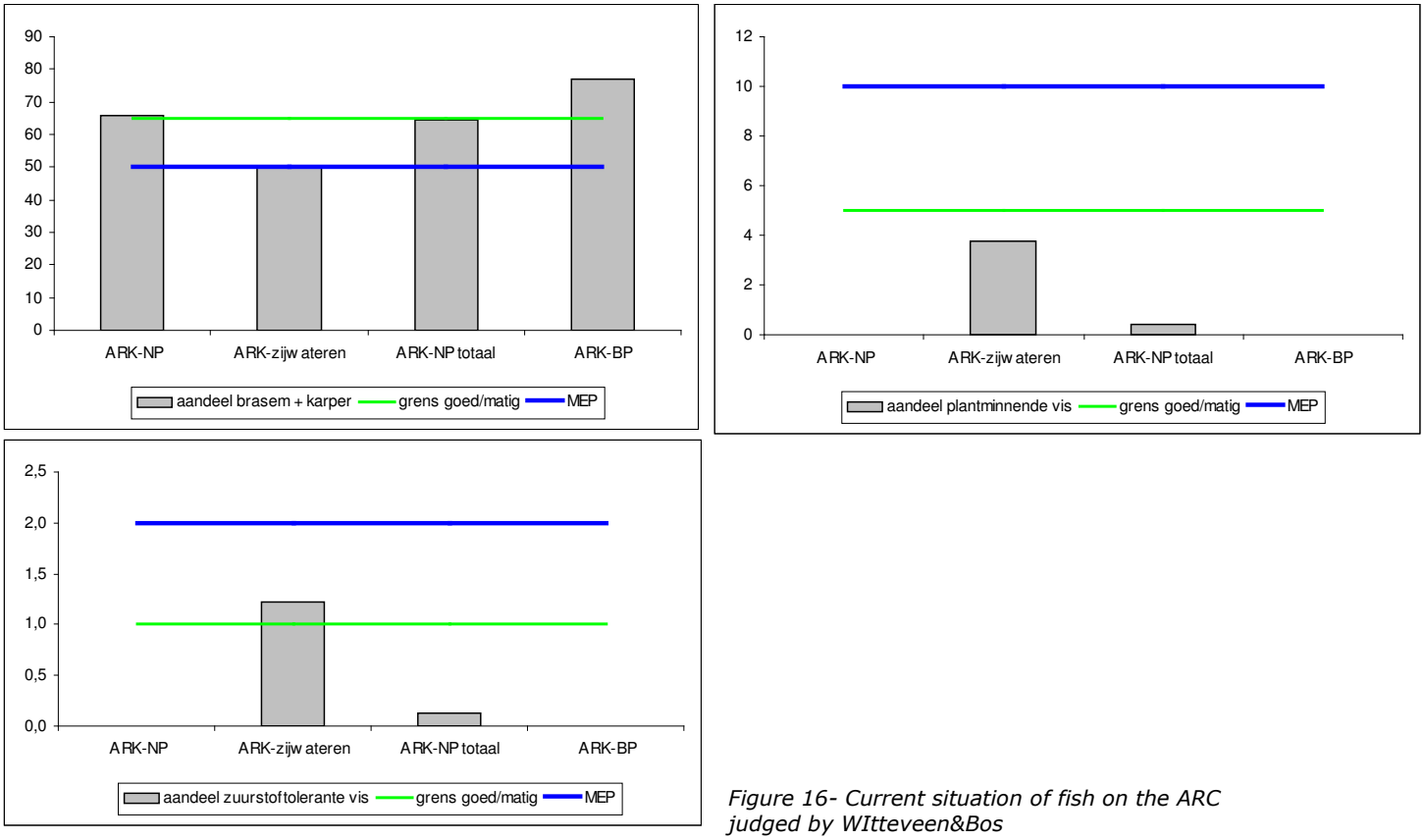



*Figure 16- Current situation of fish on the ARC judged by WItteveen&Bos*

## 5.4.2 Current situation assessed on element macrofauna

The scores of the test on the macrofauna for the ARC are showed by figure 17.

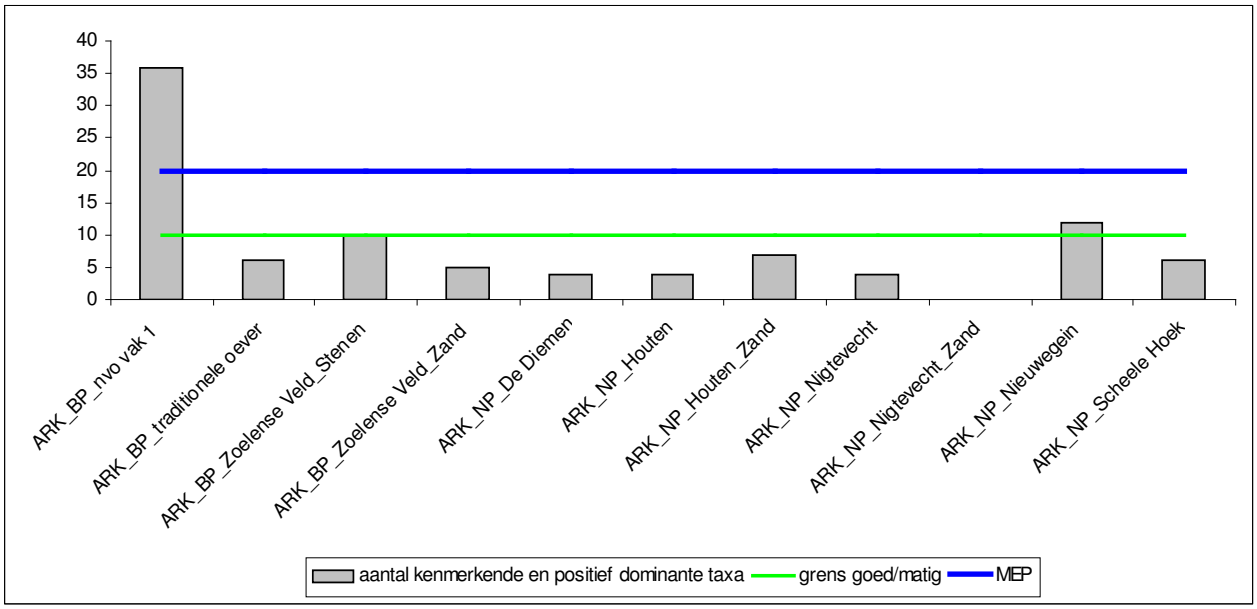



*Figure 17- Current situation of macrofauna on the ARC judged by WItteveen&Bos*

The nfb Maurikse Wetering is located in ARC Betuwepand and only that part is reaching the MEP for macrofauna. The draft report of Witteveen&Bos discuss that that perhaps has something to do with the monitoring effort and the way of monitoring. In the T0 report of Aquasense the macrofauna was also not reaching the MEP. The question about what was wrong with the monitoring data is still not answered by the cnsultancy.

## 5.4.3 Overall assessment of the WFD biological elements

The most important sticking points to reach the WFD targets for shipping canals are fish and macrofytes. The values of the references of these two biological quality elements should be levelled.

The default MEP-GEP M20 [93] compared with the ARC makes clear that just the phytoplankton is reaching the GEP. The fish score is not reaching the GEP mainly cause lack of plant using and oxygen tolerant fish. That is through the lack of vegetation (macrofytes). There are no judgements about the phytobenthos in the ARC. The macrofauna is also scoring bad, but that is perhaps through wrong monitoring.

Besides the ARC, Witteveen&Bos assessed also the monitoring data of the current situation on the reference types for eleven canals in the Netherlands. This report has the recommendation to level the reference of element fish and macrofyten, because they are too strict.

In the Official WFD approach there must be an assessment on the four indicators. It gives an impression about how huge the gap is between the current situation and the reference M20. There is a vision in this approach, but the target is not realistic for canals. Adaptations are allowed, but there are already several adaptations of the class boundaries and also new recommendations. It is not clear how the Praagmatic approach will define a target, what the level of the GEP will be. The monitoring is just started and can give an impression of the current values of the indicators, but an assessment is not possible.

### 5.4.4 Differences between the canals of the working group

The situation in the ARC is not reaching the GEP, based on the WFD biological elements (see paragraph 5.4.3), so there can be done something to improve the ecology, while the costs effectiveness of the measures for the ARC is very low. Witteveen+Bos assessed the other canals on the same way as it is described for the ARC in the previous paragraph. The canals are already divided by type (M20, M30 or R6) and by indicator values. Each canal has an other GEP requirement, but also an other starting point.
The results of the test on the biological quality element fish shows that just the North Sea Canal is scoring very well.
The results of the lowered biological quality element macrofauna show several views. The Twenthe canal has nature friendly banks which are all reaching the GEP largely, evenly the MEP. Nevertheless the nature friendly banks of the Wilhelmina canal, the Zuidwillemsvaart and the Wessem-nederweert are scoring better than the traditional banks, but not all nature friendly banks near these canals are reaching the GEP. The quality of the banks is very different. Almost none of the banks of the ARC are reaching the GEP. The Canal Gent-Terneuzen and the NSC are reaching the GEP and the NSC in some cases even the MEP.
Results of the tests on macrofyten have in majority a bad score. Even of the Twenthekanalen while the Nature friendly banks are good working, is the test on macrofyten scoring bad. Perhaps this reference is too strict.
The test on the element phytoplankton, mainly the indicator chlorofyl-a, shows that all canals are reaching the GEP. That result is understandable, because the retention time in canals is mostly low so there will be a low production of algea.

## *5.5 The contents of packages for the twelve canals*

The monitoring has been given different current situations near the twelve canals. Thereby the environment of each canal could not be compared with others. The aim of the packages with measures for each canal is to improve the ecology of the current situation so a higher score on the biological quality elements will be reached.
If there are nature friendly banks and migration barriers possible is location specific. So the package Good with just effective measures is different for each canal. The aim in the package Good is that there will be no migration barriers any more. Nature friendly banks are just mentioned in the following canals by package Good:

*Table 20- Packages good with areaal NFB*

| Canal | Areaal Nfb (%) |
|---|---|
| Bathse spui canal | 15.3 |
| Twentekanaal | 16.2 |
| Canal wessem nederweert | 12.3 |
| Noordervaart | 20.0 |
| Peel canals | 20.0 |
| Wilhelmina canal | 12.8 |

If one amount with money is available for canals and it should be divided over 12 canals it is perhaps better to invest it in an area where a lot of progression could be made. The canals with a bad score ask for a lot of money to improve the ecology a little bit. The water body is artificial and its function is shipping, perhaps fishes and water plants should have their habitat in other water systems and not in the canal. Some canals are already having a good score, but that could be improved and be more sustainable by an investment. It will be better to invest in the ecology in that canal, than in a really shipping canal, but that are political choices. The chemical quality should be improved everywhere, but the ecology is a different point. The MEP-GEP process leads to packages and give an impression about what is possible and which GEP level for the indicators should be reached for the twelve canals based on M20.

A discussion for each canal specific will be the last phase of the process. What can be done is showed in the results of the MEP-GEP process and what will be done with this water body should be answered by the managers.

## 5.6 Tools to support the decision process

Witteveen&Bos came with several packages to improve the current ecological situation. Several stakeholders will discuss the packages. The effects of the measures and what level could be reached on the reference for the ecology are difficult to assess. The expert judgments can calculate it with several knowledge rules, but that is perhaps difficult to understand for policy makers. Using a simulation or modulation tool could show the usefulness of the measures. First some modeling tools will be considerd before the Dutch tool WFD explorer will be discussed.

### 5.6.1 Models as a tool

The WFD modelling is explicitly mentioned in Article 5 characterising the surface water bodies. The relevant parameters are listed in Annex V and do not only include the former 'water quality' parameters, but also biological indicators (phytoplankton, macrophytes, fish, invertebrates) with references to the ecological status.

In the first instance several types of models are available with the potential to support the determination of reference conditions. In the second instance models may be used that contribute to understanding the risk to ecological system of catchment pressures. Although no other explicit reference to model use occurs in the WFD it is likely that they will be instrumental in cost effective implementation of the WFD. That is because the WFD requires that the most cost effective set of policy measures will be selected, which requires taking into account total costs.[94] Although the requirements of modelling for the WFD will include the usual requirements of best practice, there will be greater emphasis on the following three specific areas: Multi disciplinary catchment scale problems, active stakeholder participation and six yearly updating of the RBMP.

The current water management models are usually divided into two categories: the 'black-box models' and the deterministic models. The first group are based on data sets and as few parameters as possible. The aim of these models is to reproduce the observations as a function of external factors and the meaning of the involved parameters. Black-box models are easy to use and powerful, provided that a lot of data are available. They are not to use for predicting situations that are out of the scope of the derived data.
Deterministic models are theoritically trying to predict the evolution of the system out of its present state. Those models include a great number of variables and parameters that render them quite complex.[95] It should be recognised that although the primary WFD criterion is to improve the ecology, ecological modelling by black-box or deterministic models is relatively undeveloped in comparison with other domains.[96]

#### *5.6.1.1 Internationally projects to design a WFD tool*

The European Commission funds the projects, "River Basin Manager's toolbox" (existing of "Benchmark models for the WFD" and "REBECCA") and "Harmonising Quality Assurance in model based catchment and RBM"

River Basin Manager's Toolbox provides information and tools needed in the implementation of the Water Framework Directive (WFD) and will assist the River Basin managers in various steps of the WFD implementation process. In different steps of the implementation, such as assessment of pressures and impacts, classification, calculating the target loads, designing the programme of measures, and economical analysis, different kind of models are needed. The River Basin manager's Toolbox has been developed by two different research projects:

- Benchmark Models for the Water Framework Directive: BMW

*The BMW project is coordinated by the Finnish Environment Institute. The objective of BMW project is to establish a set of criteria to assess the appropriateness of integrated models for the use in the implementation of WFD. Moreover, the project aims at testing and demonstrating the use of integrated models applied to selected intensively studied river basins.*[97]

- Relationship between ecological and chemical status of surface waters: REBECCA

*The REBECCA project is coordinated by the Finnish Environment Institute (SYKE). The objective of REBECCA project is to bring new information of the relationships between chemical and ecological status of surface waters in order to support the implementation of the Water Framework Directive (WFD).*

Furthermore, the project Harmonised Modelling Tools for Integrated River Basin Management (Harmoni-CA) is coordinated by 5 partners.(RIZA - Institute for Inland Water Management and Waste Water Treatment, Head-department Watersystems; Ghent University, Biomath Department; Potsdam Institute for Climate Impact Research on Global Change & Natural Systems; Geological Survey of Denmark and Greenland, Department of Hydrology; University of Osnabrück, Institute of Environmental Systems Research)

To design RBMP an increasing need is felt for guided use and methodologies of harmonised high quality computer based tools (ICT-tools) supporting the design or river basin management plans and implementation of the WFD. Harmoni-CA working group tools lead to a computer based Modelling Support Tool (MoST), which provides a user-friendly guidance and quality assurance framework that will contribute towards enhancing the credibility of catchment and river basin modelling. It leads to an open, flexible, scientific sound toolbox for present and future integrated, harmonised ICT-tools. Easy access is not limited to technical access to resources, but also includes training material, demo case studies, protocols dealing with conditions for utilisation, rights of ownership, intellectual property rights and finance.[98] Try outs of Harmoni-CA MoST and its Knowledge Base (KB) represent significant advances in assuring the quality of modeling studies. However, despite support for the Hamoni-CA approach acceptance of new software by large organizations is likely to take several years.[99]

### *5.6.1.2 National project to design a WFD tool*

The project WFD explorer is part of the within goverment sponsored research programma 'Living with Water'. The tool WFD-explorer is in development in The Netherlands by several Dutch research institutes, mainly by WL Delft Hydraulics. It could give information to politicians and policy makers about the relation between ecological objectives, measures and effects. This tool will make it easier for outsiders to discuss and communicate about the choices and usefulness of measures. Also the costs will become clear. So the objective to develop an instrument is to support the drafting of a RBMP and to support the determination of the ecological potential. The challenge of this project is to find a balance between simplicity and transparency needed in policy development and acknowledging the complexity of ecological processes.

Nevertheless, WFD explorer is still in development. Since October 2006 a concept version is available in The Netherlands. Several consultancies have the task to fill in the explorer with water bodies and its data. Also the data and the area of the Amsterdam-Rhine canal are not yet filled in in the WFD explorer. The tool WFD explorer could still not be used for the case Amsterdam Rhine Canal, so using the tool to define the best package of measures to improve the ecology is not possible. While the concept MEP and GEP of the ARC are defined (with unclear biological quality element boundaries of the reference M20) by Witteveen&Bos and the next phase of selecting measures could be started. In the Dutch MEP-GEP Guidance process the tool could be used in the last phases when the objectives MEP and GEP are defined. In the Praagmatic Approach it is wanted to know the effects of measures in advance so the level of the objective GEP could be defined. For that approach the tool WFD-explorer is coming certainly a little bit too late.

## 5.7 Conclusion

***What are the possibilities in the Amsterdam-Rhine canal to reach the WFD ecological aims (GEP) for artificial waters and what is the usefulness of the tool WFD-explorer?***

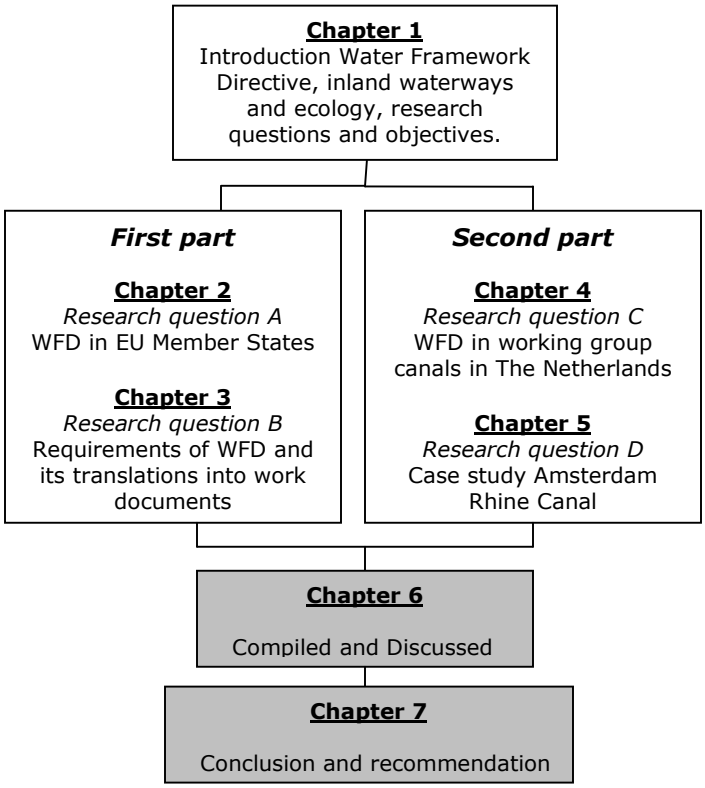
Out a long, complicated and tough process (MEP-GEP process step 1-10) came few options. There is a short list with possible measures for the ARC, which were already known before the WFD. So the WFD process does not result in an unrealistic programme of measures for a RBMP.

The results of the MEP-GEP Guidance process are worked out in four packages with possibilities. The measures to improve the ecology are related with creating natural banks and removing fish barriers in the ARC. There are no measures related with the actors to improve the ecology. Besides, the measures are determined without having a vision of the level of GEP. The working group canals used at the end of the WFD process just the Praagmatic Approach to define some measures.

The politicians and RWS should choose for a package to reach a still undefined GEP. The costs will be very high before the ARC could reach an objective GEP in 2015. It will be better to accept that the ecology of the ARC will not reach the GEP and that the current ecological situation is all right. Improving the ecology near the ARC ensures disproportionate costs. If there will be money available for shipping canals it will be better to invest in some other canals with a lot of ecological potential. An advantage of the WFD process is that canals can be compared with each other. The main function of the ARC, shipping, will be still the most important thing, but by other canals is more possible to improve the ecology.

(The WFD-explorer could be a good decisions support system. It could make the improvements on the biological quality elements and costs visible, but it is still in development and will come too late to use it in the Praagmatic Approach.)

## Integration of the four research questions



# 6 Discussion

"*STRATEGY is; A style of thinking, a conscious and deliberate process, an intensive implementation system, the science of insuring FUTURE SUCCESS.*"

**Pete Johnson**

The WFD is a new water legislation, which is coming into practice. The strategy of the WFD process can be used in several ways, but should result in an improvement of the ecology in the future. In a short overview the thesis gives the following information about the WFD implementation for artificial water bodies:

- Chapter 2; There is hardly any information about how other countries are dealing with the WFD on canals.
- Chapter 3; Several levels of reports exist to know how the WFD process is working and how to implement it on a specific water body: Official WFD – CIS reports – CIS report no 4 for AWB - Dutch MEP-GEP Guidance for AWB
- Chapter 4; The mentioned levels are extended with the Praagmatic Approach and RIZA document based on the Dutch MEP-GEP Guidance. Al these reports are used by the working group canals in The Netherlands and consultancy Witteveen&Bos to understand the WFD process.
- Chapter 5; The results of the MEP-GEP Guidance process: nature friendly banks and fish passages can improve the ecology of the canal, but are extremely expensive.

Furthermore the thesis gives an impression of the whole WFD process and how to use the MEP-GEP scheme for artificial water bodies. To get the WFD implemented in a good way some conditions should be met:

- the MEP-GEP scheme should be clear to everyone (chapter 2,3 and 4)
- the users must be good enough familiair with the WFD material (chapter 5)
- the data of the water bodies to assess the current situation on the biological quality elements must be available (chapter 5)
- there must be made political decisions (chapter 3, 4 and 5)

These conditions and the strengths, weakness, opportunities and threatness of the WFD will be discussed in this chapter.

## *6.1 SWOT analysis of the Water Framework Directive*

The SWOT-analysis summarizes the strengths, weaknesses, opportunities and threats of the WFD process.

**S**trengths:

- The WFD ensures a more structured process and more consistency in the policy of the managers of the water bodies;
- The process is obligatory, but the way of implementation is not central regulated;
- Definitions of own objectives are based on references (Official WFD approach); ensures coherencey and comparable objectives.
- Integration of the methodologies in water management and nature management in the WFD;
- Several ambition levels are allowed;
- The situations in regions, national and internationally could be compared.

**W**eaknesses:

- The guidance is difficult to use, even with the fourteen CIS reports;
- Unclear definitions are used, even for water managers;

- The flexibility in the WFD process results in a more complex implementation of the process. For instance the Praagmatic approach has been created;
- It has a high theoretical value which is difficult to use in practice;
- The translation from hydro morphology to measures for biological quality elements is hard;
- Monitoring data of a water body for the test on a biological quality element are not sufficiently available at present;
- There exists uncertainties about the real effects of the measures;
- There is little known about the relation and interaction between nature and water management;
- In practice the authorities are heavily depending on the knowledge of regional experts.

**O**pportunities:

- Improvement of the environment, water quality and ecology through whole Europe;
- Integrate the WFD with the already existing policies such as the EHS, Natura 2000 so there will be no information lost;
- Member states who want invest in the ecology get a chance, without being disadvantaged as the results are disappointing at the end;
- Participation of and communication with outsiders is possible in an objective way;
- Development of the WFD-explorer as a decision support system could make the situation visible for policy makers;
- Decision makers, politicians and ecological experts should work together;
- Communication about international developments and interpretations.

**T**hreats:

- The WFD process is objective, but with flexibility for own interpretation. That flexibility weakens the objectivity in the WFD process;
- The economical situation of member states could influence the WFD implementation process;
- Bad communication between regions and politicians makes an integral approach difficult;
- Member states are doing the WFD process just for Brussels, instead of seeing their own chances;
- Brussels is unclear on some points, so the member states must invent the wheel by its own, time wasting and minimal coherency as a result;
- Implementing the WFD on natural, artifical and heavily waterbodies is a huge amount of work;
- What can be done for a water body is defined through the WFD process, but what will a country do is still a political discussion;
- Lack of experiences and huge amount of reports combine with the deadlines.

The WFD is depending on several things before it will be a success. The intention of the WFD gets enough support, but the theory must be translated in practice and that is difficult. The action points are to improve the weaknesses so the process itself develops into a better implementation process. The whole WFD process for all waterbodies will be passed through for the first time in the period 2000-2009 and is coming back every 6 years, so 'learning by doing' is possible. In 2015 all characteristics of the process are familiar. An evaluation of the results and problems could give learning effects. The makers of the WFD should pay attention to the threats to ensure that the WFD will not fail in the mean time. Most important is that the Member States still believe in the targets of the WFD. They should not loose their motivation through the too many reports, own flexibility and unclearnesses of the WFD and in the meantime the deadlines. Water managers must make an investement first, before there will be results in the future.

## *6.2 Process of water policy and Water Framework Directive*

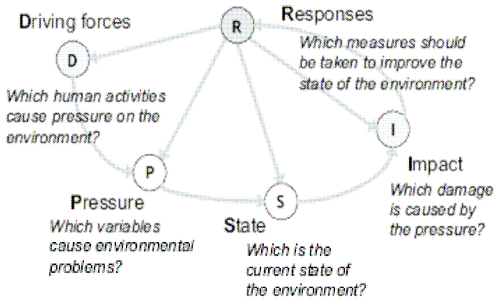
Water legislation of the European Community began in 1975 and subsequent EC Directives have had a major influence on communitarian water law and regulation. These Directives tackled specific issues separately. They were fragmented in nature and there was a lack of

progress with regard to their implementation. [100] Recognising the need to safeguard the water environment, the European Commission published the WFD in December 2000. It is the most important piece of water legislation produced by the EC, embracing the principles of sustainable development, replacing many earlier directives and strongly influencing water policy in all Member States. The international working group CIS translates the Official WFD into workdocuments. These workdocuments are very usefull to understand what must be done. The process is described into detail, but had many own interpretations about how to fill in the WFD process. The reports contains a lot of pages with still undefined terms, but the reports must be suited to the water systems own situation through whole Europe. So it will be a long and fragmented process to understand the WFD. (Contrast 1: work documents should be short, clearly and easy to understand, but there are a lot of work documents which are difficult to use through the number of pages.)
In the mean time the deadlines are strict and there is a lot to do for the WFD. That does not mean that there is a lot of information available how Member States deals with the WFD for canals. (Conflict 2, few things are known about how the Member States are dealing with canals – RBMP must be finished in 2009). At this moment the watermanagers are not so familiar with the WFD, but that will change by learning by doing. So for the second RBMP cycle it will be easier to fill in the WFD process. Then there is also more data available about the water system through the monitoring programme. More data results in a better assessment of the current situation and in more realistic GEP.

All of that does not ensure the progress of the WFD implementation nowadays and gives uncertainties about the profit of new water policies. Stakeholders want to see the benefit and are not interested in another water policy process with a too long duration. The new water policy WFD is a challenge, but there must be done a lot to get it succesfull. Otherwise there is still nothing improved or learned from the history.

## 6.3 What will be the level of the ecological targets?

The WFD is mainly inspired on natural water systems. The WFD became more and more specific and also classifications for artificial water bodies arose. Perhaps the WFD process goes too far for artificial water bodies. For instance, the Amsterdam Rhine Canal is specificially digged for shipping and the impact of it on the environment has been accepted. The inland waterway has a depth of 6 m and is not friendly for the ecology. Furthermore all kinds of industry has been developed in the area of the Amsterdam Rhine Canal. That will not be turned around.




In The Netherlands there are a few natural water bodies so the attention goes to heavily modified water bodies and artificial water bodies. For instance canals. Canals are developed for intensive shipping which generally gives little options for ecology. It is a social and economic choice to choose for transport by water instead of transport by roads. The question is how to define ecological objectives for the WFD. Some choices in the past can be turned back, but it is not an option to move the transport instead by shipping back to the road.
Starting point of the WFD for AWB is the fulfilment of function of the waterbody instead of the ecology. On the other hand that does not mean that the ecology must suffer. The question is when will the ecology be good enough. Is that just as all GEP's for all kind of water bodies types are reached? The WFD is answering that question with yes. Only the determination of the GEP is not filled in completely so it is unclear what the level of GEP must be.
The main thing is to find a balance between the pressures, impacts, economy and social acceptance and write it down in a River Basin Management Plan.[101] The WFD ensures that

there should be taken measures to improve the ecology. That is the reponse of the WFD on the current situation. Figure 18 shows the other interactions into a River Basin District where a balance in between should be find. The improvement of the ecology could be compared with a pyramid (Figure 19)


*Fig. 19- Pressures and Ecological development which could lead to dead water or MEP*

Pressures are influencing the current situation and may even lead to dead water. The WFD tries to develop the ecology with measures so an appropriate level could be reached. For natural water body the highest level, very good ecological status is defined from which the objective may deviate somewhat and for artificial water body the maximum ecological potential can be defined, accounting for the artificial nature of the waterbody. So the WFD already agrees with a lower level what could be reached for artificial water bodies.
The process, which is described in the MEP-GEP Guidance, is a first step in the direction to improve the environment. In a structured way there will become several variants for measures. So the question about what is possible to improve the ecology is answered. The next step is to find an answer on the question what do we really want to invest, how far will we go? That is still a political decision: which measures will be taken and so which level will be reached on the pyramid. There should be given an answer on: *Is it significant to take all kind of measures in a canal?* In the WFD context is the definition of significant the assessment of ecological qualities (what produces it?) and costs. By quantifying firstly the technical feasibility of measures and afterwards defining the improvement of the ecological quality (contribution) and translate it in costs. The WFD describes it, the politicians should fill in the more objective and founded assessment. The question about: *What is social economical realistic nowadays?,* will be a political discussion and is never ending. 'What can we do and what will we do', will be different in each Member State and the WFD accepts that between some boundaries. The GEP must determined for each water body specifically in a transparent way.

The WFD explorer could be a good tool for the politicians and other stakeholders to help them by filling in the process. The ecology is an unpredictable thing, but the explorer shows what kind of ecology could be reached if some measures are taken. At the end the effort is counting and not just the results.

## 6.4 The working method by the Dutch working group canals

Chapters 3 and 4 show several methods to implement the WFD. The working group canals states to prefer the Praagmatic Approach instead of the Official WFD Approach, but actually they are combining both methods.
The Dutch natural reference (M20) which should be considered as 'very good ecological status' has been compared with still uncomplete monitoring data of a water body. The status of the water body has been assessed on biological quality elements. (Bad, moderate, good, very well) The gap between the current situation and the defined objective GEP based on the reference needs to be filled in by measures. That is the Official Approach and is worked out in the CIS reports and Dutch MEP-GEP Guidance.

In the process Witteveen&Bos is clustering the canals to get four objectives for types. The Default MEP-GEP document could have been used, but in the next phase, Wittveeen+Bos is using a more complete list of measures for each canal specific and the type with connected objective is not used any more. If Witteveen+Bos had been strictly using the Praagmatic Approach the assessment on a reference would not have been necassary. Also the section in the concept report about the class boundaries of the biological elements is unnecessary. By

the Praagmatic approach, the measures counted on the current situation results in the objective GEP. So the working method of Witteveen&Bos combined the WFD approaches and series of meetings has been necessary to understand the process and to make choices. At the same time, a number of reports are produced to make the WFD process easier to understand and to use.

Directorate General for Public Works and Water management must define the MEP and GEP for each canal. In the results for the RBMP it is important that the measures, included in the GEP, should be critically evaluated and explained. That is a RBMP requirement whereon Brussels is judging the results. This requires that the costs, benefits, negative impacts, technical feasibility, social acceptance, and cost-effectiveness should be assessed. The assessments have to be made case by case.
Probably it is better to use the official WFD approach (top down) to get more arguments and to use the praagmatic approach (bottom up) to define the measures. That is because the CIS guidance no 4, MEP-GEP for AWB, has not so many political choice moments as the Praagmatic Approach in the first steps. The framework in the official WFD describes the procedure in detail and levels the level by answering questions and results into a GEP. There will be a vision defined on fore hand. The Praagmatic approach is starting without vision and looks to which measures can be used and after that what the level of GEP could be. That level will be minimal argued.

In practice, authorities will need to draw heavily on the local knowledge of regional experts when applying the Dutch MEP-GEP guidance or the Praagmatic Approach. All in all, it is a process in which decision makers and ecological experts cannot do without each other.
The public and the European Commission must be able to see a clear, transparent and well documented process, whereon decisions have been made in line with the formal WFD. An advantage of the WFD is that the water bodies in the working group canals can be compared with each other. In a national discussion there can be concluded whereon should be invested, regardless which approach is used. For the canals the Juliana canal and the ARC fewer possibilities were left than for the Twenthe canals and the North Sea canal where many measures can be taken.

The WFD process is be passed through for the first time. The process depends and consists of WFD requirements, implementation reports, data, deadlines and watermanagers without WFD experiences. The working group canals did try out the Official WFD and Praagmatic approach randomly. Both approaches ensured the same outcome by a lot of work. The WFD process was a huge learning process, but for the next RBMP cycle they could learn from the first time. There will be not so many problems anymore. The watermanagers are more familiar with the reports and there will be more data of a water body available. Or Brussels is changing the water legislation in such a way that just the natural waterbodies should walk through the whole WFD procedure for the ecology. That is because most canals have the shipping as main function and that will not change rapidly.

# 7 Conclusion

There is still little information available about the WFD implementation for artificial water bodies in the EU Member States. More specifically, for canals only something is known about the WFD process in England, Ireland and Scotland besides the Dutch approach. A EU-wide comparison of approaches therefore is not feasible.

The WFD ensures requirements on the River Basin Management Plans in 2009. The formal WFD policy is translated by an international working group CIS in informal, non-legally binding reports to assist by the implementation process in the Member States. In the Netherlands those reports are adapted to their own situation by RIZA and STOWA. The Official WFD, the CIS reports and the Dutch reports describe the process, but it is still not a straight forward methodology. The terms slight deviation and on which function some effects are not allowed are filled in. How to use the described process is still open for own interpretation. National meetings are necessary to get coherency in undefined definitions and exchange information about how to use those reports, even for the Dutch version that is necessary. So there is still

little grip for the participants who must use the reports. The water managers and other stakeholders are not familiar with all those reports. It asks a lot of reading and just exchange experiences before the whole process is understand by the users.

The Netherlands has attempted to make the process more concrete by designing a new approach which is meant to improve the implementation of the WFD on the ecology for canals. The approach is bottom up instead of top down, but in practice mainly has a different order of the same WFD steps, but that does not mean the same objective GEP will be came out. But still this new approach has its lacks and obscurities through undefined terms.

The working group canals and consultancy Witteveen+Bos that is preparing the implementation had difficulties in using the WFD reports. Through a serie of meetings it became obvious that it is not clear how to use the guidelines, the interaction between the Official WFD, Cis guidance no 4, Dutch MEP-GEP Guidance and Praagmatic Approach and definition of some terms, such as significant or disproportional. The Official WFD has a high formal value and the CIS guidances are work documents. Nevertheless, the working group canals decided not to use the Official Approach, but they are assessing the current situation and the measures and its effects on the biological quality elements on the biological quality elements of natural reference M20. Defining on a reference are steps in the Official WFD Approach. While the Praagmatic Approach is looking from the current situation to the measures which can be done and how far the score of the water body can come on the suited biological quality elements. So Witteveen+Bos does not use one predefined approach, but a combination of such approaches. The whole process for the WFD implementation on canals is still in developing. In January 2007, a default version of policy/objective variants with measures is presented by the consultancy Witteveen&Bos. The next step in the WFD process, to define the final measures for the RBMP, still is a subjective and political decision.

The current situation of the ARC is not complying to the WFD objective Good Ecological Potential, based on incomplete data. The WFD monitoring programme must deliver all data before it will be possible to assess the gap between the current situation and the reference based on the WFD biological quality indicators.

The process is meant to ensure that the objective working method between the water managers nationally and internationally could be compared. The main thing is that there will be on an integral way viewed to river basins. That could just ensure a better way of protection, improvement and sustainability of the environment not just for us, but also for the next generation. If the self imposed objectives throughout Europe are really obtainable will be visible in 2015, 2021 or 2027. The water managers are supporting the intention of the WFD nowadays, although it is felt to be a complex process, but it must still become into reality.

## *7.1 Recommendation*

It could be easier in advance as the members of the working group canals filled in the steps of the Dutch MEP-GEP Guidance. No other report had to be made and the CIS Guidance could be used easier as a guidance of how to use some definitions. Although there are also in the Dutch MEP-GEP Guidance undefined terms for example 'significant effect', the translation into the RIZA document to make a assistence has failed. Another new document with other definitions made the process more difficult.

Just start with using the WFD reports and CIS reports and do not see obstacles in advance. The process of the WFD is still in development and that will remain to the end. There is still a lot unclear and not defined, but the River Basin Management Plans must be finished in 2009. It will be learning by doing and the learned things can be used in the second RBMP cycle.

Start with the Official WFD approach to implement the MEP-GEP Guidance. It ensures a transparent way to defining the objectives. There will be a vision for a long term about the level GEP. In the second part, just defining the measures, it is easier to use the praagmatic approach.

Ensure that the monitoring will become in compliance with the WFD so that it gives sufficient information that is useable for the biological quality elements. And do not just monitoring, but also update the class boundaries of the WFD references.

Type M7 does not exist any more, but the class boundaries of the biological quality elements of type M20 should change to make it realistic for canals. Mainly the definitions for element macrofauna should be adapted, because it is not realistic to get water plants in a canal of 6 m deep.

Use the WFD-explorer as soon as possible, it will give in a transparent way the usefulness of measures. Furthermore it could help in the communication process to others.

**More research questions:**

- Why are other countries not so far for artificial waterbodies? They have the same deadlines.
- Why did the workgroup canals use the Official and Praagmatic Approach randomly?

# 8 Glossary and List of figures

| | |
|---|---|
| Artificial water body | is a body of surface water created by human activity. It is known as a heavily modified water body if, as a result of physical alterations by human activity, it is changed substantially in character as designated by an individual Member State and in accordance with the provisions of Annex II of the WFD. |
| Ecological status | is an expression of the structure and functioning of aquatic ecosystems associated with surface waters. Such waters are classified as being of good ecological status when they meet the requirements of the Directive. |
| Environmental objectives | are objectives set out in Article 4 of the Directive. These define the environmental goals which must be achieved. |
| Good ecological potential | the status of a heavily modified or artificial water body, classified in accordance with the relevant provisions of Annex V. |
| Good surface water status | is when both its ecological status and its chemical status are at least good and a surface water body is regarded as being of good status. |
| Heavily Modified Water Body | A distinct volume of surface water which, as a result of physical alterations by human activity, is substantially modified. |
| Hydrological | means pertaining to water |
| Impacts | Effects of pressures on the status of surface water and groundwater. |
| Lake | is a body of water, which may be man-made or natural, occurring in the land surface |
| Pressures | Physical expression of human activities that could change the status of the environment in space and time (discharge, abstraction, environmental changes, etc...). |
| Programme of measures | defines in detail those actions which are required to achieve the environmental objectives of the Directive within a river basin district. Applicable by the end of 2009, the programme of measures defines, for each district, the measures to be implemented to achieve the objectives defined for 2015 by the Management Plan. The programme of measures is actually a part of the management plan. |
| River | is a body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course. Upland rivers are generally fast flowing and lowland rivers are generally slow flowing and meandering. |
| River basin | means the area of land from which all surface water run-off flows, through a sequence of streams, rivers and lakes into the sea at a single river mouth, estuary or delta. |
| River basin management plan | Is a detailed document describing the characteristics of the basin, the environmental objectives that need to be achieved and the pollution control measures required to achieve these objectives through a specified work programme. |
| Surface water | means inland waters, except groundwater, which are on the land surface (such as reservoirs, lakes, rivers, transitional waters, coastal waters and, under some circumstances, territorial waters) which occur within a river basin. |

| | |
|---|---|
| Water body | is a discrete and significant element of surface water such as a river or canal, lake or reservoir, or a distinct volume of groundwater within an aquifer. |

# 9 References

[1] http://www.euwfd.com/ (August 2006)
[2] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000 establishing a framework for Community action in the field of water policy
[3] http://www.wfduk.org/wfd_concepts/ (August 2006)
[4]http://www.wfduk.org/stakeholder_reviews/Standards_Jan_2006/Supporting_Documents_TAG%20Guidance/tag_guidance/Article%20_11/POMEnvStds/WP14e-05-10-05/view
[5] Working Group 2.2 , (2003); " COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC) Guidance Document No 4, Identification and Designation of Heavily Modified and Artificial Water Bodies" , Luxembourg: Office for Official Publications of the European Communities, ISBN 92-894-5124-6
(http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive&vm=detailed&sb=Title)
[6] http://www.sepa.org.uk/publications/wfd/html/rbpf_solway/3.html
[7] Projectgroep Implementatie Handreiking, (November 2005) "Handreiking MEP/GEP, Handreiking voor vaststellen van status, ecologische doelstellingen en bijpassende maatregelenpakketten voor niet-natuurlijke wateren" RIZA rapport 2006.002, STOWA-rapport 2006-02, ISBN 90-369-5708-7; NL leeft met Water en RWS.
[8] Working Group 2.2 – HMWB, (2003) " COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC) Guidance Document No 4, Identification and Designation of Heavily Modified and Artificial Water Bodies", Luxembourg: Office for Official Publications of the European Communities
[9] Projectgroep Implementatie Handreiking, (November 2005) "Handreiking MEP/GEP, Handreiking voor vaststellen van status, ecologische doelstellingen en bijpassende maatregelenpakketten voor niet-natuurlijke wateren" RIZA rapport 2006.002, STOWA-rapport 2006-02, ISBN 90-369-5708-7; NL leeft met Water en RWS.
[10]
http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents&vm=detailed&sb=Title
[11]
http://ec.europa.eu/environment/nature/nature_conservation/eu_nature_legislation/habitats_directive/index_en.htm
[12] http://www.vidm.gov.lv/ivnvb/ivn/Eproced.htm
[13] van Maren,M., Opdam, H. (16 August 2005) "Environmental Impact of Inland Shipping and Waterway Development -DGG/TB/26000415" Ministerie van Verkeer en Waterstaat
Directoraat Generaal Goederenvervoer and Royal Haskoning Coastal and Rivers, Arnhem.
[14] http://ec.europa.eu/environment/water/water-framework/index_en.html (September 2006)
[15] http://ec.europa.eu/environment/water/water-framework/links.html (October 2006)
[16] CIS WG 4.: 1 Integrated Testing of Guidance Documents in Pilot River Basins, contactpersons Dr. Alan Barr, Mr. Larry Stapleton, Environmental Protection Agency, Ireland
[17]http://betterriverbasins.wwf.org.uk/wfd_tools/wfd_pilot_projects/
[18] http://viso.ei.jrc.it/wfd_prb/intro.html

[19] Jouan, H., Mackey, P., McGrath, R. (October 2001) Irish NGOs and The Water Framework Directive –VOICE
[20] www.doeni.gov.uk
[21] www.ehsni.gov.uk [August 2006]
[22] SNIFFER, November 2004, water use in Scotland and Ireland for WFD implementation purposes, EDINBURGH
[23] http://www.rpsgroup.com/news%20stories%20folder/downloads/Budapest%20Shannon%20Paperrev11.doc
[24] http://www.wfdireland.ie/; The Characterisation and Analysis of Ireland's River Basin Districts, in accordance with Section 7(2 & 3) of the European Communities (Water Policy) Regulations 2003 (SI 722 of 2003), National Summary Report (Ireland) 2005
[25] http://www.sniffer.org.uk/sn_wfd_development_1.asp?location=research_areas&refer=res_area_water_1.asp#identification
[26] http://www.sniffer.org.uk/ [August 2006]
[27] EPA, (2006) "Ireland Water Framework Directive Monitoring Programme
Prepared to meet the requirements of the EU WFD (2000/60/EC) and National Regulations implementing the WFD(S.I. No. 722 of 2003) and National Regulations implementing the Nitrates Directive
(S.I. No. 788 of 2005) Published by the Environmental Protection Agency, Ireland
[28] http://wasserblick.net/servlet/is/1/ and http://www.bmu.de/gewaesserschutz/aktuell/aktuell/3795.php
[29] Borchardt, B. (Universität Kassel); Bosenius, U. (BMU) (2005), "Environmental policy, Water Framework Directive -Summary of River Basin District Analysis 2004 in Germany", Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Berlin.
[30] http://www.ecologic.de/download/projekte/1950-1999/1970/draft_measures_handbook.pdf
[31] http://www.umweltbundesamt.de/wasser-e/themen/wrrl_bestand.htm
[32] http://www.iksr.org/index.php?id=316
[33] http://www.ems-eems.nl/EMS-EEMS/nl/wfd.html (September 2006)
[34] http://wasser.lebensministerium.at/article/archive/6345
[35] lebensministerium (2006) "EC Water Framework Directive Summary report of the characterisation, impacts and economics analyses required by Article 5 Austrian River Basins", Federal Ministry of Agriculture, Forestry, Environment and Water Management, Vienna
[36] SCHIMA, J. (2004)," Role of Ecosystems, Forests and Wetlands as Water Suppliers in Austria - National report" , Convention on Protection and Use of Transboundary Watercourses and International Lakes, Vienna
[37] http://www.aquamedia.at/templates/index.cfm/id/10771
[38] http://www.scotland.gov.uk/Topics/Environment/Water/17316/WFDCharacterisationNote
[39] http://www.sepa.org.uk/
[40] SEPA, (March 2005),"Scotland River Basin District Characterisation and
impacts analyses required by Article 5 of the Water Framework Directive", ISBN 1 901 322 54 8
[41] http://www.sepa.org.uk/pdf/publications/wfd/Article_5_Scotland_River_Basin_economic.pdf
[42] http://www.sepa.org.uk/ (August 2006)

[43] Waterways 2025: Our vision for the shape of the waterway network. British Waterways, June 2004. (www.defra.gov.uk/environment/water/wfd/economics/pdf/useannexes.pdf and http://www.sepa.org.uk/publications/wfd/html/economic_scotland/annex1i.html)
[44] http://www.defra.gov.uk/environment/water/wfd/ [August 2006]
[45] http://www.environment-agency.gov.uk/ [August 2006]
[46] http://www.waterways.org.uk/Home
[47] http://www.britishwaterways.co.uk/waterways/index.html [September 2006]
[48] http://www.defra.gov.uk/environment/water/iw/index.htm
[49] http://www.sniffer.org.uk/active_further_info.asp?id=301&location=
[50] DEFRA, Oct 2002, "second consultation paper on the implementing of the EC Waterframework Directive"
[51] http://www.wfduk.org/ [August 2006]
[52] Heer, J. 28 November 2004, Quick-scan of integrated water laws in different countries, Towards Integrated Water Legislation in The Netherlands, Ministry of Transport, Public Works and Water Management / RIZA/ Royal Haskoning
[53] Blind, M., de Blois, C. (2003) "The Water Framework Directive and its Guidance Documents – Review of data aspects, Institute of Inland water Management and waste Water Treatment (RIZA)
[54] http://themas.stowa.nl/Themas/Handreiking.aspx?mID=7216&rID=786&aID=1194
a- Altenburg, W.,et al. (30 november 2005), "Default-MEP/GEP's voor sterk veranderde en kunstmatige wateren, Concept versie 8", Roelf Pot onderzoek- en adviesbureau and RIZA
b- Portielje, R., Schipper, C., Schoor,M. (2005) "De invloed van hydromorfologische stuurvariabelen op ecologische KRW doelen vis, macrofauna, waterflora en fytoplankton Infobladen oorzaak-gevolg relaties voor MEP/GEP" Werkdocument RIZA/2005.098X RIKZ/2005
c- van der Molen, D., Berendsen, M. (26 september 2006) "Aanpak ecologische doelen sterk veranderde en kunstmatige waterlichamen", RIZA Lelystad
d- van der Molen, D. et al., (2003-2004), "Referenties en maatlatten voor meren ten behoeve van de Kaderrichtlijn Water" rapportnummer 2003-W05, ISBN 90.5773.232.7, STOWA, Utrecht Oranjewoud (14 april 2004),
e- "Handreiking beschrijving en beoordeling ecologische effecten van hydromorfologische belastingen", RIZA
[55] WFD CIS Guidance Document No. 4 (2003). Identification and Designation of Heavily Modified and Artificial Water Bodies. Published by the Directorate General Environment of the European Commission, Brussels. ISBN 92-894-5124-6; ISSN 1725-1087.
[56] WFD CIS Guidance Document No. 3 (2003). Analysis of Pressures and Impacts. Published by the Directorate General Environment of the European Commission, Brussels. ISBN 92-894-5123-8; ISSN 1725-1087.
[57] Working Group 2A, (2005) "CIS Guidance Document No 13 Overall Approach to the Classification of Ecological Status and Ecological Potential" ISBN 92-894-6968-4, European Communities
[58] WFD CIS Guidance Document No.7 (Jan 2003). Monitoring under the Water Framework Directive. Published by the Directorate General Environment of the European Commission, Brussels, ISBN No. 92-894-5127-0, ISSN No. 1725-1087.
[59] CIS guidance report no 2 , identification of a water body , European Communities, 2003.

[60] Kampa, E., Kranz, N. (2005), "WFD and Hydromorphology European Workshop 17-19 October 2005, Prague Workshop summary report", Ecologic.
[61] http://www.waterframeworkdirective.wdd.moa.gov.cy/docs/GuidanceDocuments/PolicySummary/HMWBPolicySummary.pdf
[62] Handreiking voor vaststellen van status, ecologische doelstellingen en bijpassende maatregelenpakketten voor niet-natuurlijke wateren, projectgroep implementatie handreiking, november 2005 RIZA and STOWA
[63] De Smit D. en werkgroep, oktober 2005, Document 'Handreiking MEP/GEP, handreiking voor vaststellen van status, ecologische doelstellingen en bijpassende maatregelenpakketten voor niet-natuurlijke wateren.',versie 1.2 , Landelijk bestuurlijk overleg water (LBOW) projectgroep handreiking.
[64] Kampa, E., Kranz, N. (2005), "WFD and Hydromorphology European Workshop 17-19 October 2005, Prague Workshop summary report", Ecologic.
[65] Buijse, T., Document 'Pragmatische implementatie Europese Kaderrichtlijn Water in Nederland, van beelden naar betekenis' RIZA
[66] van der Molen, D. et al., (2003-2004), "Referenties en maatlatten voor meren ten behoeve van de Kaderrichtlijn Water" rapportnummer 2003-W05, ISBN 90.5773.232.7, STOWA, Utrecht
[67] www.kaderrichtlijnwater.nl
[68] CIS Working Group 2.2 – HMWB, "Policy summary, Guidance Document No. 4 Identification and Designation of Heavily Modified and Artificial Water Bodies"
[69] Visser, J., (24 April 2006), "Balanceren tussen eenheid en verscheidenheid, een onderzoek naar de invoering van een corporate werkwijze bij RWS voor de implementatie van de KRW" Ersmus Universiteit Rotterdam.
[70] Handreiking voor vaststellen van status, ecologische doelstellingen en bijpassende maatregelenpakketten voor niet-natuurlijke wateren, projectgroep implementatie handreiking, november 2005 RIZA and STOWA
[71] Handreiking beschrijving en beoordeling ecologische effecten van hydromorfologische belastingen', van RIZA, opgesteld door Oranjewoud (14 april 2004).
[72] Rijksbeheersplan voor rijkswateren. Rws
[73] (Bak et al., 2000).
[74] RW 1571-1 afleiding mep-gep voor kanalen in beheer van Rijkswaterstaat concept 1 15 dec 2006
[75] (De Hoog & Pieters, 1997).
[76] Jaarsma, J., (2007), Draft report define MEP-GEP for awb;Witteveen+Bos
[77] Jaarsma, J., (2007), Report define MEP-GEP for awb;Witteveen+Bos
[78] An appointment with Mr. W. Schouten on January 15th has given an impression of the current projects in the Amsterdam-Rhine canal.
[79] 3090 Ecologisch herstel Rijkswateren, terugblik en perspectief 1990-2005 RIZ
rapport nr. 2001-045 Gerrit Polman en Wouter Iedema, nov. 2001, ISBN 9036954029
[80] 3274 ontwerp NVO ARK locatie Nigtevecht-west, RIZA werkdocument 2002.171x Lelystad, januari 2003, Wim Schouten et.
[81] No 3274 uit rws utrecht afd. Wsw bieb.
[82] Made by M. Baijens and Directorate General Public Works and watermng presentations
[83] Made by N. Jaarsma from Wittveen&Bos

[84] Monitoring by Waardenburg, NVO Maurikse Wetering
[85] Rapport vanuit OVB , organisatie verbetering binnenvisserij, 10 jr terug onderzoek naar verbetering ecologie /optimalisering. …daaruit volgde, streven van 60 km NVO in 2001.
[86] Alterra report 1309 Wageningen, MJPO en natte As , 2006
[87] 3446 Reflectiebeperking oevers ARK, verbetering vd passagemogelijkheden voor dieren, W-DWW-94-289
[88] Witteveen+Bos (d.d. 4 februari 2005) RW1358-1 Nulmeting visstand Amsterdam- Rijnkanaal en Noordzeekanaal definitief
[35] Nijboer, N.C. (2003), Definitiestudie KRW, het invullen van referentietoestanden, Alterra Wageningen
[36] Aquasense, 2004, Document 'Amsterdam-Rijnkanaal op maat gemeten, T0 monitoring en opstellen specifieke deelmaatlatten fytoplankton, fytobenthos en macrofauna', rapportnr. 2404, in opdracht van RWS Utrecht.

[89] RW1571-1 afleiding MEP-GEP voor kanalen in beheer van RWS concept 15 dec. 2006
[90] Default mep-gep made by RIZA
[91] van der Molen, D. et al., (2003-2004), "Referenties en maatlatten voor meren ten behoeve van de Kaderrichtlijn Water" rapportnummer 2003-W05, ISBN 90.5773.232.7, STOWA, Utrecht
[92] Official WFD policy;adaptations of references
[93] (Pot, et.al., 2005)
[94] Rekolainen, S., Kamari, J. et al. , Finnish Environment Institue SYKE (2003), " A conceptual framework for identifying the need and role of models in the implementation of the WFD" Int. J. River basin management,vol1, no4, 347-352
[95] Wasson, J.-G, Tusseau-Vuillemin, M.-H., Andreassian, V. et al. (2003). "What kind of Water Models are Needed for the implementation of the European WFD?" Int. J. River basin management,vol1, no2, 125-135
[96] Old, G.H., et al. (2005),"Supporting the European WFD: The HarmoniQua Modelling Support Tool (MoST), Centre for Ecology and Hydrology, Maclean Building, Wallingford, UK.
[97] http://www.environment.fi/default.asp?contentid=116046&lan=EN (December 2006)
[98] http://www.harmoni-ca.info/About_Harmoni-CA/Partners.php (December 2006)
[99] Old, G.H., et al. (2005),"Supporting the European WFD: The HarmoniQua Modelling Support Tool (MoST), Centre for Ecology and Hydrology, Maclean Building, Wallingford, UK.
[100] Woods, D. (2004), "The EC WFD: An Introductory Guide, Foundation for Water Research", UK.
[101] Dietrich, J., Schumann, A.H., Lotov, A.V. (2004)," WORKFLOW ORIENTED PARTICIPATORY DECISION SUPPORT FOR INTEGRATED RIVER BASIN PLANNING" Institute for Hydrology and Water Management, Ruhr-University Bochum, Germany

# APPENDICES