SUGGESTIONS FOR RIVER BASIN MANAGEMENT

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On behalf of the committee,

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PREFACE

This report discusses groundwater issues in the context of the implementation in the Netherlands of the EC Water Framework Directive. The report was drawn up by the Soil Protection Technical Committee at the request of the Minister of Housing, Spatial Planning and the Environment, acting in part on behalf of the State Secretary for Transport, Public Works and Water Management. In the report, the committee focuses primarily on broad strategic issues. The committee has placed the emphasis on integrating soil, water and groundwater issues in the management of river basins.

A more detailed elaboration of the broad strategic issues can be found in the report 'Groundwater in the Water Framework Directive' (Grondwater in de richtlijn Water), TCB R14 (2001). This report answers specific questions about the organisation of management, such as monitoring design, identifying trends in increases and decreases of concentrations and determining the situation in which action is required in river basin management. The report was drawn up by the Groundwater working group of the Soil Protection Technical Committee as support for the advisory process. The Soil Protection Technical Committee subscribes to the opinion of the working group and the report should be seen as an integral component of advisory activities of the Soil Protection Technical Committee.

CONTENTS

1 INTRODUCTION

The EC Water Framework Directive is intended to create better conditions for restoring aquatic systems and/or preventing their further deterioration. To achieve this purpose, the directive provides a framework for coordination in the management of water, groundwater and soil. The directive is based on the concept of river basins.

At present, preparations are being made in the Netherlands for the implementation of the management approach set out in the directive. The committee is of the opinion that the main focus of implementation should be on the improvement of coordination in the management of soil and water. This should result in shared principles for water and soil management. These will be different from the existing principles, which are, incidentally, different for water and soil. In chapter 2 of this report, the Soil Protection Technical Committee sets out its opinion on the coordination required between various aspects relating to water and soil. Chapter 3 explains how the Soil Protection Technical Committee thinks that this opinion should be translated into general basic management principles.

A question which needs to be answered with respect to the management of river basins is how management units should be delimited. The committee proposes a delimitation system based on the geohydrological characteristics of the Dutch subsoil and the groundwater located there. This delimitation approach makes it possible to adopt a form of management which is tailored as much as possible to specific geohydrological conditions. The committee elaborates this proposal in chapter 4. There is also the question of what form management will take. The opinion of the Soil Protection Technical Committee in this respect is set out in chapter 5.

In management practice, there are many specific questions relating to groundwater issues. Examples are determining trends in increases or decreases of concentrations in groundwater, monitoring, and criteria as a basis for the determination of environmental objectives. The committee is of the opinion that it is necessary, if there is to be a meaningful elaboration of these specific management aspects, for the general basic management principles to be accepted as described in this advisory report. Only then can a suitable framework be established within which the

various components of the management of river basins can provide mutual support and backup.

2 COORDINATION IN MANAGEMENT

The committee now turns to how the management of river basins can contribute to coordination in the management of soil, groundwater and surface water and the management of water quantity and water quality.

Dutch environmental management focuses on quality and quantity. When the basic management principle is quality, thinking concentrates mainly on activities which can have a detrimental effect on quality such as discharges above ground and underground, on water and in groundwater and the use of the soil as a filter and biodegradation medium. The aim of management is to influence these activities until acceptable levels are achieved for the emissions of substances into soil, water and groundwater.

Management of the environmental compartments themselves is generally less highly developed, with the exception of water systems. When the basic management principle is quantity, the primary focus is on the water systems themselves, for example when managing surface water levels with a view to land use, the introduction of extraction wells for groundwater, raising or lowering the outflow rate of water and when increasing water storage capacity.

It is not really possible to distinguish between quality and quantity for water and groundwater. Procedures which are purely concerned with water resource management (in other words procedures for the management of water quantity) can affect quality and *vice versa* (see box). Nor can the quality and quantity of water and soil be viewed separately from the local environmental conditions: concepts such as water deficit, diffusion and acidification have a limited significance if they are not linked to concrete, existing systems. It is not possible to provide coordination in this area without involving soil as an environmental compartment. In the Netherlands, this awareness has resulted in an increased interest in the integration of environmental themes. That integration will primarily take shape in area-specific management.

The Water Framework Directive aims to integrate water management through the delimitation of river basins. This approach will link up elements of environmental management which have been tackled separately in the past. The Soil Protection

Technical Committee believes that the following features of the Water Framework Directive relating to coordination are crucial for river basin management in the Netherlands:

1. the directive assumes that there is a link between the quality of water which exits river basins and the quality in large water systems which take up the drained water;
2. the directive considers quality and quantity to be necessary components of management for every river basin;
3. the directive assumes that there is a geographical relationship between groundwater systems and surface water systems.

An example of the interdependence of quantity and quality

Groundwater is extracted from deep groundwater resources for the purposes of producing drinking water or for industrial use. The extraction processes change the existing groundwater flow pattern. The hydraulic head of groundwater decreases at large depths and, as a result, the upward flow of this generally clean groundwater to the surface decreases also. In seepage areas, this groundwater is pushed out at ground level by water from agricultural areas. This results in a change in the composition of available groundwater in the stream valleys. The unique combination of low sulphate levels, low chloride levels and relatively high calcium bicarbonate levels changes to a mixture with more sulphate and chloride. The change in the groundwater composition results in a decline in groundwater-dependent ecosystems. The consequences can be seen, for example, in stream valleys in the province of North Brabant where specific stream valley vegetation is under pressure, or on the edge of the Veluwe area, where vital aquatic ecosystems are being lost in artificial springs.

The Water Framework Directive can therefore make an essential contribution to the integration of environmental themes which are thought to be desirable in the Netherlands. In order to achieve this integration, the committee believes that it is desirable to organise management on the lines of an area-based approach to the integration of environmental themes. In chapter 3, the committee discusses the basic management principles which can be used in this respect.

3 BASIC MANAGEMENT PRINCIPLES

River basin management based on the Water Framework Directive focuses on achieving good status in water systems. River basin management combines several policy areas: environment and spatial planning, water and soil, quantity and quality. New basic principles should therefore be found for management. Here, the traditional principles of soil management or water control must not be adopted unthinkingly.

AVOIDING DISTURBANCE OR DETERIORATION?

Traditional environmental management could determine a management objective as follows. In situations in which the effect of human activities is still limited, good status can, in principle, be defined as the natural initial situation. The steps necessary to achieve this situation could be directed at reducing pressures. Particularly in the case of pressures generated by substances, this type of action could be supported by a clear framework of standards. It would also be possible to indicate which activities are undesirable. In that case, although management would be based on the desired situation, it would be formulated in terms of bans on undesirable practices.

In member states such as the UK, a fairly clear approach of this kind is in common use, something which is logical there since a picture of good status can be established on the basis of a more or less natural initial situation and because the activities which constitute a threat to this initial situation can be clearly designated as burdensome and undesirable.

In the Netherlands, human influences on water and groundwater systems are inherent to land use. This is particularly clear in the case of procedures for the management of water resources. It is only possible to live in low countries such as the Netherlands if there is meticulous water management. Without doubt, human influences disturb water systems but they cannot simply be considered to be an undesirable, avoidable, burdensome activity. Low-lying polders would not exist without deep drainage. The systems we find here are therefore man-made. In a situation of this kind, the natural situation cannot therefore be used as a basis for management. So any action which is taken cannot be based on the natural situation.

That would result in a management approach which would not be appropriate for the current situation. The relationship between management objectives and the current situation would be such that it would be difficult to designate an approach for moving from the current environment to the desired environment.

Soil management

Notwithstanding what was said above about the Dutch situation, the Soil Protection Act (Wet Bodembescherming) concentrates primarily on preventing pollution. As the Soil Protection Act was being drafted and introduced, there were considerable and clearly-identifiable pressures resulting from, for example, the excessive use of pesticides and fertiliser. Practices of these kind have been brought to a stop using General Administrative Orders based on the Soil Protection Act.[1] Policy of this kind directed at banning or altering undesirable practices was required since it was very clear that these practices were harming soil quality.

The benchmark for good quality is the more or less original situation (the quality of soil in areas where there is no obvious environmental burden). This benchmark is not very different from the natural initial situation referred to above. As a result, soil policy has been based on two extremes for a long time: i) the regulation of practices which were very obviously undesirable and ii) a target based on a situation in which there are no obvious environmental pressures. It has not proved simple to reconcile the two extremes.

In the area of soil policy, it has become clear that identifying undesirable practices is not adequate as a way of getting activities onto the right track in a country like the Netherlands where soil use is intensive. Activities which have not been identified as undesirable can also be harmful in a specific area or because of the vicinity in which they take place. A change in thinking is taking place which involves increasing the emphasis on adapting activities to soil use and by adapting soil to take into account factors such as natural value, ecological value and quality of the landscape. The essence of this change in thinking is that soil management looks more specifically at the planning and use requirements in an area and less on the activities to be avoided.

[1] Examples are the Use and Quality of Animal Fertilisers Decree, the Other Organic Fertilisers Decree, the Discharges Decree and the Storage in Underground Tanks Decree.

Water management

Water management has already been looking at systems from the point of view of development in this way for some time now.[2] An example is thinking about water as an organising principle. This philosophy positions water at the centre of planning issues. On the provincial level, work is taking place on the implementation of GGOR (the Desired Groundwater and Surface Water Regime). This concept is seen as an elaboration of the provincial environmental policy with links to both water management and spatial planning. A step being prepared in water management is the establishment of the relationship between the use of water systems and the critical levels for burdens from sources which are specific to the particular use and local characteristics. In short, it can be concluded that there are differences in the development of basic principles for soil and water management.

The committee is of the opinion that the integration of water and soil in river basin management must be based on a single management principle. The committee makes suggestions in this respect below.

MANAGEMENT BASED ON QUALITY AND LOCAL CHARACTERISTICS

The desired situation will have to be determined by reference to existing soil and water systems in the area under management. The required direction of improvements in the biological, chemical and physical situation depends on the requirements for use, nature values and landscape quality. Chemical, biological or physical quality should not be seen as aims in themselves but as the ecological basis for social objectives and sustainable development. This approach means that environmental quality goes hand-in-hand with social developments and spatial planning. It is important for there to be natural processes in operation in managed systems. The natural situation can serve as a benchmark for those situations in which social objectives cannot be identified adequately for the time being.

The Water Framework Directive indicates that good status for man-made and heavily-influenced water systems can be derived on the basis of, as yet undetermined, ecological potential. In the Netherlands, studies are being conducted as a basis for determining this potential for surface waters. It would be highly advisable to conduct similar studies for heavily-influenced groundwater systems as

[2] Although, of course, water management also involves regulatory systems for preventing environmental burdens.

well. When determining the ecological potential of groundwater systems, it would therefore be necessary to look not just at the composition of groundwater ecosystems as such but also at the functions fulfilled by groundwater systems with respect to soil, surface water and land use. The report produced by the Soil Protection Technical Committee 'Raamwerk for ecologische inbreng…'[3] sets out the opinion of the committee with respect to the elements which are relevant for this area.

There is enough understanding of the relationships between water systems and the soil as a basis for management measures. However, there are no ready-made solutions. The skeleton of the Water Framework Directive should be fleshed out further on the national level by developing options and preconditions for management. Options and preconditions should be as appropriate as possible for the geohydrological conditions in the Netherlands and for current soil and water management practice. There should be further elaboration in the individual river basins, with specific attention being paid to the systems.

The further elaboration of area-specific river basin management requires a powerful management body which is prepared to enter into commitments and which can be held accountable.

When the management of river basins is based on these principles, the following questions are relevant:

1. What scale should management deal with and what are the limits of the water system or groundwater system to be managed?
2. What shape should management take, given the variation in the circumstances it has to deal with?

The opinion of the Soil Protection Technical Committee with respect to these issues is set out in the chapters below.

[3] Report 'Raamwerk voor ecologische inbreng op de beleidsterreinen bodembescherming, biodiversiteit en ruimtelijke ordening in relatie tot NMP–4 and the Fifth Planning report', TCB A29(2000).

4 SCALE AND DELIMITATION OF MANAGEMENT UNITS

Area-specific water and soil management establishes links between environmental themes, land and water use and the local environmental conditions. The scale dealt with by the management system and the delimitation of management units should support this process.

The Water Framework Directive is based on the management of the river basins of the large rivers. In the Netherlands, these are the Eems, Rhine, Maas and Schelde rivers. However, in the Dutch situation, an obvious step is to concentrate management on sub-basins. As a result of the intensive use of space, water and groundwater are factors which have to be taken into account virtually everywhere when there are activities on the surface. The regional water authorities reflect the scale of management activities at which the required detail and necessary organisational demands are in balance. Water and soil management in the Netherlands should be organised on the level of sub-basins which are comparable in size to the regional water authorities as they are organised at present.

The Groundwater working group has determined, within the conditions imposed by the river basins concept, the boundaries of geologically and hydrologically uniform areas in the Netherlands. In these areas, groundwater bodies have been identified which consist of a group of groundwater systems.[4] The uniformity in the geohydrological situation means that the groundwater systems in a groundwater body react in ways which are more or less comparable to factors which influence them. As a result, it is possible to predict and understand developments in the groundwater.

The classification of bodies of groundwater into geohydrologically uniform units makes it possible, if required, to set up management on a broader scale (scale increase) and bring together bodies of groundwater to form new geohydrologically coherent units. Inversely, it is also possible to provide specific management for one

[4] A groundwater system is a unit of groundwater which is characterised by links between the area supplying the groundwater (infiltration area) and the area where the groundwater exits to the surface (seepage area or exfiltration area).

individual groundwater system within a groundwater body (scale reduction). Delimiting the area to be managed on the basis of geohydrological coherence results, on different scales, in coherent units with logical boundaries.

The delimitation of bodies of groundwater has resulted in a geographical breakdown of the Netherlands into 15 areas. Figure 1 shows the classification for the Netherlands; figure 2 shows the Veluwe groundwater body in detail.

Figure 1. Boundaries of river basins in the Netherlands based on links between water flows and geological conditions.

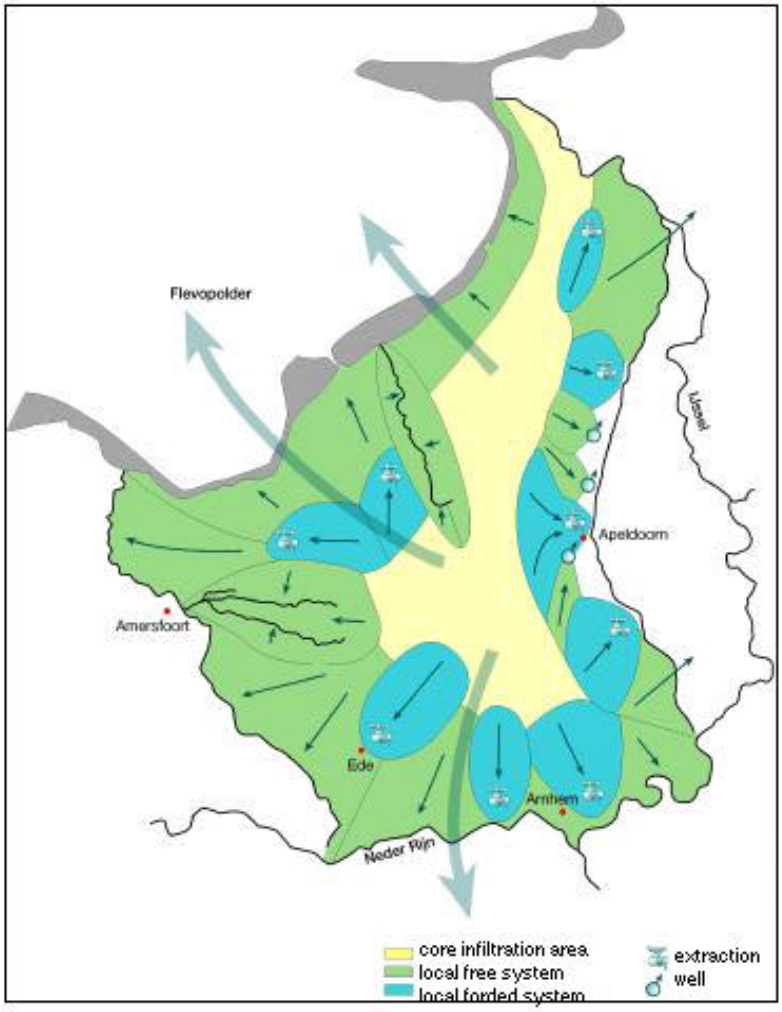

Figure 2. The groundwater body of the Veluwe river basin and its groundwater systems. A core infiltration area(yellow) is a large area in which the groundwater is taken to a large depth; a local free system (green) is a small-scale groundwater system in which the flow and the water table are more or less natural (unforced). A forced system (blue) is regulated.

5 WHAT IS THE RIGHT APPROACH?

Groundwater systems, the components of a groundwater body, are characterised by their dynamic nature but also by the fact that some developments proceed at a very slow rate. The systems are carriers of quality developments in time and space. A factor which exerts an influence at the point where a system begins will move on through the entire system. The rate at which that happens varies in different systems and depends on the nature of the factor: a change in the water table will spread rapidly whereas a substance will not usually do so. The question is how integration should take shape, given the variation in the situations.

The first step has been made by the introduction of a fixed delimitation of bodies of groundwater. This delimitation process has resulted in the selection of sub-basins, the boundaries of which are virtually constant over time. In the sub-basins, the geological structure, the thickness of the strata and soil formations through which the flows pass, flow resistance and substance bonding characteristics are more or less stable. In addition, they are uniform in structure so that the behaviour of water in the whole picture is understandable.

For further integration, a conceptual model is necessary which shows the links between the inflow and outflow of water and the associated chemical and biological components. The model shows how the situation in the system develops if something changes in the external factors which influence the system. Figure 3 shows a model of this kind as a diagram.

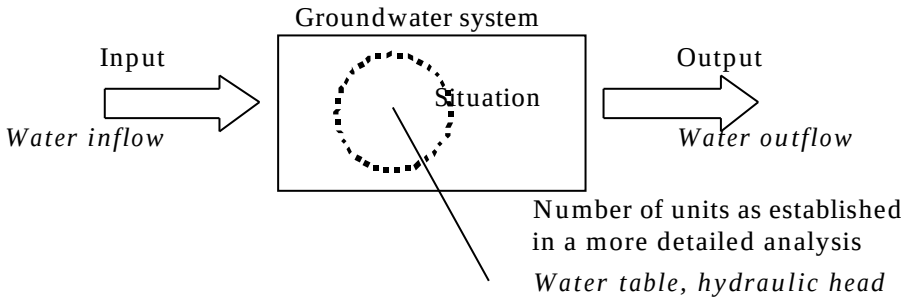

Figure 3. Highly simplified conceptual model of a groundwater system. Input and output stand for external influences on the system. Static, geohydrological features of the system determine the situation arising as a result of the influences on the system. As examples, the units relating to actual groundwater flows are shown in italics.

The variation between the systems means that it is difficult to describe the desired situation for groundwater systems in general terms. A description of this kind will have to be based on a more detailed analysis of the systems in question.

TAKING THE SLOWNESS OF GROUNDWATER SYSTEMS INTO ACCOUNT

One of the features which varies from system to system is the rate at which they respond to influences. In general, groundwater systems recover slowly. This must be taken into account because the Water Framework Directive aims to establish 'good status' in water systems in 2015. It will be necessary to assess each groundwater body in order to determine which systems respond quickly enough to achieve recovery between now and 2015. Situation-specific definitions of good status can be established for the systems and 2015 can be adopted as the target date for realisation. Management can deal with the systems in their entirety and the specific functions which groundwater fulfils in the systems. In general, these are relatively small-scale systems.

For slow systems, another approach is required. Slow groundwater systems take groundwater deep into the ground. The groundwater only returns to ground level after a very long time, often thousands of years. Figure 2 (chapter 4) shows on the map the infiltration area of a system of this kind (the ??'core infiltration area'). Restoring a large-scale system of this kind before 2015 would only be possible by means of drastic groundwater cleanup activities, generally with a low return. At the same time, it would be very desirable to establish adequate safeguards for the quality of large, deep drainage systems because of their importance as strategic water reserves. With these systems, therefore, an obvious step is to focus management on the quality of

groundwater replenishment. Table 1 provides an overview of this differentiated approach for fast and slow systems.

Table 1. Management approach for fast, small groundwater systems and slow, large groundwater systems

System	Approach	Intervention point	Benchmarks for management
Fast systems	Specific	Entire body	- The objective depends on effects in ecosystems and functions. - Derive desired inflow from desired quality development
Slow systems	General preventive	Groundwater replenishment	Aim to keep the burden as low as possible, ALARA*

*) As Low As Reasonably Achievable