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Towards sustainable management of groundwater: Policy developments in The Netherlands

Johannes P.A. Lijzen [a,*], Piet Otte [a,1], Mari van Dreumel [b,2]

[a] National Institute of Public Health and Environment RIVM, P.O. Box 1, 3720 BA Bilthoven, The Netherlands
[b] Ministry of Infrastructure and Environment, PO Box 20901, 2500 EX Den Haag, The Netherlands

HIGHLIGHTS

- The article was written to communicate developments on the groundwater management.
- The approach implies sustainable groundwater use by an ecosystem services approach.
- The national groundwater policy can set ambitions and generic goals and standards.
- This approach can help local authorities with a tailored area-oriented approach.
- Development of policy tools for subsoil planning and ecosystem services is needed.

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ABSTRACT

This article presents and discusses the main elements for a fundamental policy change for groundwater management in The Netherlands. The study analyzes the status and current use of groundwater, the increasing pressure in The Netherlands and many other countries on the natural soil–water system, the effects on quality and quantity of groundwater and the use of the subsoil. An overview is given of the current national and European regulations regarding groundwater and related policies for e.g. drinking water, soil policies and other interventions in the subsurface. The Dutch National Government is developing a new framework for groundwater management that aims a sustainable use of groundwater not only in environmental, but also in economic and social perspective. This framework for groundwater will benefit the Structure vision on the subsoil. The question is how 'sustainable use' can be a guiding principle in groundwater management, strengthening the relation between groundwater quantity and quality. It is proposed to define a generic National approach for the assessment of new and existing activities with potential effects on groundwater and for groundwater quality assessment. Additionally it is proposed to give local authorities the opportunity to set area-specific objectives on a regional or local scale to adjust for specific societal needs and area-specific characteristics. For setting these objectives it is recommended to use the concept of ecosystem services as a leading principle for defining the groundwater quality and quantity (e.g. for use as source for drinking water, aquifer thermal storage and sustaining terrestrial and aquatic ecosystems).

1. Introduction

In The Netherlands and many other countries, the pressure on the soil–water system and existing groundwater resources increases. This pressure is caused by socio-economic developments, impacts of climate change, extraction of drinking water, existing groundwater contamination and an increased use of the subsoil, such as for aquifer thermal energy storage (ATES), geothermal energy, or mining activities. The current policy for the management of groundwater quality and remediation of groundwater pollution does not seem to meet current and future needs. New policy goals for groundwater have to be formulated which take into account the costs and benefits of all these pressures on groundwater resources. The question is how groundwater policy can be formulated to meet the future needs including European and National regulations and ambitions. The European Water Framework Directive and the Groundwater Directive (EC, 2006) are in its implementation phase and national policies of EU member states now should match with European legislation.

In general the Dutch government aims at an integral environmental assessment and simplification of existing legislation, resulting in a

* Corresponding author. Tel.: +31 30 2749111.
E-mail addresses: johannes.lijzen@rivm.nl (J.P.A. Lijzen), piet.otte@rivm.nl (P. Otte), mari.van.dreumel@minienm.nl (M. van Dreumel).
[1] Tel.: +31 30 2749111.
[2] Tel.: +31 70 4560000.

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new integrated legislation for the living environment. In addition the government is developing the 'Structure vision on the subsoil' defining an integrated spatial planning framework for soil and substrate. In this vision, a layer approach is adapted making a distinction between the top soil, the groundwater layer, and, the deep subsoil ('mining layer'). The vision includes the sustainable management of groundwater linked up with soil and surface water quality.

In The Netherlands, groundwater policy is less specific than regulation and legislation for soil and surface water quality. In addition, the concept of quality over the years gradually broadened towards other aspects than chemical quality only. Groundwater quantity, biodiversity and physical aspects (temperature) of groundwater need to be considered equally important. Also important is the so-called Delta Program that comprises plans and provisions to guarantee flood safety and a sufficient supply of freshwater including groundwater, as well as climate resilient urban areas, including the relevant planning and cost-benefit analysis (Ministry of Infrastructure and Environment and the Ministry of Economic Affairs, 2013). The sustainable use of groundwater and its ecosystem services form the guiding principle for the groundwater management. Experiences with management of groundwater in areas with many contaminated groundwater sites contribute to discussions about the groundwater management in general.

The authority (powers) of the groundwater is (are) assigned to various administrative bodies. Land owners in The Netherlands have a responsibility for the quantity and quality of the groundwater, but are not the owner of the groundwater below their lands. An instrument to stimulate the responsibility, is to give value to the ecosystem services of the groundwater, e.g. its value for abstraction of drinking water and irrigation water, aquifer thermal energy storage (ATES), and the natural water storage and supply of the soil. Another question that should be answered is if and how the elements of the Groundwater directive influence national and local policy. This in particular includes the application of the principle of 'prevent and limit' (EC, 2007).

Currently, the National Government is working on an improved framework for groundwater assessment that, on one hand facilitates the use of groundwater and on the other hand protects the groundwater from non-sustainable use. Both the groundwater quantity and groundwater quality will be included in the development of a new policy; the main focus in this paper is on groundwater quality. The sustainable use of groundwater and its ecosystem services (ESS) forms the guiding principle for the groundwater management. This paper describes the elements and first step of this policy change.

First, different elements of the current and future groundwater policy in The Netherlands will be described. Second, social-economic challenges around groundwater are described. Third, the first setup is given of a generic and area-specific National framework for the groundwater assessment of new and existing activities that might influence groundwater. This is followed by an overview of the activities and ecosystem services that are currently identified and will play an important role in combining the use and protection of groundwater.

2. Overview of policy frameworks for groundwater in The Netherlands

In The Netherlands different policy frameworks have been developed. These frameworks focus on the prevention of groundwater pollution, on limiting the influence on the groundwater or on groundwater management. The following policy frameworks considering groundwater can be distinguished:

- groundwater protection;
- groundwater management and groundwater remediation;
- drinking water policy;
- implementation of European policy.

2.1. Groundwater protection

In the past 20 years, legislation was developed ensuring the quality of the soil–water system. Many regulations aim to protect the groundwater from inputs by different sources or activities. As such, the objectives of European Groundwater Directive for preventing and limiting inputs (EC, 2007) are already covered through the Dutch policy for groundwater. The following regulations are in force concerning the protection and use of the groundwater (not limitative):

- Infiltration Decree (Staatsblad, 1993; Dutch Water Act): maximal concentrations for infiltration
- Decree Discharge Outside Facilities (Staatsblad, 2011);
- Soil Quality Decree (Staatsblad, 2007a; no 469): rules on recycling of building materials, on large-scale soil applications, and on soil;
- Ministerial Circular on soil remediation 2013 (2013), under the Soil Protection Act (Staatsblad, 1986);
- Decree on the application of fertilizers, under Dutch Fertiliser Act (Staatsblad, 1997);
- Dutch Pesticides and Biocides Act (Staatsblad, 2007b).

These regulations have different quality objectives and boundary conditions in preventing and limiting the inputs into groundwater. Some focus on specific measures to be taken, others on limiting the calculated maximal concentration in the top-layer of the groundwater, or the maximal influence of the groundwater it is in contact with (Verschoor and Swartjes, 2008).

2.2. Groundwater management and groundwater remediation

The management of the groundwater quality and remediation of contaminated sites are defined in the Ministerial Circular on soil remediation and based on principles as set out in the Soil Protection Act. The current policy on contaminated groundwater aims to identify, restore and manage sites with seriously contaminated groundwater (Swartjes et al., 2012). For this objective, regulations, standards and instruments have been developed, including Target Values and Intervention Values (IVs) for frequently occurring substances in groundwater.

Dutch Target Values for organic compounds are based on the so called negligible risk level. For inorganic compounds it is based on the negligible risk level added to the 90-percentile of background concentrations (for groundwater >10 m). For inorganic compounds in shallow groundwater other values apply. Exceedance of these values triggers further research looking for non-natural, anthropogenic sources. These values also form the default remediation objective in case of a contaminated site.

The Dutch Intervention Value for groundwater is based on the serious risk level for humans and the ecosystem, including direct consumption of groundwater as drinking water. The value is a trigger for further investigation and a decision about the urgency for remediation of historical groundwater contamination. Many other European countries also have Intervention values as a trigger for remediation and threshold values in relation to the Groundwater Directive (Carlon, 2007). However, the exact levels and methodology for deriving these values differ between the countries. In the Circular (Ministry of IenM, 2013) an area-specific approach for large scale groundwater contamination is described next to the common 'single source-plume' approach. An area specific approach is recommended when the complexity of sources and plumes as well as the scale of contaminated groundwater impedes a case by case remediation. An area-specific approach preferably results in an integrated strategy for the groundwater management, including all relevant aspects. The new opportunity of setting area-specific objectives could be extended to the groundwater management in general.