2009 - 2015

River basin management plans

Ems, Meuse, Rhine Delta and Scheldt – a summary

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22 December 2009

Introduction

In 2000, the member states of the European Union adopted the Water Framework Directive, in which they agreed that by 2015 (or, under strict conditions, as soon as possible) groundwater and surface water will be of good quality. To that end, individual management plans are to be formulated for each river basin, indicating the objectives for groundwater and surface waters, and showing how quality can be maintained and, where necessary, improved.
River basin management plans have since been drawn up for the Dutch parts of each of the international river basins of the Ems, Meuse, Rhine and Scheldt. As these plans elaborate and substantiate policy choices in relation to the implementation of the Water Framework Directive in The Netherlands, these plans are part of and must be considered in conjunction with the National Water Plan. This document presents a summary of the four river basin management plans.

The formulation of these plans was preceded by a comprehensive and intensive preparatory process. The national government, provincial authorities, water boards and municipal councils jointly performed studies and analyses, set objectives and developed programmes of measures. During the process, intensive consultation took place with interest groups at local, regional and national level.

The first four river basin management plans took effect on 22 December 2009. Exactly one year earlier (on 22 December 2008), the four draft river basin management plans were presented for public consultation. The consultation period lasted six months, from 22 December 2008 until 21 June 2009.[1] Once the results of the consultation rounds had been incorporated, the four plans were adopted by the Dutch government.

1 For the Scheldt, this period was extended until 20 July 2009.

1 Why should we pay attention to clean and sufficient water?

1.1 Clean and sufficient water is of key importance

Water plays a vital role in our lives. It meets our basic needs and is crucial for the economic development of the Netherlands. Water is indispensable for drinking water supply, agriculture, fishery, energy generation, industry, the transport sector and tourism. Moreover, sufficient quantities of good quality water are essential to nature in the Netherlands.

In the second half of the twentieth century, large portions of our surface water and groundwater became polluted due to the increase in discharges from industries and households as well as contamination from diffuse sources such as agriculture, traffic and transport, and building materials. Moreover, the natural character of many waters largely disappeared as a result of drastic changes to the land development of the Netherlands and the use of land and water.

The water system in our densely populated, low-lying country has been modified on a large scale. In many places, (ground)water levels have been lowered, channels in rivers deepened and meandering rivers and streams straightened. As a result of unnatural hydromorphology and lack of natural dynamics, certain water plants and aquatic animals have declined in number or even disappeared completely.

1.2 The Water Framework Directive

In 2000, the EU member states adopted the Water Framework Directive, the primary objectives of which are the general protection of the ecology of all waters, the protection of groundwater quality and quantity, and the specific protection of species and habitats, sources of drinking water, and bathing water.

The goal is to have achieved good ecological and chemical status in all surface waters as well as good chemical and quantitative status of all groundwaters by 2015. This means that direct discharges into groundwater are no longer permitted and that an increase in chemical pollution of groundwater must be prevented. In part, the member states are free to determine to what extent a goal must be met. For example, the degree to which the hydromorphology and natural dynamics of a water system can be restored. The next step is to formulate programmes of measures to achieve the goals. Goal attainment may be postponed until after 2015 or the scope of a goal lowered, but this is subject to strict conditions.

1.3 River basin management plans

A key agreement in the Water Framework Directive is that member states collaborate on improving the water quality in each river basin. By 2009, every country was to have drafted a first river basin management plan for its own national part of an international river basin. In addition, the member states in the international river basin districts of the Ems, Meuse, Rhine and Scheldt jointly developed a roof report. The essence of the river basin management plan is an overview of the general and environmental objectives for all waters and a summary of the measures to be taken to achieve them. The river basin management plan also comprises a general description of the area, an economic analysis, an overview of the main threats to groundwater and surface water, and a description of the effects of climate change on water quality and water management. Moreover, the river basin management plan also includes an overview of the programme of measures and the monitoring programme. Finally, it incorporates several maps, including those presenting the current state of groundwater and surface water based on the monitoring programme.

In the Netherlands, all government levels involved in water management (water boards, the Directorate-General for Public Works and Water Management, the provinces, the municipal councils and the Ministry of Transport, Public Works and Water Management, the Ministry of Agriculture, Nature and Food Quality, and the Ministry of Housing, Spatial Planning and the Environment) have worked closely together in recent years to meet all obligations under the Water Framework Directive. The main results have been collated in the river basin management plans for the Ems, Meuse, Rhine delta and Scheldt. The State Secretary for Transport, Public Works and Water Management bears final responsibility for the Water Framework

Directive in the Netherlands and, therefore, also for drawing up and publication of the four river basin management plans.

1.4 Formulating objectives and measures

Under the terms of the Water Framework Directive, Dutch environmental quality and monitoring requirements are laid down in the 2009 Decree on the quality requirements and monitoring of water (Bkmw 2009). The objectives and measures derived from the decree are incorporated into a water plan. The objectives for heavily modified and artificial surface waters are laid down for each individual water body, those for waters in the main system are laid down in the Management and Development Plan for National Waters, and those for regional waters in a provincial water plan or provincial spatial plan.

The programme of measures for a river basin management plan comprises both basic measures and supplementary regional measures. Basic measures are all measures resulting from European obligations and national generic policy. Supplementary regional measures are all measures taken for specific water bodies with a view to achieving the objectives of the Water Framework Directive.

The water management authorities are responsible for ensuring that the supplementary regional measures for each individual water body are recognisably included in the water plan. This decision was taken by the Netherlands in order to guarantee that the objectives and measures to be reported to the European Commission in the river basin management plan are actually endorsed and implemented by the (ground)water authorities in question.

2 The Dutch approach

The Water Framework Directive introduced a new working method in water management. Water management authorities and other relevant authorities involved are encouraged to step up collaboration on a river basin level. They are also under the obligation to implement the measures they have announced. In its formulation of the river basin management plans, the Netherlands has opted for a unique national and regional form of collaboration. This section addresses this approach.

2.1 Water Framework Directive: what's new?

Water policy has been an issue in the European Union since the mid-1970s, in the wake of the development of national water policy in a large number of European countries. The first binding agreements concerning water were standards for environmentally hazardous substances in groundwater and surface water. In the 1980s, this was followed by guidelines for the treatment of urban wastewater and the reduction of nitrate and phosphate pollution in agriculture. Then came guidelines for the protection of flora, fauna and habitats, and bathing water. All this resulted in a significant improvement in water quality. However, in the 1990s an awareness/understanding emerged that good water quality would only be possible by taking a single, integrated approach within river basins, that also involved citizens and stakeholders. This prompted the formulation of the Water Framework Directive, which was adopted in 2000.

Another new aspect of the Water Framework Directive in addition to this river basin approach is the focus on ecological water quality. As good ecological water quality differs for each type of water, the member states of the European Union jointly developed an ecological yardstick for each type of water. Good ecological water quality is determined on the basis of such aspects as the presence of fish, phytoplankton, benthic invertebrate fauna and water plants, as well as physicochemical parameters, such as temperature, oxygen, acidity and phosphate and nitrogen levels in the water. The standards for priority pollutants are proposed by the European Commission and adopted for the European Union as a whole; standards for other pollutants are determined by individual member states. This should, preferably, be coordinated for each river basin.

A new element of the Water Framework Directive is the obligation to produce results relating to the implementation of measures in the river basin management plans. This means that the measures from the first river basin management plan must be implemented in the 2009 – 2015 period. In the event of a phased approach (which applies to many of the Dutch waters), it is necessary to report which measures will be implemented after 2015. While these measures are not subject to an obligation to produce results, the parties are obligated to perform to the best of their ability. By the time the second river basin management plan is adopted in 2015, the Netherlands will have committed itself to an adjusted programme of measures with an obligation to produce results for the 2016 – 2021 period.

2.2 New national cooperation

In order to effectively implement the Water Framework Directive, intensive consultations have taken place between the authorities involved and the interest groups. Citizens have been informed and consulted. Because water management in the Netherlands is strongly decentralised and the water boards have their own management and financing system, it was decided to set up a new collaborative structure in which the central government marks out the national framework and is responsible for international coordination. The water boards have been given the role of formulating objectives and measures for each water body with which to meet the obligations under the Water Framework Directive.

The *Nationaal Wateroverleg* (NWO) is a consultative body in which the central government (VenW, VROM, LNV)[2] and the umbrella organisations of the provinces, water boards and municipalities participate. The different levels of government also hold administrative coordination meetings for each (constituent) river basin (Regional Administrative Consultation Committees, RBO). The Netherlands is divided into four river basins: Ems, Meuse, Rhine and Scheldt. The Rhine river basin is subdivided into four constituent river basins: Rhine-West, Rhine-East, Rhine-Central and Rhine-North. The Ems river basin is subdivided into two constituent river basins: Lower Ems and Ems-Dollard. This means that there are eight (constituent) river basins in the Netherlands.

2.3 Impetus for international cooperation

The Water Framework Directive has given a new impetus for international cooperation. There are two

2 VenW Ministry of Transport, Public Works and Water Management;
VROM Ministry of Housing, Spatial Planning and the Environment;
LNV Ministry of Agriculture, Nature and Food Quality.

Table 1 Number of bodies of surface and groundwater for the Dutch part of each river basin

River basin	Surface water bodies	Groundwater bodies
Ems	22	2
Meuse	155	5
Rhine	491	11
Scheldt	56	5
Total	**724**	**23**

Table 2 Number of government bodies in the Netherlands involved in each river basin

Government body	Rhine	Meuse	Scheldt	Ems
Water boards	18	7	3	2
Provinces	10	4	3	2
Municipal councils	305	121	20	24
Central government (VenW (incl. RWS[3]), LNV and VROM)	1	1	1	1

forms of cooperation:

- Cooperation with all countries in an international river basin. This mainly concerns the large, transboundary rivers. There is also close cooperation with existing international river committees for Rhine, Meuse, Scheldt and Ems.
- Coordination with our immediate neighbours concerning the groundwater and surface water on or near the borders. This mainly concerns streams and rivers flowing towards the Netherlands.

The countries have together drafted a portmanteau river basin management plan for each of the international river basins (Ems, Meuse, Rhine and Scheldt). These describe the current problems in the river basin and what joint measures are taken by the countries.

2.4 Method followed for drawing up the river basin management plans

A number of steps precede the actual formulation of the river basin management plans. First of all, the surface water and groundwater in the Dutch part of a river basin is divided into water bodies on the basis of several criteria. The smallest waters, i.e. streams with a river basin smaller than 10 km², or waters with a surface area smaller than 50 hectares, are excluded and are not part of a water body. All in all, there are 724 surface water bodies and 23 groundwater bodies in the Netherlands (see table 1).

The river basin is described and an economic analysis performed, including a forecast of the economic developments until 2015. Another step is the description of water services, including an estimate of the cost recovery percentage. In 2006, monitoring programmes were set up to measure the status of the groundwater bodies and surface water now and in the future (KRW measuring network). In 2009, these monitoring programmes were updated and incorporated into the river basin management plans.

The data from the KRW monitoring network was used to determine the current status of the groundwater and surface water. Where necessary, water management authorities added extra measurements and specific area-related knowledge. Human impact on the water bodies was also catalogued. These are substances and sources resulting from human activity that pollute the water as well as physical interventions that have a negative impact, such as solid banks and (ground) water abstraction. This knowledge has been used to formulate the objectives and the related measures for each body of groundwater and surface water.

In 2005 and 2006, the water management authorities conducted a general review to determine objectives and measures. The results of this review were collated in the 2006 Decembernota policy document. Regional processes were used for a detailed analysis of the objectives and measures in the 2006-2007 period. These regional processes were supervised by the water management authority with all other levels of government (see table 2) and immediate stakeholders taking part. The working method was coordinated at national level to ensure that the differences between the regions in a river basin and between river basins themselves would not be too large.

The regional processes primarily analysed the additional measures required at local and regional level to solve problems related to pollution or an unnatural hydromorphology of waters. The ministries of VenW, VROM and LNV examined whether international and national policy on hazardous substance management could be tightened. A new national action programme for diffuse sources was adopted in 2007.

In 2009, the four draft river basin management plans were available for consultation of public inquiry a period of six months. The draft versions of the National Water Plan, the Management and Development Plan for National Waters, the provincial water plans or provincial spatial plans, and the water management plans of the water boards were also available. The opinions received were addressed and the resulting changes incorporated into the final plans. Also included was an overview of the modifications resulting from the public participation procedure. In 2009, an overview of the effects of climate change on water quality was included in the river basin management plans, together with the findings of a check of the robustness of the proposed programme of measures in respect of climate change.

3 RWS Rijkswaterstaat

3 Four river basins

The Netherlands is part of four international river basins: Ems, Meuse, Rhine and Scheldt. This chapter contains a brief description of the Dutch part of these river basins.

3.1 Introduction

The Netherlands is located in the delta of four major rivers. As a result, the Netherlands is a flat and low-lying country, with approximately 26% of its surface area located below sea level.

River deltas are often densely populated because of their favourable location along the water and the presence of fertile arable soil. This is also true for the Netherlands, which is one of the most densely populated areas in the world.

The Netherlands' low-lying position, the intensive land use and the transport over water have drastically changed the water system in many places. Particularly in the low-lying part of the Netherlands, most of the smaller surface waters were excavated by humans. The shape and natural dynamics of many rivers, streams and lakes have also substantially changed as a result of human intervention.

Typical phenomena in the Netherlands are the polders and reclaimed lakes. Surplus water is collected via a system of small canals and discharged to the surrounding external water by means of pumping stations and discharge sluices. The hydrological regime in the Netherlands is highly artificial. In summer, water levels are relatively high to ensure sufficient water for the crops. In winter, water levels are kept relatively low to create sufficient storage capacity in the event of heavy rainfall.

Another typically Dutch phenomenon is the large-scale damming up of tidal outlets to protect the country from flooding. The construction of the IJsselmeer dam (Afsluitdijk) in 1932 transformed the Zuiderzee into the IJsselmeer lake. The Delta Project in the southwestern Netherlands and in the Lauwersmeer was constructed in the wake of the 1953 flood disaster. Here, too, the construction of dams created freshwater lakes. The Oosterschelde flood barrier offers a unique solution for the Oosterschelde that largely safeguards the supply of salt water and the tidal action.

Below is a brief description of the Dutch part of the Ems, Meuse, Rhine and Scheldt river basins.

3.2 The Ems river basin

Location
The Ems rises in Germany and is 371 km long. The river flows mostly through Germany and discharges into the Ems Dollard. The surface area of the Ems river basin totals 18,000 km^2, a relatively small part of which (2,600 km2) is located in the Netherlands.

The Dutch part of the Ems river basin consists of two very different sections: the Lower Ems area and the Ems Dollard area, including the coastal zone.

The Dutch part of the Ems river basin covers most of the province of Groningen and a small part of the province of Drenthe. The Ems river basin as a whole has a population of 3 million, of whom approximately 480,000 live in the Netherlands.

Spatial characteristics
The Dutch part of the Ems river basin consists largely of farmland (mainly arable farming). In the south is the Drents Plateau with its many sandy areas, the central part consists mostly of former peat district, and the northern part is covered by marine clay polders. Most urban areas are in and around the city of Groningen.

Protected areas
The Dutch part of the Ems river basin contains several protected areas: eight Natura 2000 areas, one area for shellfish waters, 48 bathing waters, one

surface water body and one groundwater body for the abstraction of water for human consumption.

Characteristics of the surface water system
The Ems Dollard is part of the Ems estuary and has a gradual freshwater/saltwater gradient. Large parts of the intertidal area are uncovered by water at low tide. An interesting aspect is that the border between the Netherlands and Germany in this area is contested. Because it is such a substantial part of the Ems Dollard area, the two countries have decided to cooperate closely on water and nature management here.

In the subarea of the Lower Ems on Dutch territory, the rivers Hunze and Drentse Aa discharge water from the Drents Plateau to the Ems Dollard. The northern part of the province of Groningen consists mostly of low-lying polders, where water is discharged into offshore water by means of discharge sluices or drainage. In summer, water for the IJsselmeer is supplied from the Rhine river basin. The water is let in at Lemmer and transported to the low-lying areas of the Ems river basin via the province of Friesland. There is only one location (near De Punt in de Drentse Aa) where surface water is abstracted for the production of drinking water.

There are 22 designated surface water bodies in the Ems river basin. With the exception of the Ems Dollard coast, all of them have the status ‘heavily modified’ or ‘artificial’.

Figure 1 Boundaries of the Dutch part of the Ems river basin

Characteristics of the groundwater system
The groundwater in the Dutch part of the Ems river basin flows from the Drents Plateau toward the Ems Dollard estuary. The layers of boulder clay in the soil exhibit poor permeability, causing stagnation of the groundwater between the Drents Plateau and the flat, lower lying area to the northeast. In the distant past, this led to peat formation. This peat was extracted on a large scale in the last century.

The Ems river basis has two groundwater bodies: one saltwater body and one freshwater body, with 12 locations where groundwater is abstracted for human consumption.

3.3 The Meuse river basin

Location
The Meuse (or Maas in Dutch) rises in France and has a length of 905 km. With a river basin of 36,000 km² covering four countries (France, Belgium, Germany and the Netherlands), the Meuse is one of Western Europe's medium-sized rivers. The Dutch part totals some 7,700 km² and covers the entire province of Limburg, the major part of the province of Noord-Brabant and small parts of the provinces of Zuid-Holland and Gelderland. It is a widely varied area: from calcareous hilly country in the southern part via sandy soils in the central part to a vast polder and delta area in the western part.

Spatial characteristics
Agriculture is dominant in the Dutch part of the Meuse river basin. Compared to the other Dutch river basins, the number of large water bodies with a large surface area is limited, formed by the Meuse itself, former tidal inlets and the coastal water.
The Meuse river basin as a whole has a population of 8.8 million, of whom 3.5 million live in the Netherlands. Noord-Brabant in particular is fairly densely populated. Fifteen percent of the Dutch Meuse river basin consists of nature reserve.

Protected areas
The Dutch part of the Meuse river basin contains a total of 43 Natura 2000 areas, one area for shellfish waters, 134 bathing water locations, five surface water bodies, and three groundwater bodies that have been designated for abstraction of water for human consumption.

Characteristics of the surface water system
Streams occur in a large part of the Meuse river basin. Those in the hills of Limburg are relatively fast-flowing and of significant value for nature and the landscape. The streams on the sandy soils of Noord-Brabant are also interesting in terms of nature, because they mostly pass through nature reserves. The streams through urban areas and areas of intensive agriculture are important for the hydrological regime.

There also are a number of large canals in the area, such as the Zuid-Willemsvaart and the Wilhelmina-kanaal. These waterways have an important economic function and are critical for the supply and discharge of water in dry and wet periods.
Where the Meuse enters the Netherlands, it is still a fast-flowing river and the stretch known as the Grensmaas can meander freely. Flanking the Zand-maas, the Meuse valley continues to the border with Noord-Brabant, where the river becomes the Bedijkte Maas. Ultimately, the Meuse flows into the Hollands Diep and the Haringvliet and via discharge sluices to the sea. A limited portion of the water is discharged to sea from the Hollands Diep via the Volkerak-Zoommeer and the sluiceway in the Westerschelde. All these major water bodies are former tidal inlets that were closed off from the North Sea by construction

of the Delta Project after the storm surge of 1953. This transformed them into freshwater lakes with little or no tidal movement.

There are four locations in the Meuse river basin where surface water is abstracted for drinking water: Zandmaas, Haringvliet-West, Brabantse Biesbosch and Beneden Maas. This drinking water is used on a large scale outside the Meuse river basin.

There are 155 surface water bodies in the Meuse river basin, some of which have the status ‘natural’. These are six streams and small rivers (Merkske, Niers, Swalm, Rode Beek, Roer and Gulp) and the coastal water.

Characteristics of the groundwater system
The groundwater system is characterised mainly by the elevated Zuid-Limburg limestone plateau with its deep stream valleys, as well as by thick sand deposits in the tidal channels and shallow sand deposits on the horsts. There are five groundwater bodies and 81 locations where groundwater is abstracted for human consumption.

Figure 2 Boundaries of the Dutch part of the Meuse river basin

3.4 The Rhine delta river basin

Location
The Rhine rises in Switzerland, taking water from nine countries to the sea. With a length of 1,320 km, the Rhine is the second largest river in Europe after the Danube. The Rhine river basin has a surface area of 186,000 km² and a population of almost 50 million. The Dutch part of the Rhine river basin is also called the Rhine delta working area, which is the result of an agreement between the Rhine riparian states to divide the Rhine river basin into nine working areas. The Rhine river basin is the furthest downstream. The Rhine river basin is a transboundary area: 90% of its total surface area of 31,700 km² is located on Dutch soil, and 10% on German soil. The Dutch part of the Rhine river basin comprises nine provinces: Noord-Holland, Utrecht, Flevoland, Gelderland, Overijssel and Friesland and parts of Zuid-Holland, Drenthe and Groningen. The German part covers portions of the states North Rhine Westphalia and Lower Saxony.

Spatial characteristics
The Rhine is characterised by widely varied geology, soil structure, landscape, relief and climate. The western part consists mainly of coastal areas, vast low-lying polders and reclaimed lakes, and a river area. The central part comprises the large water bodies around the (reclaimed) Flevoland and the sandy Veluwe area. The eastern part is primarily made up of elevated sandy ground with a number of moraines. In the past, large tracts of land would be inundated for months at a time. The northern part of the Rhine river basin is home to the Wadden Sea, the low-lying polders along the Wadden Sea dyke, and the Frisian lake area.

Because of the many rivers, the IJsselmeer, Markermeer, the border lakes and the lakes in Friesland, Noord-Holland and Zuid-Holland, the Rhine's water surface is relatively large (25%). The Wadden Sea and the long coastal zone also make a significant contribution to the water-rich character of this part of the Rhine river basin.

The Rhine river basin is densely populated, with over 360 people per square kilometre. The Randstad conurbation alone accounts for 40% of the Dutch population. The northern and eastern parts of the Rhine river basin have a relatively high level of agriculture, while the central part (IJsselmeer area) and the German part have a relatively large number of nature areas.

Protected areas
The Dutch part of the river basin of the Rhine delta contains a great many protected areas: 110 Natura 2000 areas, two shellfish waters, 392 bathing water locations, nine surface water bodies and nine groundwater bodies for abstraction of drinking water for human consumption.

Characteristics of the surface water system
Almost all waters in the western, low-lying part of the Rhine river basin are man-made. An elaborate network of dykes, ditches, weirs and pumping stations keep the people living and working in the polders safe. The hydrological regime in these areas, in which the ditches, storage basins and canals play a key role, is fully regulated.

Many streams rise on the sandy ground in the central and eastern parts of the Rhine river basin. A lot of the brooks on the Veluwe are man-made. Brooks are important for nature and for the hydrological regime. Water drainage has been optimised by canalising the brooks, and water levels have been regulated by the construction of weirs.

The IJsselmeer used to be the Zuiderzee. The construction of the IJsselmeer dam and the reclamation of the Flevopolder have drastically changed the area's nature and hydrological regime. The IJsselmeer and Markermeer lakes have become two large freshwater lakes. Border lakes have been created along the Flevopolder and the water bodies in Flevoland were constructed to drain the polder. The waters in Friesland are also highly regulated. The hydrological regime requires that Rhine water is taken from the IJsselmeer and then discharged to the Wadden Sea.

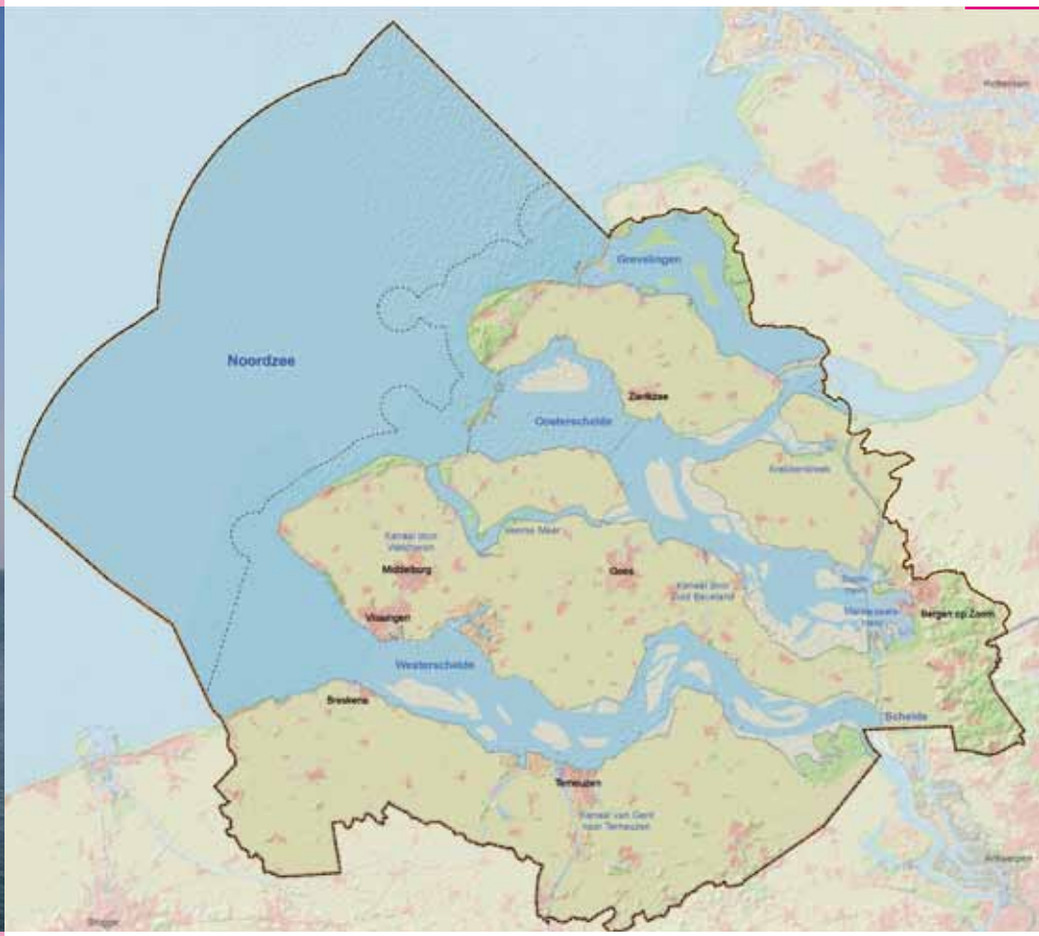
One location in the IJsselmeer and two locations in the Amsterdam-Rijnkanaal are used to extract surface water for drinking water.

There are a total of 491 water bodies in the Dutch part of the Rhine. Of these, the Naardermeer, the Wadden Sea, the Wadden Sea coastal zone and the North Sea coastal zone are designated as ‘natural’ water bodies.

Characteristics of the groundwater system
There are eleven distinct bodies of groundwater in the Dutch part of the Rhine: salt, sand, with or without upper layer, mud flat and dune. The groundwater bodies ‘feed’ plant and animal habitats that depend on groundwater. These include Natura 2000 areas. Groundwater affects the ecological quality of the surface water. There are 265 drinking water extraction locations in this area.

Figure 3
Boundaries of the Rhine delta work area, which comprises the Dutch part of the Rhine delta river basin and the adjoining part in Germany

Figure 4 Boundaries of the Dutch part of the Scheldt river basin



3.5 The Scheldt river basin

Location
The Scheldt rises in France, flows through three countries and is approximately 350 km long. The Scheldt river basin has a surface area of 22,000 km², of which 3,200 km² is located in the Netherlands. The Dutch part of the Scheldt river basin covers the province of Zeeland and small parts of the provinces of Noord-Brabant and Zuid-Holland.

Spatial characteristics
A striking characteristic of the Dutch part of the Scheldt river basin is its large water surface: almost 35% of the area is covered by water. Three quarters of the land is used for agriculture (mainly arable farming), 10% is urban area. A relatively small part of the land (3%) is a nature reserve. The Scheldt river basin as a whole has a population of almost 13 million, of whom 470,000 live in the Netherlands.

Protected areas
The Dutch part of the Scheldt river basin is home to a number of protected areas: 18 Natura 2000 areas, four shellfish waters, 68 bathing water locations and two groundwater bodies for the abstraction of water for human consumption.

Characteristics of the surface water system
The waters in the Dutch part of the Scheldt river basin can be roughly divided into polder waters and large water bodies. There are a lot of polder waters, given that the land part of the Scheldt river basin consists almost entirely of polders. The system of ditches discharges the collected water to the surrounding offshore water by means of pumping stations and discharge sluices. The hydrological regime is highly artificial. In summer, polder water levels are kept relatively high to ensure sufficient water for the crops. In winter, the levels are relatively low to create sufficient storage capacity in the event of heavy rainfall.

In many low-lying polders, salty groundwater rises up as seepage water. This often makes the water of many polder waters brackish.
The Westerschelde is one of two estuaries that still exist in the Netherlands. High and low tide differ widely and large banks fall dry during low tide.
The Oosterschelde is the other large water mass with tidal movements, although not as large as several decades ago. After the flood disaster of 1953 it was decided to improve the country's flood protection. As part of the Delta Project, new dams and flood barriers were constructed and dykes raised. This drastically changed the Delta area. Almost all tidal inlets have been closed off in whole or in part from the North Sea and divided into compartments with a strongly regulated hydrological regime. Freshwater, brackish water and salt water alternate. The required salt content and water level of each compartment are regulated using sluices and weirs. Examples include the Veerse Meer, the Grevelingen and the Zoommeer.

No surface water is extracted for drinking water in this river basin.

There are 56 water bodies in the Scheldt river basin. With the exception of the North Sea coastal zone, these are all 'heavily modified' or 'artificial'.

Characteristics of the groundwater system
There are a total of five groundwater bodies in the Scheldt river basin. A distinction is made between groundwater above and below the 'Boomse Klei', a virtually impermeable clay layer. The groundwater in the shallow sand layers in the Scheldt river basin is mostly salty. Only in elevated areas and in places where the sand layers reach up to ground level has the groundwater become fresh as a result of precipitation. This is the case in dune areas, creek ridges and aeolian sand. Groundwater is abstracted for drinking water in four locations: the dunes of Schouwen-Duiveland, in Zeeuws-Vlaanderen, and in two locations in western Brabant.

4 What is the current situation like?

Regulations and measures have resulted in a significant improvement of the status of the groundwater and surface water. However, population density, intensive land use and transboundary pollution are primary reasons why clean and sufficient water is not available everywhere in the Netherlands.

4.1 Water quality problems

Physico-chemical pollution
Water quality in the Netherlands is compromised by substance pollution, the main substances being nitrogen and phosphate, pesticides, PAHs and heavy metals. Most pollution comes from diffuse sources, the key ones being fertiliser and pesticides in agriculture and pesticides on paved surfaces. Dirt run-off from roads as well as exhaust fumes also affect the quality of the water.

Regulations and measures have significantly reduced pollution by point sources in recent decades. Nevertheless, effluent discharges from wastewater treatment plants and industries and the overflow of waste water from sewage systems (in the case of heavy rainfall) still cause pollution.

Hydromorphological alterations and water level management
The organisation and management of coastal and transitional waters, rivers, streams and lakes are closely connected to the functional uses of these water bodies. Frequent modifications have been introduced to prevent flooding and waterlogging or to make the water and the surrounding area suitable for shipping, living or agriculture. Such modifications include the canalisation of rivers and streams, the construction of dykes (reclamation) and drainage (water level management). Also waters such as canals and ditches have been man-made. Some of these 'new' man-made and modified waters can not be improved without significant adverse effects on (e.g.) flood protection and shipping. These waters are given the status 'heavily modified' or 'artificial'.
The ecological objectives of these waters are then aligned with the possibilities that the artificial or heavily modified organisation has to offer, attempting where possible to take measures to limit the negative effects of unnatural or steep banks, barriers for fish ladders and artificial water level management, for example, into account.

Pollution coming in from abroad
Water is not bound by borders. Because the Netherlands is located in the delta of a number of major rivers, a large proportion of the water comes in from abroad. In order to be able to achieve the objectives, it is of key importance to cooperate with other countries in the four river basins. The advantage of the Water Framework Directive is that every member state has the same task: achieving a good status by 2015.
At the moment, water that flows across the Dutch border from abroad still exceeds the standards for a number of substances.
Partly based on these cross-border problems, international lists of river basin-relevant substances have been drawn up for each river basin. These substances include copper, zinc, PCBs, PAHs and certain pesticides.

4.2 The current situation

The chemical and ecological status of the surface water bodies and the chemical and quantitative status of the groundwater bodies are assessed according to the 'one out all out' principle. This means that the lowest score for one of the parameters used to determine the status is decisive for the final assessment of the status score.
The status of the water bodies is based on the first results of the KRW measuring network for monitoring. These are data from the 2006 – 2008 period, which the water management authorities supplemented with additional measurement data and regional knowledge. For the assessment of the surface water and groundwater in the Dutch part of the four river basins, see Figures 5 and 6.

Chemical status of surface water
The chemical status is determined on the basis of attainment of the priority substances standard. Of the four river basins, those of the Rhine and Scheldt have the highest percentage of water bodies with a good rating (80%), followed by the Ems (60%) and Meuse (25%). In each river basin there are several substances that exceed the standards in a limited number of water bodies. In the Ems this is isoproturon. In the Scheldt river basin these are cadmium and diuron. Substances that exceed the standard in the Rhine river basin are primarily indeno(1,2,3c,d)pyrene and (to a lesser extent) cadmium, mercury, benzo(b) fluoranthene/benzo(k)/fluoranthene and benzo(a)

pyrene (both PAHs). In the Meuse river basin, it mainly concerns cadmium and, to a lesser extent, trifluraline and diuron. In all four river basins, tributyltin and sometimes benzo(g,h,i)perylene/indeno(1,2,3c, d)pyrene exceed the standard in a significant part of the major national waters.

Ecological status of surface water

Ecological quality is determined by biological parameters, general physico-chemical parameters and other relevant pollutants (also see 5.1 under Good ecological status of surface water). The quality of the biological parameters (fish, small aquatic animals, water plants and algae) appears to vary widely in individual water bodies throughout the country.

Of the physico-chemical parameters, high concentrations of nitrogen and phosphate are the greatest problem. In Rhine and Ems, transparency is regularly insufficient. Of the other relevant substances, it is mainly copper, zinc and ammonia that exceed the standard in many water bodies. Moreover, in the Meuse river basin in particular some plant protection products (dimethoate, pirimicarb), PAHs (benzo(a) anthracene) and various PCBs exceed the standard in a relatively large number of water bodies (approx. 10%). In the Scheldt, the same applies to benzo(a)anthracene. Unlike a few surface water bodies in the Rhine river basin, none of the surface water bodies in the Meuse, Scheldt and Ems river basins has been awarded the rating 'good', because all these parameters are combined for the assessment of the ecological status.

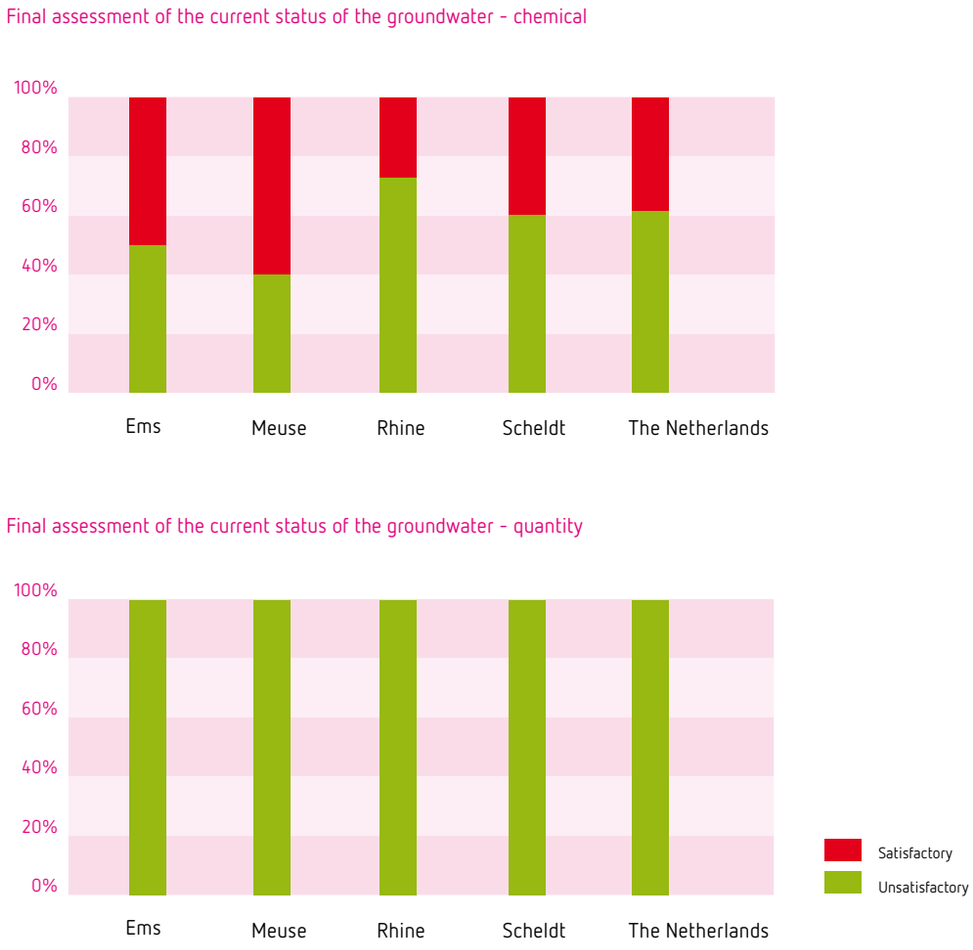
Figure 5 Final assessments of the chemical and ecological status of surface water bodies for the separate river basins and for The Netherlands as a whole

Chemical status of the groundwater bodies
Of the 23 groundwater bodies, 14 have a good rating for chemical status. Occasionally, phosphate (Ems, Rhine), chloride (Rhine) and arsenic (Scheldt and Ems) exceed the standard in the deep groundwater. This usually has a natural cause, so no measures are specified. In a number of bodies of groundwater, the standards for nitrate (Meuse) and pesticides (Ems, Scheldt) are exceeded. Measures (mainly generic) can be taken to tackle these problems. Based on the extent to which standards are exceeded, about half of groundwater catchments for human consumption (drinking water and foodstuffs industry) run the risk of deterioration of water quality.

Quantitative status of the groundwater bodies
The quantitative status of all groundwater bodies is good. This means that there is no depletion of the available groundwater. Abstracted groundwater is sufficiently replenished with precipitation surpluses or infiltrations.

Aside from the quantitative status of the groundwater bodies, the task for the Natura 2000 areas that depend on sufficient quantities of groundwater is to ensure that the groundwater level does not drop. For these areas, measures have been included in the WFD programme of measures.

Figure 6 Final assessments of the chemical and quantitative status of the groundwater bodies for the separate river basins and for the Netherlands as a whole.



5 What do we want to achieve?

The objectives for surface and groundwater as laid down in the Water Framework Directive stipulate that a good status must be achieved by 2015 (in exceptional cases no later than 2027). This chapter explains what this means and what objectives have been set.

5.1 Objectives

The objectives for surface water bodies are determined on the basis of chemical and ecological quality. The objectives for groundwater bodies are determined on the basis of chemical quality and quantitative status. Other waters not designated as a water body must be of such quality as to not hinder the achievement of goals in the water bodies.

5.1.1 Good chemical status of surface water

The chemical status of surface water bodies relates to substances for which standards have been determined at European level. These are 33 priority substances and eight pollutants from other, existing European directives, including pesticides. Thirteen of the priority substances have been identified as priority hazardous substances. Emission and discharge of these substances must be reduced to zero where possible.

5.1.2 Good ecological status of surface water

The ecological quality of surface water bodies has been divided into environmental objectives for:

- biological species of the categories algae, water plants, small aquatic animals and fish;
- hydromorphological parameters, such as water level and discharge fluctuations, variations in width and depth, and structure of the riparian and shore zone;
- general physico-chemical parameters: phosphate, nitrogen, acidity, temperature, salinity and transparency;
- specific pollutants, for which standards have been identified at national level and where possible harmonised internationally for each river basin.

When a water body is designated as ‘heavily modified’ or ‘artificial’, authorities are free to determine for this water body what good ecological quality fits with the deviating status. See section 5.2 for a more detailed explanation. A substantial part of the surface waters in the Netherlands has been designated as ‘heavily modified’ or ‘artificial’. This designation and the reasons for it are being justified in the river basin management plans and the water plans of Rijkswaterstat and the provinces.

5.1.3 Objectives for groundwater

The chemical status of groundwater relates to standards established in part at European level (nitrate and plant protection products) and in part at national level (threshold values for chloride, nickel, arsenic, cadmium, lead and phosphate). Groundwater must be chemically clean and available in sufficient quantities.
This quantitative objective determines that the abstraction of groundwater from a groundwater body must be balanced by natural or artificial replenishment. Moreover, the volume of the groundwater may not diminish to the extent that it hinders attaining the objectives for bodies of surface water or causes salt water intrusion. Nature areas that depend on the supply of sufficient groundwater of good quality must not become depleted as a result of human activities.

5.1.4 Drinking water abstraction

The Water Framework Directive specifically addresses the quality of the surface water and groundwater that is abstracted for human consumption now and in the future. The quality of this water must not deteriorate. Protection zones will be established to protect drinking water abstraction locations.

5.2 Realistic goals

Standards for chemical quality of surface waters have been set at the European level, applying to all member states of the European Union, while ecological objectives have been set at national level.
Determining the ecological objectives for waters depends on the type of water as well as on the status ‘heavily modified’ or ‘artificial’.
If the ecological objective can only be reached using hydromorphological recovery measures that have significant adverse effects on key uses, such as shipping or safety (flooding), the ecological objectives for a certain type of water may be modified. This option is subject to stringent conditions, and only the ecological objective can be adjusted, not the chemical objective. Analyses by the water management authorities show that a large proportion of the surface waters in the Netherlands is artificial or heavily modified.

Figure 7 Overview of the method of setting objectives for surface water and groundwater

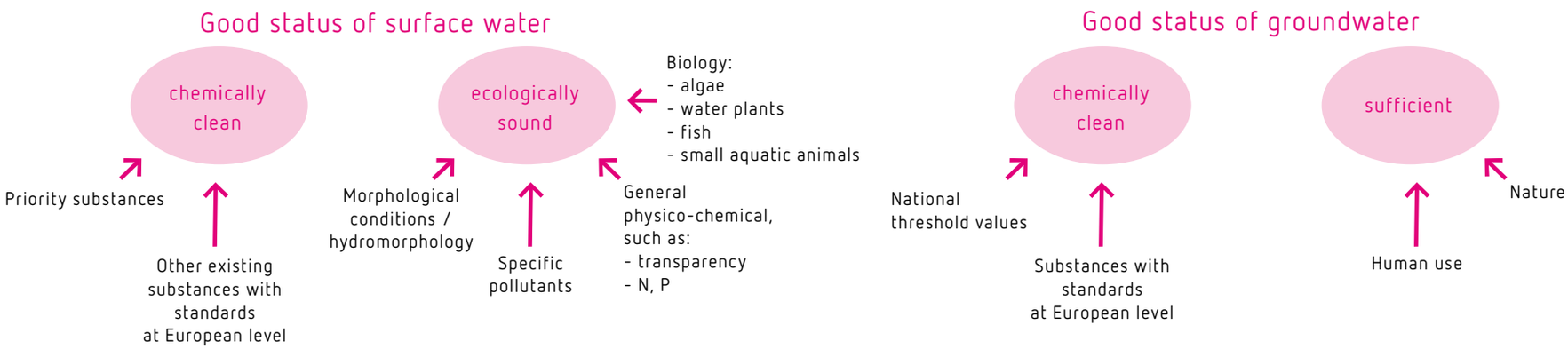


Table 3 Number of surface water bodies (SWB) per river basin, for which extension of deadlines after 2015 is necessary.

River basin	Total number of SWBs	Number of SWBs requiring phasing	Percentage of SWB phasing (%)
Ems	22	18	82
Meuse	155	137	88
Rhine	491	422	86
Scheldt	56	48	86
Total	**724**	**625**	**86**

Table 4 Number of groundwater bodies (GWB) per river basin, for which extension of deadlines after 2015 is necessary.

River basin	Total number of GWBs	number of GWBs requiring phasing	Percentage of GWB phasing (%)
Ems	2	1	50
Meuse	5	2	40
Rhine	11	3	27
Scheldt	5	1	20
Total	**23**	**7**	**35**

5.3 Who sets the objectives?

Environmental quality requirements for bodies of groundwater and surface water are laid down in the Decree on the quality requirements and monitoring of water (*Besluit kwaliteitseisen en monitoring water*, Bkmw 2009). An exception is made for ecological objectives for artificial and heavily modified surface water bodies, which are included in the water plans. For the main water system, this is the Management and Development Plan for National Waters, for the regional waters the provincial water plan or provincial spatial plan.

5.4 When will the objectives be achieved?

The objectives for all water bodies must be achieved by 2015. Targets may be lowered or deadlines may be extended, albeit under specific conditions. Extending the deadline beyond 2015 is permitted for one or more of the following reasons:

- the required improvements cannot technically be achieved within that period;
- achieving the improvements is disproportionately expensive;
- natural circumstances obstruct timely improvement.

Expectations are that for a significant proportion of the waters in the Netherlands not all objectives will be achieved by 2015. Of the 724 surface water bodies, 99 are expected to meet the objectives in 2015, while the target objectives for 625 water bodies (86%) will not be achieved until after 2015. See table 3 for the number of water bodies in each river basin for which the objectives are expected to be attained in 2015 and which require time extension beyond 2015.

Seeing as the objectives for a number of pollutants are not expected to be achieved even by 2027, it has already been indicated that they will probably have to be lowered in the river basin management plans to be formulated in 2021. Implementation of the measures is a step-by-step process, so that the targets may, if necessary, be lowered in 2021 based on advanced knowledge and understanding. Examples of pollutants to which this may apply are PAHs, TBT, nitrogen, phosphate and a number of pesticides.

Of the 23 groundwater bodies, 15 are expected to reach the objectives by 2015. The other 8 (35%) will not reach their objectives until after 2015 (see table 4).

6 What measures will we be taking?

A programme of measures needs to be set up for each river basin. This chapter summarizes the programmes of measures for the four river basins. The programme of measures for each river basin is included in the river basin management plan.

6.1 Introduction

The Pollution of Surface Water Act (*Wet verontreiniging oppervlaktewateren*), that came into force in 1970 in the Netherlands marked the start of a progressive and successful water quality piece of legislation. Licensing has greatly decreased pollution from industrial discharges, while significant progress has also been made as a result of the construction and improvement of wastewater treatment plants. Over the years, attention has shifted from point sources to diffuse sources, such as pollution from fertilisers, heavy metals, PAHs and pesticides.

This has resulted in a significant improvement of chemical water quality. At the same time, however, the realization dawned that ecological water quality also deserved more attention. This is reflected in the Third and Fourth National Policy Documents on Water Management. Since the early 1990s, Dutch water management authorities have also invested substantially in improving the ecological structure.

6.1.1 EU directives and international agreements

Most water quality policies are generic and apply to the Netherlands as a whole. Most regulations and legislation focus on the construction of sewers, waste water treatment, limiting nitrate and phosphate from fertilisers and the restrictive admittance of pesticides. Much of this national policy concerns an elaboration of European directives.

Since the mid-1970s, agreements have been reached in the International Rhine Commission on reducing the discharge of chemicals, salt and thermal discharges. The fire at Sandoz in 1986 and the resulting Rhine Action Programme boosted international collaboration in the Rhine river basin. An International Ems Commission has also been in place for many decades. The 1990s saw the establishment of international river commissions for the Meuse and Scheldt. All commissions have worked hard in recent years on implementing the Water Framework Directive. Joint analyses of the problems in the river basin have been performed and programmes of measures coordinated. Agreements for substances relevant to river basins such as nutrients, pesticides, cadmium, copper and zinc are also being prepared. Further agreements will have to be reached in the coming planning periods.

6.2 Basic and supplementary measures

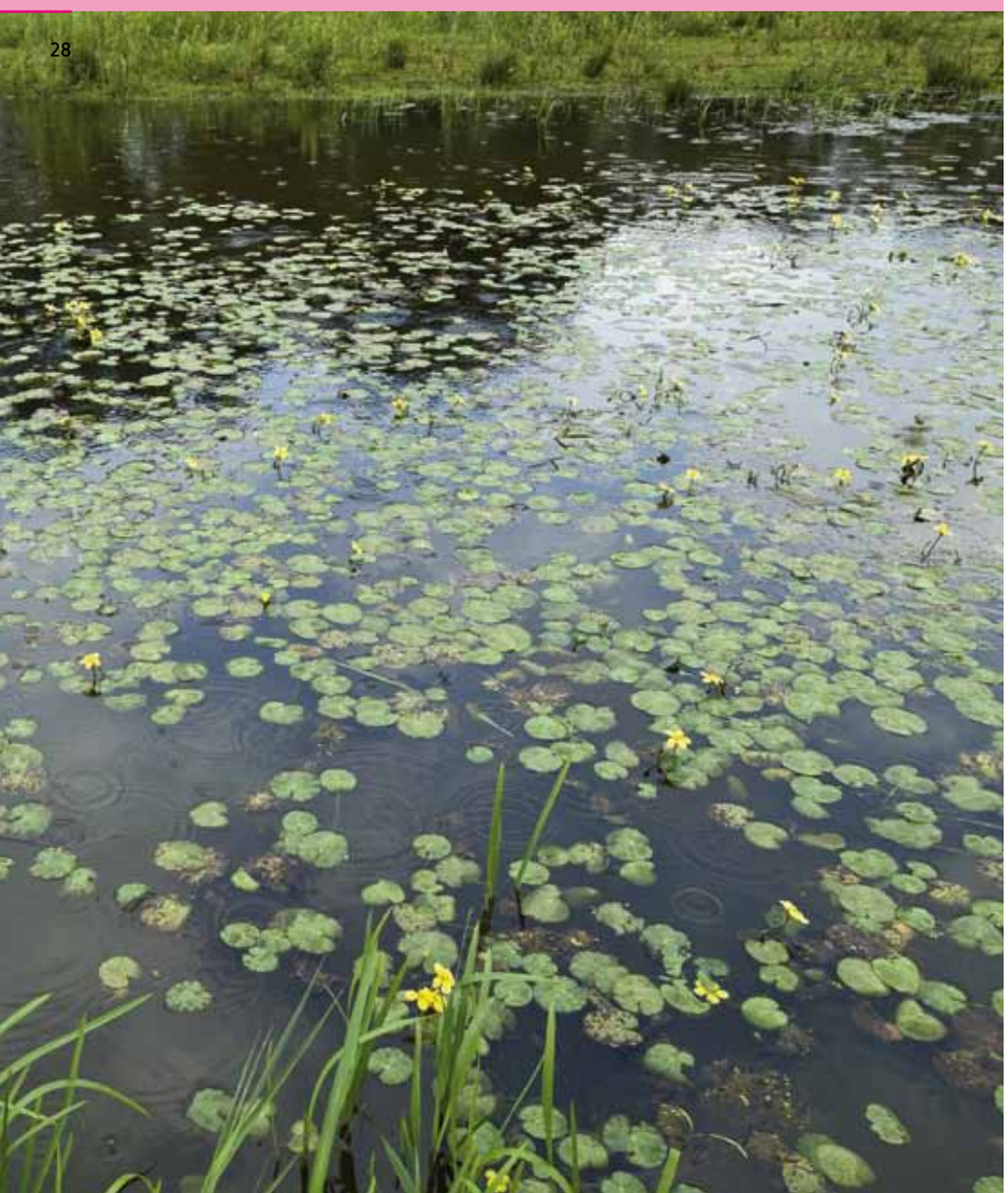
Every programme of measures contains basic measures and, where necessary, supplementary measures. Basic measures are all measures ensuing from European obligations and national generically applicable policy. Supplementary regional measures are all measures taken for specific water bodies with a view to achieving the WFD objectives.

6.2.1 Basic measures

The set of measures as a whole mainly comprises measures based on existing generic policy developed for the implementation of European directives other than the WFD. Some measures are still in the implementation stage. There are thirteen directives of direct relevance to water quality, including the Nitrates Directive, the Urban Waste Water Directive, the Plant Protection Products Directive, the Habitat Directive and the Drinking Water Directive.
There are also measures that are based on national policy and adopted as generic measures. These are sometimes concretised for specific areas, such as in relation to licensing by provinces and water boards, measures for improving water quality under the National Water Plan, and measures to prevent flooding and waterlogging for Water Management in the 21st Century. This has already resulted in a comprehensive set of hydromorphological recovery measures. Other examples of measures based on national policy concern regulation of the abstraction of surface water and groundwater, metering and pricing drinking water, levying groundwater tax and measures to promote sustainable and efficient water use and realise cost recovery of water services. Managing the abstraction of surface freshwater and groundwater and the artificial replenishment of groundwater bodies are also part of this.

6.2.2 Supplementary measures

Water quality will greatly improve once all basic measures have been implemented. However, for many water bodies the objectives for groundwater and surface water are still not expected to be achieved. This requires supplementary measures. These are



Licensing

The 2009 Decree on the quality requirements and monitoring of water (Bkmw 2009) stipulates that, in adopting the water management plan and the provincial water or spatial plan, the water management authorities and the provinces, respectively, take the environmental quality requirements of the WFD into account. These plans should, therefore, indicate what measures are being taken to meet these requirements. As regards chemical quality, current licensing policy, including the emission-immission test for surface waters, and the existing general rules remain the starting point for assessing point sources. By periodically upgrading the state of the art in terms of best available technologies and best environmental practices – taking into account cost effectiveness and economic capacity of companies and sectors – and applying this in the source-oriented approach, total emissions and discharges in the management area can be reduced, creating space for new activities and related emissions. In this way, economic activities are disconnected from the resulting environmental impact in an attempt to achieve environmental objectives. In the event of localised disproportionate growth of preferred activities, the management plan in question will indicate how these activities are or can be made compatible.

If water conditions are insufficient as a result of environmental impact from existing inputs and these inputs cannot be reduced or not in time, this may mean that, for the time being, no permits will be granted for new inputs. However, a permit may nevertheless be granted if the activity for which a permit has been requested is of significant public interest and if adequately limiting the new discharge or emission is technically not feasible or disproportionally expensive now or in the near future. In that case, the plan must indicate that the environmental quality requirement cannot be achieved and that the target must be lowered. This will have to be thoroughly substantiated.

mainly regional and site-specific measures such as the hydromorphological restoration, the construction of ecological corridors, and designing weirs, locks and pumping stations so that they allow fish to pass through. Moreover, substance discharges and emissions will be reduced by modifying wastewater treatment plants, decontaminating discharges in areas without sewer systems and tackling sewage overflows. The supplementary measures also include the restoration of existing water-rich areas and projects in the areas of research, development and demonstration.

6.3 The measures

This section contains an overview of the supplementary local and regional measures needed to further reduce pollution and improve ecological quality. The central government is responsible for an effective regulatory framework, including the implementation of European directives. It also sees to effective coordination with other policy fields, so that any measures taken in other areas can contribute to improving the water quality. The water management authorities are responsible for most of the programme of supplementary measures. Rijkswaterstaat manages the main water system, the water boards manage the regional surface water system and shallow groundwater, and the provinces manage the deep groundwater system. Municipalities are responsible for measures relating to sewers, the disconnecting rainwater from the sewer system, and the management of urban water.

Municipalities can also limit diffuse discharges by using non-leaching construction materials and reducing the use of chemical pesticides. They can achieve this by setting a good example or by additional regulation.

Provinces and municipal councils also play a key role in the spatial incorporation of measures, for example creating space for restoring the meanders of streams. An important tool is the land use plan. Municipalities grant building permits and inform citizens about water quality. They also take into account the importance of surface water protection through execution of the *Watertoets* (Water Test). All these activities are in line with current municipal policy.

6.3.1 Reducing the environmental impact of pollutants

The environmental impact on surface water resulting from nutrients and pollutants (such as pesticides and heavy metals) is primarily reduced by means of national measures and licensing, although supplementary regional measures also contribute. The key supplementary measures in the first planning period (2009-2015) include:

- modifying 115 sewage overflows;
- removing approx. 6 million m^3 of polluted dredge (from aquatic sediments);
- improving purification of 50 wastewater treatment plants;
- establishing manure- and fertilisation-free zones over and above the statutory minimum along 791 km of ditches and streams.

Licensing and (generic) measures reduce the environmental impact on groundwater resulting from pollutants (such as pesticides and nutrients) and groundwater abstractions. These include remediation and analyses of polluted locations, and the reduction of leaching and inflow of pesticides and other pollutants to groundwater abstraction locations for human consumption. The measures necessary for industrial abstractions will be studied in more detail in the first planning period. The Mergelland nitrate study (*Nitraatonderzoek Mergelland*) pays area-specific attention to the problem of nitrate in the groundwater in the Meuse river basin.

6.3.2 Improving ecological water quality

The drastic hydromorphological changes of most surface waters are a particular impediment to proper ecological development. It is, therefore, no more than logical that supplementary sets of regional measures are aimed primarily at adjusting the hydromorphology, management and maintenance of water systems. For the first planning period (2009 – 2015), a comprehensive programme has been established that includes the following measures:

- construction of 1,734 km of nature-friendly banks (nfb) along standing waters;
- construction of 806 km of nature-friendly banks along flowing waters, and remeandering streams;
- widening over 1,100 m of watercourses and constructing them as wetlands;
- modifying 628 structures to improve fish migration.

The programme is represented in tables 5 to 8.
A distinction has been made between measures for the first planning period (2009 – 2015) and for the next two planning periods (2016 – 2027). The set of measures for the 2009 – 2015 period is subject to an obligation to carrying out these measures. Construction measures included by water management authorities for which land must be acquired – e.g. for the construction of nature-friendly banks – or for which agreements must be reached with managing authorities, such as the establishment of manure- and fertilisation-free zones over and above the statutory minimum, are specified on the basis of voluntary acquisition or voluntary agreement, such as within the framework of subsidy schemes.
The measures in the 2016 – 2027 period are subject to a 'best efforts' obligation. This may be deviated from in the next river basin management plan, which is to be adopted in 2015. At that time, a new obligation for measures to be carried out will be agreed on for the new planning period (2016 – 2021).

6.4 Implementation

Preparations for the implementation of the measures are underway at many places. To improve efficiency, they are linked to other area-related projects planned for the next few years (synergy). With a view to the obligation to carry out the measures, each of the executive authorities will closely monitor implementation of the programme of measures. Progress for each (constituent) river basin will also be addressed in the Regional Administrative Consultation Body (*Regionaal Bestuurlijk Overleg*, RBO). Every year, a progress report will be submitted to the Lower House.
The first formal Water Framework Directive progress report on the implementation of the programme of measures will be formulated in 2012 and sent to the European Commission.

Table 5 Summary overview of the supplementary measures for the Dutch part of the Ems river basin for the 2010 - 2015 and 2016 - 2027 periods

Ems				
RBMP	Name of measure	Unit	Total 2010 - 2015	Total 2016 - 2027
Approach to point sources				
	Tackling sewage overflows	ha / no.	67 / 4	
	Decreasing impact of wwtp	no.	2	
	Disconnecting paved surface	ha	3	
	Decontamination of polluted soils / groundwater	no.	2	
Approach to diffuse sources				
	Decreasing emissions of nutrients from agriculture	no.	1	
	Removing polluted dredge	ha	15	55
	Setting up manure- and fertiliserfree zone	km		20
Regulation of water movement and hydromorphology				
	Widening water syst, wetlandcreation / lowering floodplain	ha	10	
	Removing weir	no.	2	
	Making structures passable for fish	no.	17	
	Widening / nfb; slow-flowing / still water	km	44	78
	Deepening water system (overdimensioning)	ha	113	
	Other hydromorphological restoration measures	ha / no.	2350 / 2	50 / -
	Widening / remeandering / nfb; (fast) flowing water	km	64	53
	Adjusting water level	ha		200
Other measures				
	Active vegetation- / water quality management	km / no.	41 / 1	76 / -
	Financial measures	no.	2	
	Creating constructed wetlands	no.		1
Investigations				
	Conducting research	no.	10	

Table 6 Summary overview of the supplementary measures for the Dutch part of the Meuse river basin for the 2010 - 2015 and 2016 - 2027 periods

Meuse				
RBMP	Name of measure	Unit	Total 2010 - 2015	Total 2016 - 2027
Approach to point sources				
	Discontinuing non-purified discharges	no. / year	9 / 24	
	Tackling sewage overflows	no.	83	
	Other emission-reducing measures	ha / no.	4 / 2	
	Decreasing impact of wwtp	no.	12	13
	Disconnecting paved surface	ha / no.	332 / 3	118 / -
	Decontamination of polluted soils / groundwater	no.	2	
Approach to diffuse sources				
	Other source-oriented measures	no.	1	
	Removing polluted dredge	ha / m^3 / no.	1233 / 302000 / 1	
	Decreasing emissions from plant protection products / pesticides	ha / no.	1624 / 28	
	Setting up manure- and fertiliserfree zone	ha / km	62 / 697	60 / -
Regulation of water movement and hydromorphology				
	Widening waters & wetland creation / lowering flood plain	ha / km	264 / 6	296 / 11
	Adjusting inlet / flushing / separating water	no.	7	1
	Adjusting water level	no.	2	3
	Making structures passable for fish	no.	144	324
	Widening / nfb; slow-flowing / still water	km	281	697
	Other hydromorphological restoration measures	ha / no.	250 / 13	- / 2
	Construction of side channel / restoring connection	km / no.	17 / 19	29 / 48
	Retaining water in system capillaries	no.	3	
	WB21 measures	ha	70	
	Widening / remeandering / nfb; (fast-) flowing water	ha / km	18 / 385	- / 691
	Adjusting (ground)water levels	ha	10790	18823

Other measures				
	Construction of specific habitats for fish	km	63	66
	Creating constructed wetland	no.	1	
	Active vegetation / water quality management	ha / km	47 / 702	
	Active fish stock and shellfish stock management	no.	3	
	Other management measures	no.	1	
	Altering / limiting functional use	ha / no.	3 / 21	12 / -
	Providing information	no.	47	
	Construction of special habitats for flora and fauna	no.	20	39
	Drafting a new plan	no.	28	
	Other instrumental measures	ha / no.	3384 / 4	
	Management of large-scale groundwater pollution	no.	2	
	Altering / relocating groundwater extraction	no.	1	
Investigations				
	Conducting research	no.	141	3

Table 7 Summary overview of the supplementary measures for the Dutch part of the Rhine river basin for the 2010 - 2015 and 2016 - 2027 periods

Rhine				
RBMP	Name of measure	Unit	Total 2010 - 2015	Total 2016 - 2027
Approach to point sources				
	Discontinuing non-purified discharges	km / no.	2 / 355	- / 108
	Tackling sewage overflows	m^3 / no.	30 / 23	- / 6
	Other emission-reducing measures	ha / km / no.	- / - / 252	2 / 14 / 7
	Decreasing impact of wwtp	no.	34	4
	Disconnecting paved surface	ha	93	8
	Decontamination of polluted soils / groundwater	no.	45	16
Approach to diffuse sources				
	Decreasing emissions of nutrients from agriculture	no.	616	
	Other source-oriented measures	no.	7	
	Decontaminating leaching bank/shore protection	km	30	5
	Removing polluted dredge	ha / km / m^3 / no.	2000 / 10 / 5567989 / 23	408 / 10 / 1957290 / -
	Decreasing emissions of plant protection products / pesticides	no.	7	6
	Setting up manure- and fertiliserfree zones	ha	174	5
	Decreasing emissions from traffic / shipping	no.	1	
Regulation of water movement and hydromorphology				
	Widening waters & wetland creation / lowering flood plain	ha / km / no.	840 / 18 / 1	455 / 14 / -
	Shoaling the water system	ha / km / m^3	56 / 1 / 4000	- / 30 / 137727
	Adjusting inlet / flushing / separating water	ha / no.	1900 / 76	600 / 36
	Adjusting water level	ha / no.	23671 / 31	20850 / 40
	Removing weir	no.	28	4
	Making structures passable by fish	no.	426	506
	Widening / nfb; slow-flowing / still water	ha / km / no.	75 / 1292 / 7	185 / 2553 / -
	Deepening water system (overdimensioning)	ha / m^3 / no.	1 / 94680 / 1	- / 164568 / -
	Other hydromorphological restoration measures	ha / km / no.	6254 / 47 / 117	2418 / 89 / 154
	Construction of side channel / restoring connection	ha / km / no.	- / 64 / 28	56 / 111 / 30
	Retaining water in system capillaries	ha / km / no.	12 / 9 / 1	- / 8 / -

	Widening / remeandering / nfb; (fast-) flowing water	ha / km / no.	153 / 343 / 2	737 / 499 / -
	Adjusting (ground)waterlevel	no.	3	
	WB21 measure	ha / no.		24 / 1
Other measures				
	Construction of special habitats for fish	ha / km / no.	10 / - / 29	20 / 30 / 23
	Creating constructed wetland	ha	228	4
	Active vegetation / water quality management	ha / km / no.	948 / 978 / 3	467 / 1796 / 3
	Active fish stock or shellfish stock management	ha / no.	103489 / 23	94970 / 12
	Other management measures	ha / km / no.	116 / 1913 / 9	- / 55 / 17
	Altering / limiting functional use	ha / no.	332 / 1	59 / 1
	Financial measures	no.	2	2
	Providing information	no.	17	
	Construction of special habitats for flora and fauna	ha / no.	11 / 3	127 / 7
	Drafting new plans	no.	12	2
	Other instrumental measures	ha / no.	100 / 9	- / 2
	Adjusting vegetation on banks / shores	ha / km / no.	20 / 66 / 1	13 / - / -
	Amending / introducing (new) legislation	no.	1	
	Managing large-scale groundwater pollution	no.	1	
	Altering / relocating groundwater extraction	no.	7	4
Investigations				
	Conducting research	no.	864	328

Table 8 Summary overview of the supplementary measures for the Dutch part of the Scheldt river basin for the 2010 - 2015 and 2016 - 2027 periods

Scheldt				
RBMP	Name of measure	Unit	Total 2010 - 2015	Total 2016 - 2027
Approach to point sources				
	Discontinuing non-purified discharges	year	6	
	Decreasing impact of wwtp	no.	2	
	Repairing leaking sewers	no.	5	
Approach to diffuse sources				
	Removing polluted dredge	ha	27	
	Setting up manure- and fertiliserfree zones	km	94	
Regulation of water movement and hydromorphology				
	Adjusting water level	no.	0	
	Making structure passable for fish	no.	41	50
	Widening / nfb; slow-flowing / still water	km	117	138
	Other hydromorphological restoration measures	ha / no.	57 / 3	- / 1
	Widening / remeandering / nfb; (fast-) flowing water	km	14	21
	Adjusting (ground)water levels	ha	137	232
Other measures				
	Construction of special habitats for fish	km	8	8
	Active vegetation / water quality management	ha	26	
	Active fish stock or shellfish stock management	ha	111	121
	Altering / limiting functional use	no.	1	
	Providing information	no.	9	
	Construction of special habitats for flora and fauna	no.	5	10
	Drafting new plans	no.	2	
	Other instrumental measures	ha	6749	
Investigations				
	Conducting research	no.	12	

7 What are the costs and the benefits?

The protection of water quality is one of the core tasks of water management authorities in the Netherlands. Most of the costs incurred are related to implementing current water quality management, including maintaining the wastewater treatment plants.
The Water Framework Directive provides sets of measures that ensure that Dutch waters will be clean and ecologically sound, and that the countries upstream make a significant contribution to achieving good water quality in the Netherlands.

7.1 Introduction

For years, government authorities and the business community have been making significant investments in facilities and services intended to improve water quality, such as the construction, management and maintenance of sewers and wastewater treatment plants. A large proportion of these costs is related to obligations under European or national legislation and apply to the Netherlands and the European Union as a whole. Moreover, measures are taken at local or regional level that go beyond these basic measures. Such supplementary measures may concern the further reduction of pollutant emission, or the construction of nature-friendly banks or fish passes. This category of measures in particular is increasing significantly as a result of the Water Framework Directive. They constitute a large step towards achieving the objectives of the Water Framework Directive.

7.2 Costs

The Water Framework Directive addresses the cost aspect in three different ways. First of all in relation to determining whether a surface water body has the status 'heavily modified'. This concerns the question of whether the implementation of hydromorphological recovery measures aimed at achieving the ecological objective for the surface water in question will have *significant negative effects* on existing uses that are of major social importance. Such recovery measures could cause financial or economic damage to key activities such as shipping, flood protection or drinking water supply. If negative effects are likely, recovery measures need not be taken and ecological objectives can be adjusted accordingly.
A second aspect in which costs play a role is the *cost effectiveness* of programmes of measures. When formulating a programme of measures for one or more water bodies, the most cost-effective one will be opted for.
A third aspect relates to the question of whether implementation of all measures required to achieve the goals by 2015 is *disproportionally expensive*. In that event, there is reason to extend the term for achieving the objectives by six or twelve years (to 2027 at the latest).

Governments have given these cost aspects ongoing attention in recent years. In formulating the programme of measures for the four river basins under the Water Framework Directive, the feasibility of objectives was carefully balanced against the affordability and practicability of measures. It is also important to note that the programmes of measures were developed in area-based processes, involving authorities and interest groups, considering the consequences for the different interests, the effects on water quality and the practicality and costs of the measures.

7.2.1 Land acquisition

As to whether a programme of measures is cost-effective or disproportionally expensive or not, a lot of attention has been paid in the Netherlands to the costs of land acquisition. This represents a major cost item for the construction of nature-friendly banks and allowing streams to meander again, etc.. Land acquisition on a voluntary basis is significantly cheaper than expropriation, but has the disadvantage that it often takes a lot of time and that it is impossible to predict when exactly the land can be purchased. Because of the often significantly lower costs and the often prolonged nature of expropriation procedures, programmes of measures are based on voluntary acquisition of land, which is why some of these measures have been postponed until the second planning period.
Another effective way of reducing the costs of measures is to link up WFD measures with other spatial developments and previously planned renovations of engineering structures, wastewater treatment plants (wwtps) and sewage systems, for example. If such spatial developments or renovations are not planned until after 2015 it is much more

favourable to implement the related measures in the second or third planning period (improving synergy).

This approach has resulted in a set of measures that significantly contributes to improving the water quality and limits the costs as much as possible.

7.2.2 Investment costs

Investment costs in the 2009 – 2015 period for implementing supplementary measures in the four river basin management plans total over € 2.2 billion. Half of this amount (€ 1.1 billion) will be spent on measures to improve water regulation and the design of the main and regional water systems.
Over 40% of the investment costs for supplementary measures (€ 0.9 billion) will be spent on tackling point sources and diffuse sources. For the period after 2015, supplementary measures for the four river basins are expected to total approx. € 2.0 billion. This means that the total investment in supplementary measures under the Water Framework Directive is currently estimated at over € 4.2 billion.
See table 9 for an overview of the investment costs per river basin, divided into time periods. Table 10 presents a division of investment costs for the different categories of additional measures per river basin for the first planning period (2009 – 2015).

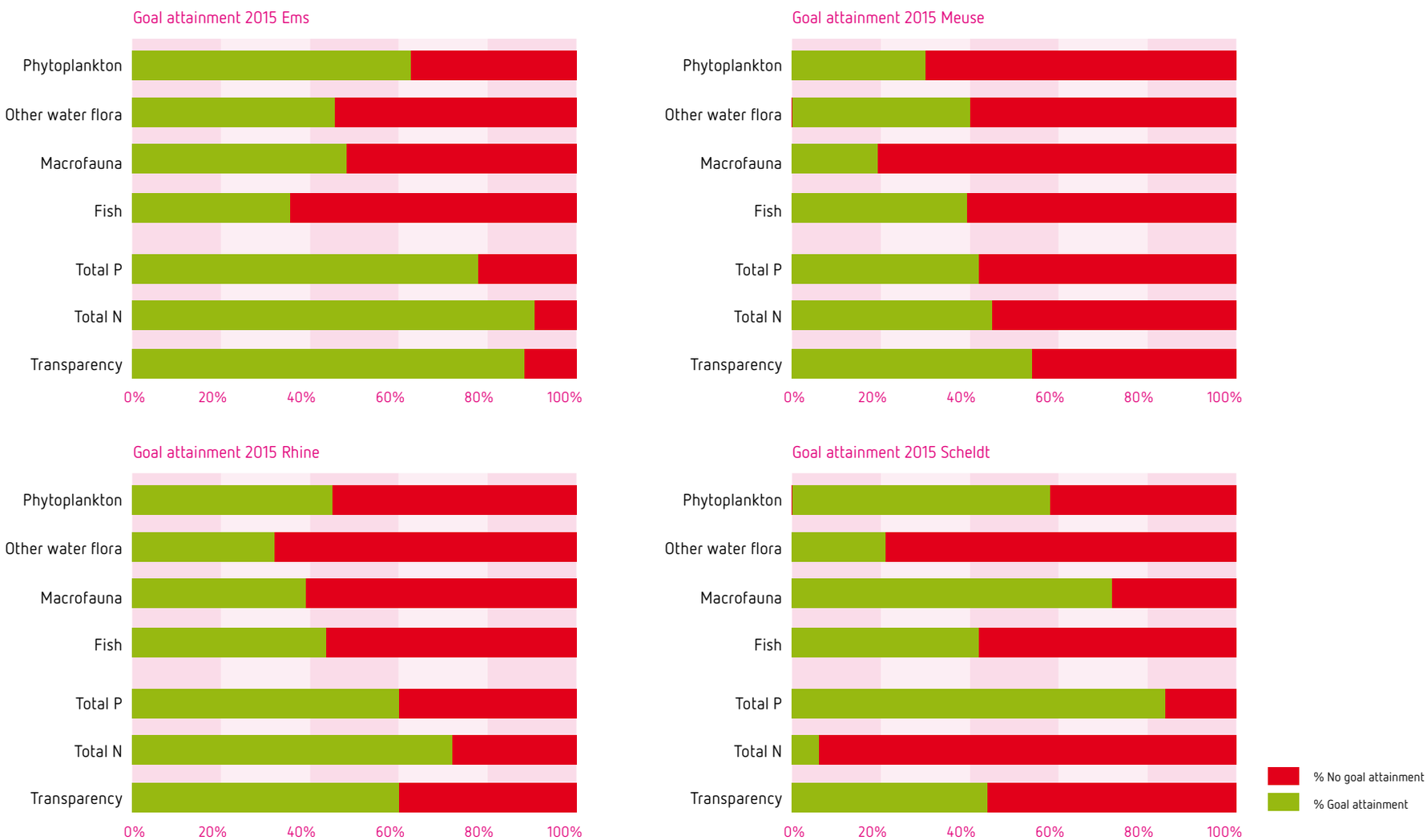
Table 9 Overview of investment costs of supplementary WFD measures according to period

(x million €)	Ems	Meuse	Rhine	Scheldt	Total
2010-2015 period	149	503	1.502	74	2.228
2016-2027 period	119	780	1.076	27	2.002
Total	268	1.283	2.578	101	4.230

Table 10 Overview of investment costs of supplementary WFD measures for the 2009-2015 period according to type of measure

(x million €)	Ems	Meuse	Rhine	Scheldt	Total
Groundwater and surface water abstraction			9		9
Tackling point sources	43	110	441		594
Tackling diffuse sources	3	40	251	9	303
Regulation of water movement and hydromorphology	91	297	688	35	1.111
Supplementary measures	9	47	60	26	142
Conducting research	3	9	53	4	69
Total	149	503	1.502	74	2.228

Figure 8 Percentage of water bodies per river basin to reach biological parameter objectives in 2015



7.3 Benefits

The implementation of the measures is a major step towards clean and ecologically sound surface water and clean and sufficient groundwater.

7.3.1 Attaining WFD objectives

The water management authorities have estimated the expected extent of goal attainment in 2015 by implementing measures in the first planning period. Figure 8 presents a summary of a number of relevant parameters regarding the ecological status for the river basins of the Ems, Meuse, Rhine and Scheldt.

The chemical quality of the surface water is expected to gradually improve by 2015 and beyond in terms of both priority substances and specific pollutants. This is the result of:

- Continuing the *Waterwet-vergunningverlening* (licensing under the Water act) by means of a source-oriented approach and application of the emission-immission test, in which the WFD quality requirements are incorporated using the water management plans;
- Further improvement of the wwtps, the cleaning up waste water discharges and the improvement of the sewage system by tackling overflows and disconnecting paved surfaces;
- The remediation of polluted aquatic soils in regional and national waters;
- The further reduction of emissions of plant protection products by tightening admittance policy – which will be geared to the quality objectives and the monitoring data of the WFD – and tackling drinking water supply problems;
- The implementation of measures in countries upstream.

The water management authorities estimate that all measures proposed for the 2009 – 2027 period together represent a significant step towards achieving the goals by 2027. This is confirmed by the ex ante evaluation of the Water Framework Directive carried out in the spring of 2008 by the Netherlands Environmental Assessment Agency (*Planbureau voor de Leefomgeving*) on behalf of the Ministry of Transport, Public Works and Water Management.

7.3.2 Benefits of the measures

Implementation of the measures results in a considerable improvement in water quality. This has direct benefits in terms of greater bio-diversity: a higher natural value in and outside of the Natura 2000 areas, such as more species of algae, water plants, macrofauna and fish.

Clean and transparent water combined with attractive, nature-friendly banks and other wet nature areas also improve spatial quality. This takes the form of a better living environment, a better residential quality and an attractive climate for establishing business. Moreover, the improvement of the water quality and the redesign of watercourse increase the number of recreational options. Finally, improvement of the quality of the (ground)water may, in due course, simplify the purification of drinking water.
All these benefits have a use-related and amenity value, with possible positive effects on health. These benefits are difficult to express in monetary terms, which is confirmed in the Ex ante evaluation of the Water Framework Directive.
The key gain of all these efforts will be that future generations will also have sufficient and clean water.

Figure 9 KNMI climate scenarios 2006 Source: www.knmi.nl/klimaatscenarios/

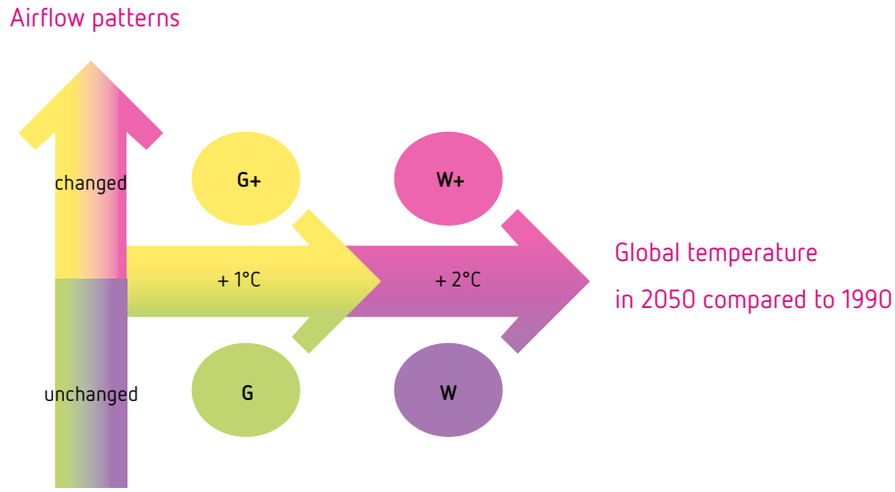


Table 11 Estimate of the sensitivity of water types to impact related to climate change

Impact	Watertypes				
	Still waters (lakes)	Flowing waters (rivers)	Coastal waters	Transitional waters	Groundwater
Eutrophication	●	●	●	●	●
Salinisation	●	●	●	●	●
Regulation of water level (fluctuations)	●	●	●	●	●
Discharge dynamics	●	●	●	●	●
Connectivity	●	●	●	●	●
Thermal load	●	●	●	●	●

● almost always sensitive
● sensitive where affected
● sensitivity minor or heavily dependent on local circumstances
● negligible

8 What is the impact of climate change?

The climate is changing: for this century, a significant climate change is predicted for which European countries must prepare. It has been agreed, therefore, that the river basin management plans should also address the effects of climate change on water quality and water management.
To analyse whether the proposed programmes of measures from the river basin management plans are climate proof, an estimate was made in 2009 of the expected effectiveness of the proposed supplementary WFD measures under the conditions of the forecast future climate.

8.1 Introduction

The European Union member states and the European Commission believe that climate change needs to be included in the river basin management plans. In 2008, they agreed that the river basin management plan was to contain a brief description of the effects of climate change on water quality and water quality management for the river basin. The results of a 'climate check' of the WFD programme of measures must be included in the river basin management plan. This means that an estimate will have to be made as to whether the different types of measures are robust in light of the expected climate change. In other words: will the measures continue to be effective in the face of climate change? To answer this question, an analysis has been performed in the Netherlands based on the available knowledge and using expert judgement.

8.2 KNMI climate scenarios

The assessment of the consequences of climate change was based on four recent scenarios formulated by the Royal Dutch Meteorological Institute KNMI (also see Figure 9):

- Moderate scenario with unchanged airflow patterns (**G**)
- Moderate scenario with changed airflow patterns (**G+**)
- Warm scenario with changed airflow patterns (**W**)
- Warm scenario with unchanged airflow patterns (**W+**)

The moderate scenarios (G and G+) assume an average worldwide temperature increase of +1°C in 2050 compared to 1990, while the warm scenarios (W and W+) assume a +2°C temperature increase.
A key question is whether climate change will lead to changes in airflow patterns in Western Europe. The plus scenarios (G+ and W+) expect a change in air circulation patterns over mainland Europe, resulting in more and longer dry periods in summer as well as more frequent heavy rain showers. All scenarios assume that winters will become wetter and milder. Finally, it is assumed that sea levels will rise by up to 85 cm by 2100; the lower limit is a rise of 35 cm.

8.3 Expected effects of climate change

Effects on (ecological) water quality
The effects of climate change on the (ecological) water quality can be divided into three categories:

- direct (physical) effects, such as the water levels, water temperatures, and low and high discharge volumes;
- (physico)chemical effects, such as increasing salinisation due to the intrusion of salt water when discharge volumes are low, higher concentrations of nutrients, greater chance of algal bloom;
- biological effects, such as the decrease or disappearance of species and shifting of the range of distribution of species.

Climate change will probably also lead to changes in a number of impacts related to the effects described above. Table 11 presents an estimate of the sensitivity of the categories of water types to different types of impact.

In summary, expectations are that climate change will result in negative effects on water quality. Roughly speaking, this means that the task of achieving the water quality objectives will become more difficult in the coming years as a result of climate change.

Climate-robustness of the measures
Almost none of the measures from the WFD programme of measures is expected to be less effective as a result of climate change. Most measures have a neutral or even positive score, which means that the effectiveness of the measure is expected to increase in the event of climate change. The purifying effect of water purification marshes, for example, increases under high temperatures, thus increasing the effectiveness of the measure.

8.4 Climate change in the 2016-2021 river basin management plan

In order to more deeply embed the consequences of climate change in the next river basin management plans from 2016 onwards, a number of topics will be worked out in more detail over the next few years. This concerns such subjects as gearing the monitoring programme to climate change, updating climate scenarios and cataloguing gaps in knowledge.

9 Where do we go from here?

At the end of this summary we would like to look ahead to see what we can expect in terms of the Water Framework Directive over the next few years. The focus is on implementing measures, monitoring quality improvement and starting preparations for the next river basin management plans.

9.1 Implementation

A period of intensive preparations that led to the publication of the river basin management plan will be followed by implementation of the programme of measures for 2009 – 2015. This shifts the focus from planning to implementation. Implementation progress will be monitored and reported to the Lower House on an annual basis. In 2012, a progress report will be drafted for the European Commission.

9.2 Monitoring programme

The WFD monitoring programme and the performance of research projects will serve to keep close track of and record the effects that measures have on water quality and biological parameters. This enables us to better estimate the effects of the measures, which is quite difficult at the moment. Not only in terms of ecological effects of organisation and management measures, but also of the effects of, for example, manure-related measures on nutrient contents and the response of biological organisms.
The Water Framework Directive monitoring programme was launched in 2006 and updated in 2009.
'Monitoring aimed at further study' is being developed for specific surface water bodies. Based on the measurement data, the effect of measures can be tracked, thus making it easier to assess the remaining task over the next few years.

9.3 The second river basin management plan for the 2016 - 2021 period

Based on the new monitoring results, an assessment will be conducted in 2013 to determine how the quality of the ground- and surface water compares to the water quality objectives to be achieved by 2015. The water quality in 2015 as estimated by the water management authorities will be used as an alternative for those water bodies for which it is clear that the objectives will not be achieved by 2015 (phased implementation). Based on this comparison, an assessment will be made to see whether the measures implemented until then have resulted in the expected improvement of the water quality. These results and the Implementation of Measures 2009 – 2015 progress report will form the basis of the sets of measures to be formulated for the 2016 – 2021 period and beyond. The results of planned studies of innovations will also be used to improve water quality further.
In December 2014, the second draft river basin management plans will be available for inspection. The final plans will be published by 22 December 2015 at the latest.
Although lowering of the objectives is, in principle, possible for each river basin management plan, it was decided in the 2006 Decembernota policy document to wait until drafting the third river basin management plan (in 2021) to check whether this would be necessary for certain water bodies.

9.4 More information

Each river basin management plan contains a list of responsible organisations from which background information can be obtained. The websites *www.kaderrichtlijnwater.nl* and *www.Nederlandleeftmetwater.nl* are sources of considerable additional information.

Publication information

This is a joint publication of the Ministry of Transport, Public Works and Water Management, the Ministry of Housing, Spatial Planning and the Environment and the Ministry of Agriculture, Nature and Food Quality.
For more information about the river basin management plans and the National Water Plan, see www.kaderrichtlijnwater.nl, www.nationaalwaterplan.nl and Nederlandleeftmetwater.nl.

You can also download a PDF version here.

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