Internationally Coordinated Management Plan for the International River Basin District of the Rhine

December 2009

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Internationale Kommission zum Schutz des Rheins

Commission Internationale pour la Protection du Rhin

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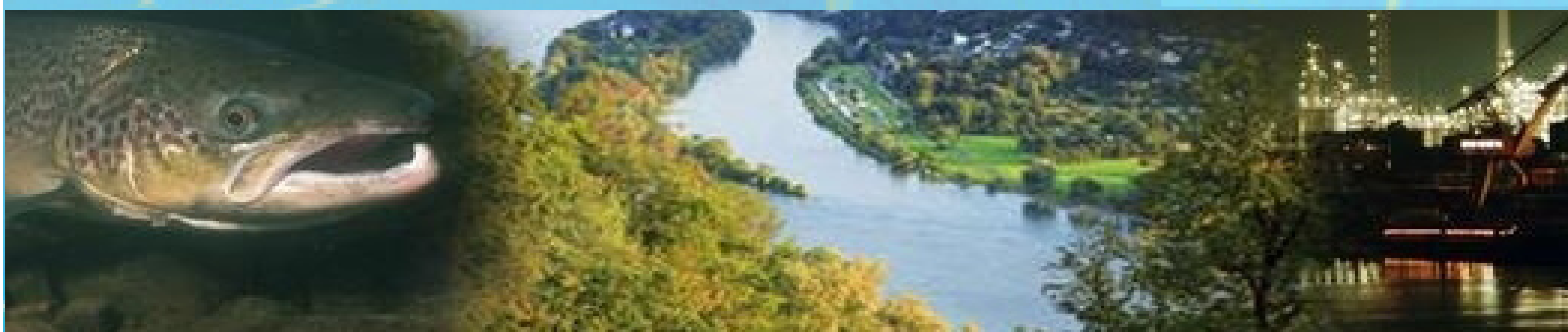

Imprint

Joint report of

The Republic of Italy,
The Principality of Liechtenstein,
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The Republic of France,
The Grand Duchy of Luxemburg,
The Kingdom of Belgium,
The Kingdom of the Netherlands

With the cooperation

of the Swiss Confederation

Data sources

Competent Authorities in the Rhine river basin district

Coordination

Rhine Coordination Committee in cooperation with the International Commission for the Protection of the Rhine (ICPR)

Drafting of maps

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(Part A = Overriding Part)

December 2009

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Introduction

This is the first internationally coordinated management plan for the international Rhine river basin district (IRBD Rhine, Overriding Part A) as specified by the European Water Framework Directive (WFD) which entered into force on 22 December 2000 (Directive 2000/60/EC). The fundamental objective of the WFD is to achieve the "good" status of all surface and groundwater bodies by the year 2015. To this end, coordinated management plans must be drafted for all river basin districts covering all aspects of water protection. This management plan for the IRBD Rhine is the result of multinational coordination according to Article 13, Paragraph 3 WFD including consideration of public response to the published draft of the management plan (Part A) according to Article 14, Paragraph 1c) WFD.

To fulfil the coordination obligations set down in Article 3 WFD, the ministers from Liechtenstein, Austria, Germany, France, Luxemburg, Wallonia and the Netherlands responsible for water protection in the international river basin district together with the competent member of the European Commission decided at a conference of Ministers held on 29 January 2001 in Strasbourg, to coordinate the work required for the entire IRBD Rhine (see Map K 1.1). This decision aims to achieve coherent implementation of the WFD and develop an international management plan for the river basin district. Italy with only a very small share in the IRBD has joined in this approach.

During this conference of ministers, Switzerland agreed to support the EU Member States, the federal states and the regions in their coordination and harmonisation work. Within this procedure, Switzerland is bound by conventions under international and Swiss national law. Liechtenstein is also bound by the WFD as the directive has, in the meantime, been integrated into the EEA Agreement.

A coordination committee made up of representatives from the Rhine-bordering countries and the European Community, representatives of the federal states of the Federal Republic of Germany and representatives of the region of Wallonia in Belgium has been charged to coordinate implementation of the WFD. The Secretariat of the International Commission for the Protection of the Rhine (ICPR) supports the Rhine Coordination Committee in implementing these tasks.

Due to the size and complexity of the river basin district, the Rhine Coordination Committee decided at its meeting on 4 July 2001 in Luxemburg, to split the management plan for the international river basin district Rhine (IRBD Rhine) into an Overriding Part A and subordinate B Parts consisting of detailed plans or joint texts for the nine separate areas of operation.

These mostly cross-border areas of operation were delimited on the basis of natural features and are presented in Map K 1.2:

- Alpine Rhine / Lake Constance,
- High Rhine,
- Upper Rhine,
- Neckar,
- Main,
- Middle Rhine,
- Moselle/Saar,
- Lower Rhine,
- Delta Rhine.

During their meeting in Bregenz in 2005, the representatives of the IRBD Rhine member states defined the structure of content and report coordination for the development of the management plan based on Annex VII A WFD as illustrated in Figure 1.

The management plan for the areas of operation is drafted at national level and takes the coordination required between the states or federal states/regions concerned into account. A detailed presentation is included in Parts B of this plan.

The overriding part of the management plan for the IRBD Rhine (Part A) is drafted jointly by the representatives of all states concerned within the ICPR and the Coordination Committee in charge of implementing the WFD.

The major water management issues for the entire river basin district are the recurrent theme of Part A of the management plan. The management issues have been defined in the management plan report according to Article 5 WFD from 18 March 2005[1] (hereafter: the survey) drafted for the IRBD Rhine:

[1] "International Rhine river basin district. Characteristics, assessments of the impacts of human activities on the environment and economic analysis of water use. Report to the European Commission on the results of the survey according to Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (article 15(2), 1st indent); Part A = Overriding Part, status 18 March 2005 – www.iksr.org

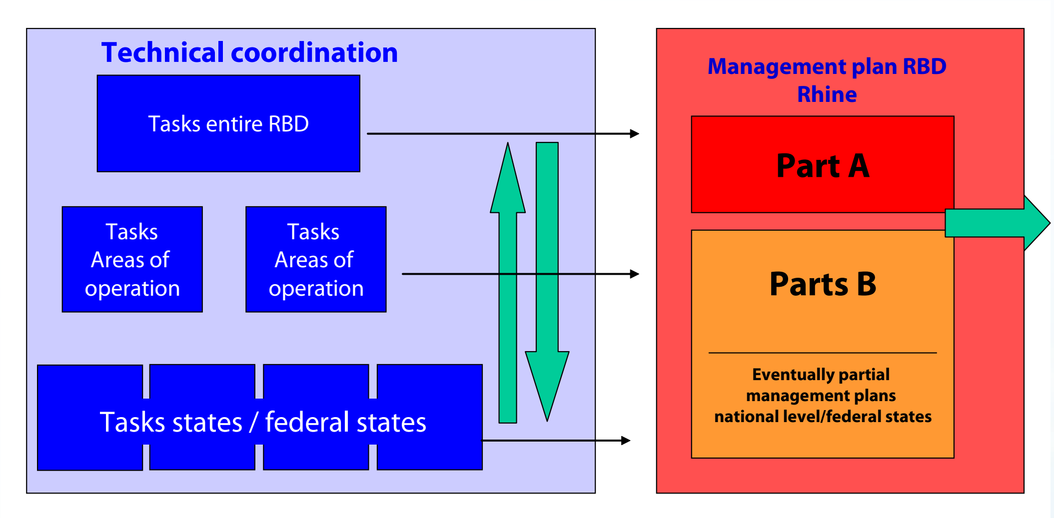


Fig. 1 Structure of international coordination

- "Restoration"[2] of biological river continuity, increased habitat diversity;
- Reduction of diffuse inputs interfering with surface waters and groundwater (nutrients, pesticides, metals, dangerous substances from historical contamination and others)
- Further reduction of classical pollution of industrial and municipal origins
- Harmonisation of water uses (navigation, energy production, flood protection, regional land use planning and others) with environmental objectives;

The overriding part of the Management Plan (Part A) is based on the basic network of water bodies (catchment area > 2,500 km^2) of the Rhine defined in the survey (Map K 1.1). For the other water bodies, please refer to the Part B management plans. In particular, the management plan describes the surveillance, the objectives to be achieved and the programmes of measures. The management plan, therefore, on the one hand, serves as a means of information for the public and the European Commission while, on the other, it records international coordination and cooperation between the states in the river basin district as required by WFD, Article 3, Paragraph 4 and Article 13, Paragraph 3.

The survey includes comprehensive information on the IRBD Rhine. To avoid repetitions and preserve clarity in this overriding part of the management plan, reference to this information will made at suitable points of the following text. The survey report (Part A and Parts B) is also available on the ICPR website www.iksr.org.

[2] As far as possible, river continuity is to be restored.

1 General description

The Rhine connects the Alps to the North Sea. It is 1,320 km long and is one of the most important rivers in Europe. The river catchment area covering some 200,000 km² spreads over nine states (see Table 1). The source area of the Rhine lies in the Swiss Alps. From there the Alpine Rhine flows into Lake Constance. Between Lake Constance and Basel, the High Rhine largely forms the frontier between Switzerland and Germany. North of Basel, the Franco-German Upper Rhine flows through the lowlands of the Upper Rhine. The Middle Rhine, into which the Moselle flows in Koblenz, starts at Bingen. In Bonn, the river leaves the low mountain regions and becomes the German Lower Rhine. Downstream of the German-Dutch border, the Rhine splits into several branches and, together with the R. Maas, it forms a wide river delta. The Wadden Sea adjacent to Lake IJssel fulfils an important function in the coastal ecosystem.

To improve water quality, 96 % of the some 58 million people living in the Rhine river basin district have so far been connected to a wastewater treatment plant. Many big industrial plants or chemical parks (a considerable part of worldwide chemical production is located in the Rhine catchment area) have their own wastewater treatment plants which are, at the very least, state-of-the-art facilities. As a result of considerable investment in the construction of wastewater treatment plants in all states, point sources now contribute less often to classical pollutant contamination than in the past. The pollutant and nutrient contamination currently being observed is largely of diffuse origin. Agriculture and municipalities have already made efforts to reduce these discharges.

The marked mining activities in the Rhine catchment area, particularly in the Moselle-Saar area, in the Ruhr area and the open-cast lignite mining areas along the left bank of the German Lower Rhine are equally relevant. Even though mining activities have decreased considerably and will continue to do so, their effects still endure in many places.

Table 1: Some characteristics of the Rhine catchment area

Surface	Approx. 200 000 km²
Length main stream Rhine	1,320 km
Mean annual discharge	338 m³/s (Konstanz), 1.260 m³/s (Karlsruhe-Maxau), 2,270 m³/s (Rees)
Important tributaries	Aare, Ill, Neckar, Main, Moselle, Saar, Nahe, Lahn, Sieg, Ruhr, Lippe, Vechte
Important lakes	Lake Constance, Lake IJssel
States	EU Member States (7): Italy, Austria, France, Germany, Luxemburg, Belgium, Netherlands, other states (2): Liechtenstein, Switzerland
Inhabitants	Approx. 58 million
Important uses	Navigation, hydropower, industry (abstraction and discharge), municipal water management (wastewater treatment and rainwater), agriculture, drinking water supply, flood protection, leisure

Maps K 1.1 and K 1.2 provide further information on the boundaries of the international Rhine river basin district, its major tributaries and other features[3].

Half of the surface of the Rhine catchment area is used for agricultural purposes; about one third is forest and protection area; almost 10 % are built-up areas and more than 5 % are covered by water. Lake Constance, Lake IJssel, the Wadden Sea and the coastal waters are included in these 5 %.

The Rhine is one of the most intensively used watercourses of the earth. In the past and with a view to reducing the associated pollution, extensive measures entailing extensive investment were introduced. Further efforts are still required.

The climate is changing in Europe. The winters are expected to become more humid, while summers will presumably be drier. Regionally, the amount of precipitation falling in a short time may be greater than today. Among other things, for the Rhine this means that runoff levels and water temperature may change. Climate change may impact flood protection, drinking water production, industrial activities, agriculture and nature. In the long run, the increase in temperature will lead to rising sea levels.

Due to requirements concerning the quality of the marine environment, in particular that of coastal waters, Rhine water quality is of particular importance.

Moreover, the Rhine provides drinking water for a total of 30 million people. For drinking water purposes, several large water treatment plants abstract raw water directly (Lake Constance) or via riverbank filtration, or they

3 For the Netherlands, the Prinses-Margriet-Canal has been included in the maps, but it is only assessed on Level B.

abstract Rhine water filtered through the dunes.

The Rhine and a number of its tributaries contain sediments some of which are considerably contaminated by industrial and mining activities in the past. As a result, during strong flooding or dredging activities, for navigation purposes for instance, re-mobilised sediments may cause temporary pollution.

Hydro-morphological modifications for navigation purposes and the use of hydropower, flood protection, drainage of swamps and land reclamations have resulted in a distinct decrease of the natural habitat of the Rhine, so that many ecological functions of this lifeline have become more limited. However, important approaches towards developing water ecology in the water system are already in place such as the "Salmon 2020" programme, the Lake Constance Lake Trout programme, the Management Plans for the Eel, the "Habitat Patch Connectivity along the Rhine" and other such programmes concerning the alluvial areas or migratory fish in the Rhine catchment area.

For further details and information on the international river basin district, please refer to the survey under www.iksr.org.

1.1 Surface water bodies

The Rhine catchment area spreads over five of the System A ecological regions listed in Annex XI WFD:

- Eco-region 4 (Alps, altitude > 800 m),
- Eco-regions 8 and 9 (western and central high hills, altitude 200 – 800 m) and
- Eco-regions 13 and 14 (western and central lowlands, altitude < 200 m).

During the survey, a typology of the surface water bodies was established for Part A of the IRBD. The categories (rivers, lakes, transitional or coastal waters; groundwater, artificial water bodies, heavily modified water bodies) and the pollution impacting them were decisive for classification of the water bodies.

All states in the Rhine river basin district have chosen System B according to WFD (see Annex II, No. 1.1 WFD) to describe the types of surface water bodies (see Map K 4).

The typology of the main stream of the Rhine is extensively presented in a separate report which also includes the fact files of the different types of river ections[4].

[4] Development of a typology (of sections) for the natural river Rhine, 2005, Koblenz, ICPR – Technical Report No. 147 - www.iksr.org – Technical Reports

Map K 2 presents the location and delimitation of the water bodies (surface waters) in the network of water bodies relevant for the Overriding Part A and corresponding to the basic network of water bodies of the survey. Apart from the main stream of the Rhine it also includes the tributaries with catchments larger than 2,500 km², lakes with a surface area of more than 100 km² and, as artificial waters, the most important navigation lanes (canals).

With respect to the delimitation of the surface water bodies, please refer to the survey, Pages 18 – 19.

The reference conditions specific to each type developed on a national scale are applicable as reference conditions.

When classified according to WFD, a water body may be evaluated as natural, heavily modified or artificial (see Map K 5). This distinction is relevant for the objectives to be achieved.

1.2 Groundwater

Map K 3 represents the location and delimitations of the groundwater bodies in the IRBD Rhine including the coordinated groundwater bodies along the state frontiers.

Regarding the delimitation of the groundwater bodies, please refer to Chapter 2.2.1 of the survey (Pages 28 – 29).

2 Human activities and stresses

2.1 Hydro-morphological modifications including abstraction

Water regulation and river continuity – migration obstacles

Numerous hydraulic measures have resulted in vast hydro-morphological modifications which have greatly impacted the ecological function of the Rhine. These effects include, among others, the almost complete restriction of river dynamics, the loss of alluvial areas, the impoverishment of biological diversity, and obstacles to fish migration. Rectification and river bank stabilisations have shortened the course of the river and, along longer sections, the construction of dikes cuts the floodplains off from river dynamics. As a result there is today a deficiency of natural structural variety and of important structural elements required for natural species diversity and intact biocoenosis.

Eight hundred km of the Rhine between Rotterdam and Basel are navigable. From Iffezheim (Upper Rhine) to the North Sea estuary, the Rhine flows freely without obstacles. For navigation purposes (among others the depth of the navigation channel), hydropower generation and flood protection purposes, the water levels of the main stream of the Rhine have been regulated and numerous water constructions, such as sluices, barrages and dikes, have been built. Between the outlet of Lake Constance and Iffezheim, there are 21 barrages in the main stream or bypass rivers serving the purpose of hydropower generation which do not, or only to a limited extent, grant river continuity for fish, biota and sediments. In the upper reaches of the Rhine (Alps and their foothills) there are numerous reservoirs and barrages serving power generation; during power consumption peaks, the hydropower plants often regulate the water supply according to the need for power supply ("hydropeaking operation"). That means that flora and fauna are not only impacted by interference with river continuity but also by the surge effects of hydropeaking operation.

There are more than 100 barrages (often combined with hydropower plants and shipping) with barrage locks in the Neckar, Main, Lahn and Moselle tributaries.

Additionally, there are several important navigation channels in the Rhine river basin district connecting several river districts, e.g. the Main-Danube-Canal. The ecological potential of these artificial waters is also to be used. At the same time, attention is drawn to the possible immigration of neozoa (see Chapter 4).

Water intakes

Water abstraction from the waters of the basic water network or from transboundary groundwater bodies are of great importance for drinking water supplies for human consumption and for supplying industry with process water. However, as the Rhine catchment area on the whole is not considered to be an area of water scarcity, the abstraction of water for drinking water production from surface water bodies such as Lake Constance, Lake IJssel and Lek does not represent relevant stresses for the water quantity.

Abstraction of groundwater for public drinking water supply is an important factor in large areas of the Rhine catchment area. Additionally, groundwater is used in mining, industry, trade and for irrigation purposes in agriculture.

In spite of numerous quantitative stresses, the quantitative state of groundwater in the Rhine catchment area is basically not to be considered as being at risk. Stresses on the quantitative state of groundwater due to the lowering of the groundwater level in open-cast lignite mining along the Lower Rhine and in the mining area in Saarland are exceptions. On the Lower Rhine, this is a major transboundary problem between Germany and the Netherlands.

2.2 Chemical pollution from diffuse and point sources

Chemical substances play an important role in assessing the state of surface and groundwater bodies.

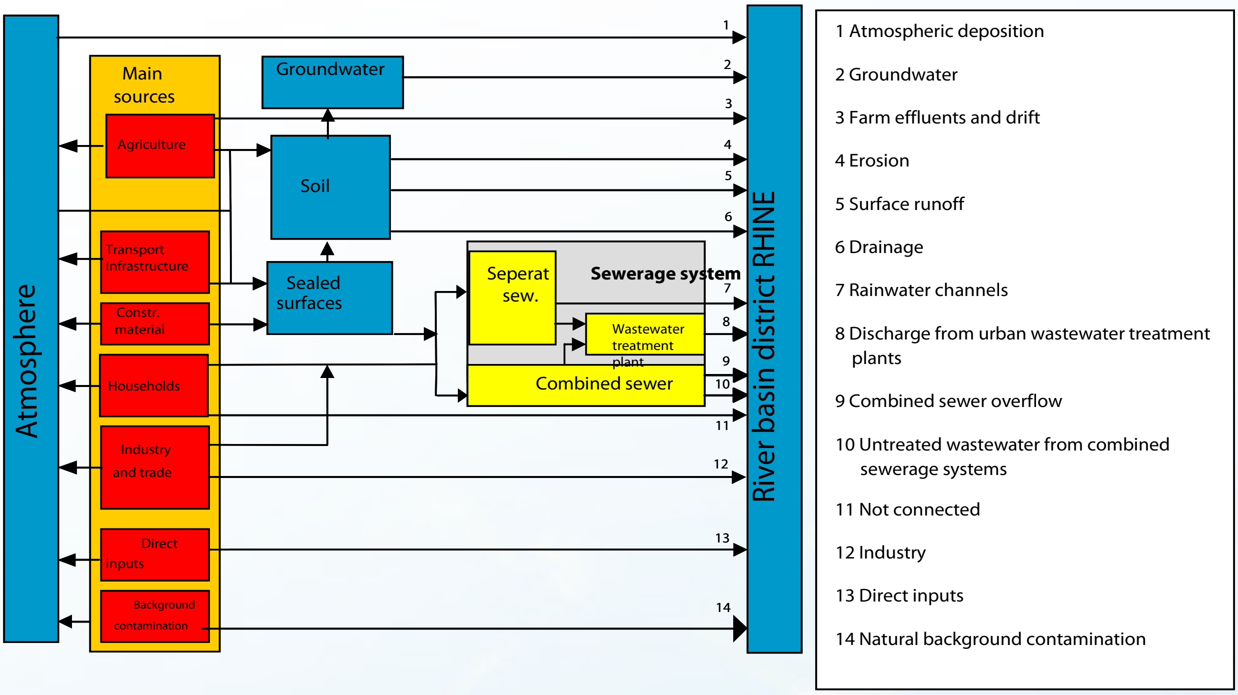


Figure 2: Emission pathways for determining the pollution of surface water bodies

2.2.1 General information

In the Rhine river basin district, wastewater from households and plants connected to the public sewage system and from so-called indirectly discharging industry and trade facilities is treated in approx. 3,200 large wastewater treatment plants. This means that the majority of the population (96%) is connected to a wastewater treatment plant.

The wastewater treatment plants have a total development capacity of at least 98 million population equivalents. Approximately 200 wastewater treatment plants with a total capacity of more than 100,000 population equivalents each represent about half of the total capacity in the Rhine catchment area.

In the EU, requirements for the discharge of urban wastewater are set down in the "Council directive concerning urban waste water treatment" (91/271/EEC).

The survey inventoried some 1,000 industrial direct dischargers in the international river basin district. To protect waters against pollution by specific, persistent, toxic, biologically accumulating substances, in the EU, the "**Council directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the community" (Directive 2006/11/EC, formerly 76/464/EEC) applies to direct dischargers.**

Additionally, for different industrial branches the "Directive concerning integrated pollution prevention and control" (Directive 96/61/EC) applies. The plants concerned are registered in the PRTR (Pollutant Release and Transfer Register).

During the survey, a large number of minor discharges were not taken into account of which the sum may, however, represent a significant contamination. The reason for this were the conclusions drawn from the IPPC directive concerning threshold values.

Existing agricultural uses, human settlements and traffic are diffuse input sources of nitrogen and phosphorous compounds, heavy metals and pesticides. When passing Directive 91/676/EEC, the objective of the EU was to reduce contamination due to nitrates of agricultural origin. By 2013, the Member States must take further measures for the implementation of this directive which are expected to lead to further improvements.

Modelling of the nitrogen and phosphorous contaminations shows that a substantial proportion of nutrient emissions can be attributed to the agricultural use of the soil. As far as total nitrogen is concerned, washout passing by groundwater and drainage is by far the most important source; in respect to total phosphorous, erosion and topsoil runoff as well as release from point sources must also be added to the aforementioned sources.

Due to the implementation of the pesticides directive (91/414/EEC) and of national regulations and recommendations concerning the appropriate use of pesticides, and due also to targeted implementation of measures on a co-operative basis in water conservation areas, improvements have now also been achieved with respect to discharges of pesticides. However, measurable contaminations with pesticides are still being recorded in the basic network of water bodies.

Pollution of surface waters with heavy metals is partly due to the diffuse inputs of fertiliser and farm manure and partly to mining activities and runoff from sealed surfaces, in particular traffic arteries.

2.2.2 Relevant inputs into surface waters

Nutrients

Excessive concentrations of nitrogen or phosphorous may be problematic for the biological water quality of inland waters. In addition to this, increased nitrogen loads pollute the marine environment, in particular that of the Wadden Sea. This phenomenon is generally known as eutrophication.

Since 1985, the nutrient concentrations of the main stream of the Rhine have been under intensive surveillance.

Phosphorous concentrations no longer pose a problem to be treated in terms of Overriding Part A, although, in some areas of operation, they are still too high. Regionally, (e.g. in some tributaries of the Rhine or in Lake IJssel) further reductions of phosphorous contents are planned; the corresponding reports can be consulted in the B parts of the management plan.

As far as eutrophication processes are concerned, **nitrogen** is not a limiting factor on a local scale but it does play an important part at Level A, as it is a source of coastal water pollution, in particular of the Wadden Sea.

The coastal water bodies off the Rhine estuary are particularly sensitive and, considering their species diversity, particularly deserving of protection.

Efforts going on since 1985 to reduce nitrogen in all the states of the Rhine river basin district have already resulted in an almost 25 % reduction of nitrogen concentrations in the coastal waters. In some years, the stripe of coastal waters – apart from the Wadden Sea – achieves the "good" status, but in other years it does not achieve this status. The "good" status has not been achieved in the "Wadden Sea" water body.

Between 1985 and 2000, nitrogen concentrations of the Rhine at the German-Dutch border at Bimmen/Lobith, i.e. above where the different Rhine arms branch off, have sunk from 6.5 mg total nitrogen to 3.3 mg (annual average value). Since 2000, values have remained comparatively stable at this level.

A comparison of the corresponding annual loads shows that the total nitrogen load discharged from the river basin district has been reduced by some 35 % during the past 20 years.

The states in the IRBD Rhine have consequently come considerably closer to their declared objective of reducing the nitrogen pollution by 50 % (according to the Conference on the Protection of the North Sea 1987 and the Rhine Action Programme as extended in 1989). However, further reductions are required to stabilise the "good status" in the coastal water bodies and to achieve this status in the Wadden Sea water body.

In this connection it must be pointed out that Dutch coastal waters are considerably – but not only – impacted by the runoff from the Rhine via the Nieuwe Waterweg and the Haringvliet on its way to the coast. There is a direct correlation between the river load in the delta and concentrations in the coastal area. Estimates indicate that runoff from the Rhine and Maas carries 77 % of the total nitrogen load of the coastal area within the 1-nautical mile coastal zone, about 13 % originate from the Channel, 6 % from the Belgian Scheldt, 2 % from France and 1 % each from Great Britain and Germany (Blauw et al. 2006).

Substances relevant for the Rhine

The latest surveys show that among the 15 substances relevant for the Rhine[5] which, in 2003, were defined as relevant for the river basin district, zinc continues to be problematic. It also appears that the substances of copper and polychlorinated biphenyls (PCB) which are detected at many monitoring stations are problematic.

The most important copper and zinc sources are from wastewater treatment plant emissions and soil releases. The sources are:

- Construction activities (corrosion of water pipes and gutters);
- Traffic (copper in brake linings and zinc in car tyres);
- Road equipment (zinc in crash barriers);
- Navigation (copper and zinc on vessel coatings);

[5] List of Rhine substances 2007, Koblenz, ICPR – Technical Report No. 161 – www.iksr.org - Technical Reports.

- Agriculture (copper baths in cattle breeding, copper and zinc in fodder and livestock droppings).

Formerly, PCBs were used as softening agents in plastic materials, in transformers and as a compound of hydraulic fluids. They are persistent and accumulate in the food chain as well as in sediments.

For detailed applications, sources, input pathways and measures please refer to Chapter 7.1.2.

Priority (hazardous) substances and substances figuring in WFD Annex IX

Only some of the 33 priority (hazardous) substances figuring in WFD Annex X and of the other eight substances figuring in WFD Annex IX are problematic in the IRBD Rhine: Phthalates (DEHP), phenols (4-para-nonylphenol, 4-tert-octylphenol), brominated diphenylethers (PBDE), diuron, isoproturon, hexachlorobenzene (HCB), polycyclic aromatic hydrocarbons (PAH) and tributyltin (TBT).

The monitoring methods to determine phthalates (DEHP, softening agent in plastics) do not yet deliver sufficiently testable results for correct appreciation of the problem.

According to the EU detergents directive 2003/53/EC, the phenols mentioned may no longer or almost not be processed in consumer goods.

Diuron and Isoproturon are pesticides liable to be discharged into waters via diffuse pathways. In some member states there is a ban on diuron.

HCB is a by-product generated during the synthesis of chlorinated hydrocarbons and was formerly used as a softening agent and fungicide.

PAHs are not directly bound to a local source of emission but are above all caused by diffuse emissions from combustion plants and motors, car tyres, navigation and the use of coal tar and creosote, primarily as a wood protection agent in hydraulic engineering. The atmosphere is the main pathway of emissions.

Until recently, persistent and biologically accumulating TBT-compounds were used as antifouling agents in ship-bottom paints.

For detailed applications, sources, input pathways and measures please refer to Chapter 7.1.2.

2.2.3 Relevant inputs into groundwater

The most important groundwater contamination is due in particular to **nitrate** and **pesticides** from diffuse agricultural sources. Furthermore, in urban areas, several substances of diffuse origin act as pollutants. Point sources may be of local importance, but are not relevant for the entire river basin.

2.3 Other impacts of human activities on the state of the waters

Further stresses, which may in particular play a part downstream of Lake Constance originate from different uses such as power generation, flood protection and navigation (lapping of waves, turbulences due to ships' propellers, distribution of invasive species or pollution due to accidents in navigation, illegal disposal of residual load, cleaning or bulk water), polluted sediments (risk of re-suspension and re-mobilisation due to floods or dredging), mining (hydraulic, thermal and/or chemical pollution due to mine water or percolating water), thermal pollution (cooling water discharge from power plants and industry) and historic contamination.

3 Register of protection areas

As in the survey, three maps represent the relevant areas of protection depending on water:

Map K 6: Water abstraction for human consumption;

Map K 7: Fauna-flora-habitat areas dependent on water – Natura 2000 (Directive 92/43/EEC);

Map K 8: Bird protection areas dependent on water – Natura 2000 (Directive 79/409/EEC).

The total surface area of Natura 2000 areas in the IRBD that are dependent on water amounts to approximately 19,000 km^2 (about 10 % of the total area of the Rhine RBD).

For Switzerland, these three maps indicate the corresponding areas based on national legislation.

Measures concerning transboundary protection areas have been coordinated. Concerning the other protection areas, please refer to the Part B reports.

4 Surveillance networks and results of surveillance programmes

Water bodies must be controlled regularly in order to check their condition. Furthermore, this surveillance shows whether improvement measures are proving successful in respect to the most important management questions.

As far as the basic water body network of the Rhine is concerned, the ICPR, ICPMS, the Commission on Lake Constance and the German Commission for Keeping the Rhine Clean have agreed upon and been implementing an international chemical monitoring programme since 1950 and a biological monitoring programme since 1990. Within the framework of the Chemical and Biological Monitoring Programme for the Rhine 2006/2007 adapted to the requirements of the WFD, chemical and physical parameters as well as biological quality components have been monitored.

In addition to the national reports on the surveillance programmes prescribed by the WFD, the internationally coordinated surveillance monitoring programme forming the basis of this management plan is presented in a common summary report on the coordination of the surveillance monitoring programmes (reports Part A)[6].

This report not only presents the coordination of the results of international monitoring of EU Member States but also coordination with non-EU Member States.

4.1 Surface water bodies

According to the requirements of the WFD, surface water bodies (rivers, lakes, transitional and coastal waters) must, as a matter of principle, achieve the "good" status by the end of 2015. If designated as artificial and heavily modified waters, they must achieve a "good ecological potential" and a "good chemical status".

The networks monitoring the ecological and chemical status were established on schedule by 22 December 2006.

Map K9 presents the location of the monitoring stations for the biological surveillance monitoring of the basic network of water bodies (catchment area > 2 500 km^2).

Map K 10 presents the location of the monitoring stations for the chemical and physico-chemical surveillance monitoring and the results of the surveillance monitoring assessment according to the WFD for these monitoring stations.

4.1.1 Ecological status / ecological potential Inland waters

The ecological status is determined by the biological status (biological quality components): (phytoplankton, phytobenthos, macrophythes, macrozoobenthos, fish) and general physical-chemical components as well as specific pollutants supporting the biological findings.

The species composition of the **phytoplankton** and increasing biomass indicate the nutrient contamination of a water body. **Phytobenthos** (above all benthic diatoms = Bacillariophyta) reacts to changes in water quality with characteristic shifts of species composition and species frequency, and indicates nutrient and salt pollution, saprobity and the state of acidity in the water body. Aquatic **macrophytes** (aquatic plants) may equally be used to assess the nutrient pollution of flowing waters; however, they also react distinctly to interferences with the flow regime (e.g. impoundment) and reflect the structural conditions of a water body (substrate diversity and dynamics, degree of cover establishment of the river bank and the river bottom).

Species composition, dominance relationships and the presence of invasive species (originating from other regions) of the **macrozoobenthos** (invertebrates living on the river bottom) serve as an indicator for water quality and structural conditions in the water body.

Species composition, abundance and age structure of **fish** indicate structures of large areas, river continuity, modifications of discharge (e.g. impoundment, water intake, diversion) and thermal pollution.

In the following, a surveillance assessment is conducted on Level A for the different biological quality components and for the further physical-chemical parameters as well as specific substances supporting the biological findings relevant for the assessment of the present ecological state (for monitoring stations see Annexes 1 and 2).

Chapter 5.1.1 includes statements on the "good ecological potential" (GEP) to be achieved by 2015 instead of the "good ecological status" where water bodies are classified as heavily modified or artificial.

All Member States, the federal states or the regions have determined the criteria for evaluation of the ecological status according to WFD Annex V for each type of water

6 Report on the coordination of the surveillance monitoring programmes according to Article 8 and Article 15, Par. 2 WFD in the international Rhine river basin district (IRBD) (report Part A), version from 12 March 2007 – www.iksr.org - WFD implementation

body/water and for each relevant quality component.

Even though the methods of assessment differ between the Member States or federal states/regions, a comparison within the ICPR itself reveals that the basis is comparable.

Detailed comparison of these assessment methods is performed within the framework of European inter-calibration. It was, therefore, decided not to conduct additional inter-calibration in the Rhine catchment area.

As the inter-calibration procedures have not been completely accomplished at European level, the results for the ecological status/ecological potential at the surveillance monitoring stations in the basic water body network of the IRBD Rhine based on national assessment procedures have been compiled in Annex 1.

In Germany, the ecological status for heavily modified water bodies was largely also assessed just as for natural waters. As an alternative, the result of this assessment for heavily modified water bodies was considered to be equivalent to the ecological potential.

In France, assessment criteria modified on the basis of expert judgement were used for the general assessment of heavily modified water bodies so that Annex 1 and Map K13.1 indicate the ecological potential.

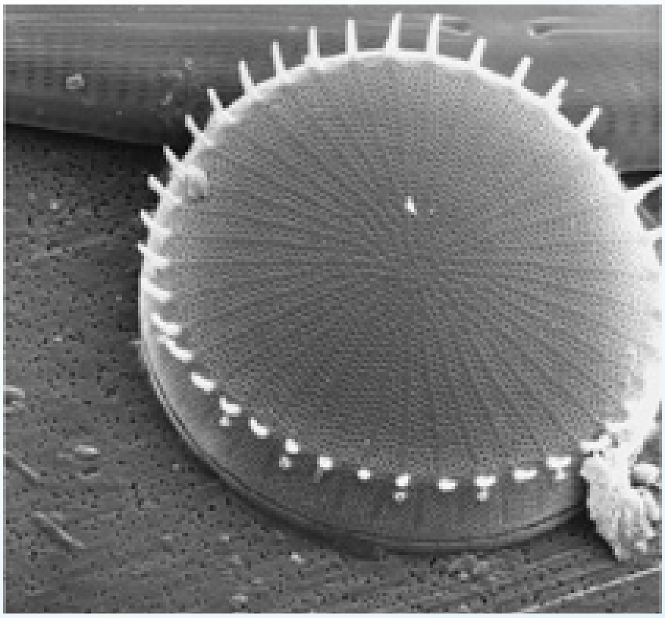
In the Netherlands, the ecological status and ecological potential were assessed for all quality components; for heavily modified water bodies, modified assessment criteria were used.

In Austria, ecological status was at first determined in the same way as for natural water bodies. The status assessment was also used for assessment of the ecological potential unless an expert judgment showed that no further improvement measures were possible and that "good ecological potential" had consequently already been achieved.

For the GEP, Luxemburg proceeded with an estimation of assessment criteria oriented towards measures.

Map K 13.1 presents the national assessment of the present ecological status or potential of surface water bodies in the IRBD Rhine (basic network of water bodies, catchment area > 2 500 km²).

Biological quality components



Phytoplankton: Centric diatom,scanning electron microscopic photo: R. Klee

As far as the **main stream of the Rhine** is concerned, a co-ordinated investigation of the biological quality components was carried out[7]. In the following, an assessment of the analysis results for each biological quality component of the individual sections of the Rhine is outlined.

Phytoplankton

Centric diatoms form by far the largest part of the plankton biomass in the main stream of the Rhine[8] – in some places more than 90 %; further important groups of algae are cryptomonads and chlorophyta. Other groups are only of temporary or local importance. Due to increased nutrient contamination, phytoplankton increases as it progresses downstream.

Compared to analysis in 2000, nutrient contents of the Rhine are regressing only slightly while phytoplankton production in the entire main stream of the Rhine largely remains the same.

[7] Biological Monitoring Programme for the Rhine River 2006/2007, Part A – Summary report on the quality components phytoplankton, macrophytes, phytobenthos, macrobenthos, fish, 2009, Koblenz – ICPR – Technical Report No. 168 – www.iksr.org – Technical Teports

[8] Biological Monitoring Programme for the Rhine river 2006/2007, Part II-A – Phytoplankton in the Rhine (2006-2007), 2009, Koblenz – ICPR – Technical Report No. 169 – www.iksr.org – Technical Reports

The status of the plankton in Lake Obersee and Lake Untersee of Lake Constance is assessed as good.

The High Rhine is assessed as "good" at Öhningen; in this section, it is still considerably dominated by the plankton of Lake Constance. Further downstream, at Reckingen, the ecological status of the river is "very good". Based on the phytoplankton, the lower Upper Rhine and the Middle Rhine are classified as "good", while the lower Lower Rhine at the German-Dutch border is of "moderate" quality. This downstream quality classification reflects the increasing nutrient concentration in the downstream regions. Additionally, as flow velocity decreases, longer water retention time in the Lower Rhine favours phytoplankton development which already increases distinctly in the Middle Rhine and reaches its peak at Kleve. In the Delta Rhine, the chlorophyll-a-concentrations in Lake IJssel are comparable to those in the Lower Rhine, while lower concentrations were monitored at Maassluis.

Since phytoplankton is not a relevant quality component in all running waters in the Rhine river states, it has not been determined everywhere. In some states, only chlorophyll was monitored.

Map K 13.1.1 represents the results of the present national assessment of phytoplankton in the IRBD Rhine (basic network of water bodies, catchment area > 2 500 km²) according to the WFD.

Macrophytes (aquatic plants)

All in all, 36 species of water plants[9] have been detected in the Rhine. Among them, 23 higher plant species (particularly often *Potamogeton pectinatus, Myriophyllum spicatum)*, 8 bryophytes and 5 stoneworts.

The total coverage of macrophytes and species numbers as well as the number of growth forms tend to decrease the further downstream they are in the Rhine. Higher aquatic species (seed plants and fern) are found in all sections of the river Rhine. Taxonomic groups sensitive to stronger eutrophication are limited to the upper reaches as far as the Middle Rhine (submersed pond weeds) or have only been detected in the High Rhine and Lake IJssel (stonewort).

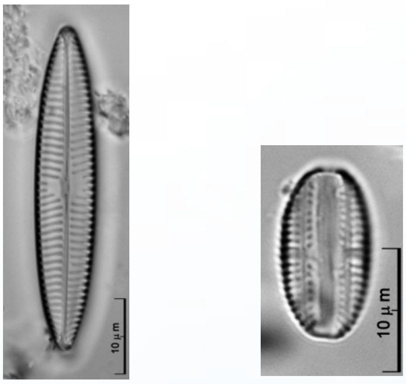
As far as the biological component of aquatic plants / phytobenthos is concerned, the status of Lake Constance is classified as "good".

In the High Rhine, all three monitoring stations are rich in species and forms of growth (10-14 species); in general, the status can be said to be good. In the Upper Rhine, the upper reaches as far as Rhine Kilometre 317 and the lowermost section around km 542 are equally rich in species and growth forms (four to ten species) and the state is "good". A small number of species with few forms of growth is found in the sections in between, in some sections there are no macrophytes; these are assessed to be 'poor' and 'bad'. In the Middle Rhine, only one monitoring station was examined which proved to be rich in both species and forms of growth. In the Lower Rhine, all four monitoring stations are poor in species and forms of growth with a maximum of three species and have low coverage. In the Delta Rhine, the "Oude Maas" monitoring station, with a high number of forms of growth, was assessed to be "good" on a national level, while the "Waal" location was assessed to be "poor" due to its low number of growth forms and low coverage. In spite of the occurrence of stonewort, indicating good water quality, Lake IJssel too was assessed to be "bad" because of low coverage and a few growth forms.

As far as macrophytes (aquatic plants) are concerned, the state of the Wadden Sea is judged to be "poor". This is above all due to the limited occurrence of seaweeds. Seaweeds and common salt marsh grass are **angiospermae.**

Water buttercup *Ranunculus fluitans* Photo: K. van de Weyer

[9] Biological Monitoring Programme for the Rhine river 2006/2007, part II-B – (partial compartment macrophytes) – Distribution of macrophytes in the Rhine, 2009, Koblenz – ICPR - Technical Report No. 170 – www.iksr.org Technical Reports



Diatoms *Amphora pediculus* and *Navicula tripunctata*. Photo: M. Werum

Phytobenthos

Of the 269 identified and fixed diatom species in the Rhine[10], *Amphora pediculus, Achnanthes minutissima, Navicula cryptotenella, Nitzschia dissipata* and *Cocconeis placentula* are most wide spread, have the greatest number of individuals and are often found in mass forms. Varying species composition and frequency indicate a distinctly degrading ecological state occurring in upstream to downstream direction. Trophic level and saprobity are low in the High Rhine and increase further downstream.

The ecological quality of analysed locations on the High Rhine is very good. While the sections of the Upper Rhine analysed as far as Mannheim are largely assessed to be "good", the middle and lower part of the Upper Rhine is largely characterised as "moderate". The quality of the Middle Rhine is moderate and tends towards the "good" status. The ecological quality of the Lower Rhine is "good" to "moderate". In the Delta Rhine, the "good" to "moderate" status prevails.

Map K 13.1.2 presents the results of the latest national assessment of the biological component macrophytes/ phytobenthos/angiospermae in the IRBD Rhine according to the WFD (basic network of water bodies, catchment area > 2 500 km^2).

Macrozoobenthos (invertebrates living on the river bed)[11]

All in all, more than 560 species or higher taxa were detected along the Rhine. Above all, molluscs (Mollusca), oligochaeta, crustaceans, insects, freshwater sponges and bryozoa make up the aspect. Abundance varies from one section of the Rhine to the next. Depending on the position in the transverse profile and seasonal aspects, there are between 0 to 10,000 individuals/m^2.

Mayfly *Epeorus alpicloa*. Photo: B. Eiseler

In the Anterior, Posterior and Alpine Rhine, rheophile insect species, i.e. the larvae of mayflies, stone flies and trichoptera typical for the system of the Alpine Rhine are dominant. Species diversity is high and species composition increases in downstream direction. None of the immigrated new species have so far been able to settle in the lower reaches of the Alpine Rhine. The status can be said to be good. Only the hydropeaking surge and negative waves due to hydropower plants in the Alpine Rhine impact the species number, species composition and abundance of individuals. Lake Constance and Lake IJssel being standing waters have their own fauna composition which is distinctly different from that of the rest of the Rhine.

The High Rhine is one of the most species-rich sections of the Rhine. Particularly in the freely flowing sections it is characterised by a macrozoobenthos community close to the natural state. Introduced fauna species are being found increasingly. The status can be said to be good.

Downstream of Basel, the natural longitudinal segmentation of the Rhine is impacted by anthropogenic interferences. In the navigable and trained Rhine (Upper, Middle, Lower and Delta Rhine), benthic fauna is largely uniform and is – apart from invasive species - dominated by common and frequent colonisers of bigger rivers and streams with little demands on their habitats (ubiquists). Elements of the original fauna are partly found in connected oxbow lakes and loops of the original course of the Rhine. The status of this section of the Rhine can be characterised as "moderate" to "poor". In some sections

[10] Biological Monitoring Programme for the Rhine river 2006/2007, part II-C – (partial compartment phytobenthos) – Benthic diatoms in the Rhine, 2009, Koblenz – ICPR Technical Report No. 171- www.iksr.org – Technical Reports.

[11] Biological Monitoring Programme for the Rhine river 2006/2007, part II-D – The Macrozoobenthos in the Rhine (20062007), 2009, Koblenz – ICPR – Technical Report No. 172 – www.iksr.org – Technical Reports

along the Lower Rhine it is even "bad". The status of the Rhine arms in the Delta has also been classified as "moderate" to "poor".

The macrozoobenthos in the Rhine is closely connected to the pollution of the river water. At the beginning of the 20th century, some 165 species, among them 100 insect species, were detected. With increasing wastewater pollution of the Rhine and its sinking oxygen content, this number diminished drastically, in particular between the middle of the 1950s and the beginning of the 1970s. Thus, in 1971, only five insect species were detected. From the mid 1970s on, improved oxygen content resulting from the construction of industrial and municipal wastewater treatment plants allowed many characteristic river species which had been said to be extinct or heavily reduced to return. However, many species are still absent. In some cases, the areas to which they have retired are so far away that a natural return seems unlikely.

Invasive species

Invasive species are ecdemic animal species from other regions. Among others, numerous species from the Black Sea region which have immigrated through the Main-Danube-Canal since 1992 are found in the Rhine. Often, these invasive species settle in the main stream and in tributaries in considerable biomasses and, attached to vessels, they even spread upstream - often at the expense of the indigenous fauna. In some part, anthropogenic influences such as increased water temperature, hydraulic engineering measures and substances present in the water favour their development. The dominance and constancy (= relative frequency or distribution of a species compared to other species and related to a specific habitat) of invasive species partly leads to considerable restructuring of the biocoenosis. Original Rhine species (e.g. *Hydropsyche* sp.; see Fig. 3) or old invasive species (e.g. *Gammarus tigrinus)* have been crowded out and replaced.

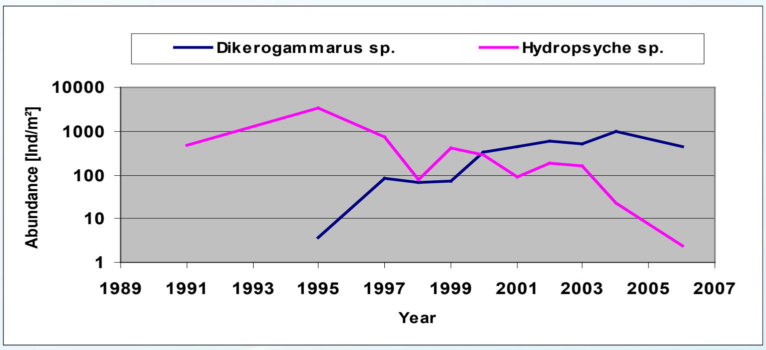


Fig. 3: Abundance of the predatory *Dikerogammarus sp*. introduced from the Black Sea and of the indigenous caddis worm *Hydropsyche sp*. in the Middle Rhine.

During the last 15 years, the total number of species has been relatively constant in the navigable part of the Rhine. However, the average number of species per monitoring station has been regressing since 1995 (see also Fig. 4 for the Lower Rhine). Presumably, the invasive species as a factor of biological stress are partly responsible. In addition, the absence of suitable habitats in the river itself prevents the return and spreading of a benthos fauna typical of the Rhine. If at all, many of the **insect species** detected in the Rhine around 1900, such as the typical Rhine ephemera *Oligoneuriella rhenana* are only detected in the Rhine tributaries, as they do not find any suitable habitats in the main stream.

Asian mussel *Corbicula fluminea*. Photo: K. Grabow

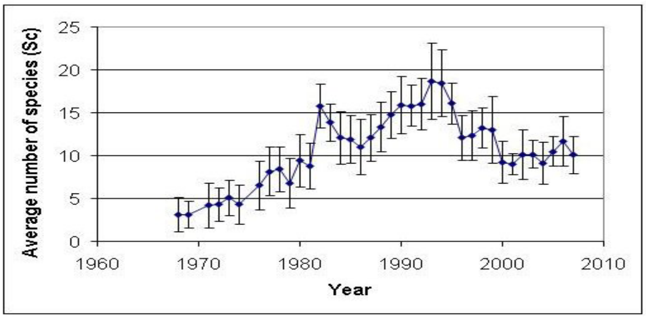


Fig. 4: Average number of species of the macrozoobenthos in the period from 1968 – 2006 along the Lower Rhine[12]

Figure 4 shows the average number of species of the macrozoobenthos in the 1968-2000 period on the Lower Rhine. Due to rising oxygen content and decreasing pollution, macrozoobenthos species numbers increased until the beginning of the 90s; later, invasive species increasingly spread at the expense of species typical for the Rhine.

As far as the macrozoobenthos is concerned, the situation in the coastal waters indicates a "moderate" status, while the status in the Wadden Sea is characterised as "good".

Map K 13.1.3 shows the latest national assessment of the benthic invertebrate fauna (macrozoobenthos) in the IRBD Rhine according to WFD (basic network of water bodies, catchment area > 2 500 km²).

Fish[13]

The species composition in the Rhine is almost complete. Together with the three existing trout varieties (lake trout, sea trout, brook trout) and non-indigenous species, 67 fish species were detected. Thus, all historically identified species except for the Atlantic sturgeon have returned. A new, non-indigenous fish species, the round goby, has arrived. Another newcomer in the list of species is the European sea bass which from time to time migrates from the North Sea into river estuaries. Comparatively undemanding species (roach, bream, chub, perch, bleak, ruffe) are dominant. The stock of predatory asp has distinctly increased and spread to further areas.

Most fish species are found in the Upper Rhine and the Delta Rhine including Lake IJssel, where some marine species as well as brackish water species are detected. The least number of species is in found in the Alpine Rhine. The reasons for this are partly natural. However, neither the course of the river nor developments since the middle of the 1990s give evidence of a distinct development tendency of the number of species.

Compared to the freely flowing reaches, the many impounded reaches of the Rhine and most tributaries present considerable deficits for the habitat of the fish fauna. In the Alpine Rhine, river training, the modified flow regime due to the use of hydropower for power generation (hydropeaking) and the cutting off of Alpine Rhine tributaries resulting from the lowered river bottom in the main river are limiting factors for the fish fauna. Habitats for rheophile species are absent in the impounded Alpine Rhine, the High Rhine and the southern Upper Rhine. On the whole, frequency and biomass are comparably low. In the High Rhine, the reduced stock of grayling and nase are representative of the insufficient quality of habitats for rheophile species.

For species spawning on gravel and in herbaceous areas or which spend parts of their life cycle (juvenile stage) in oxbow lakes and stillwaters rich in plants, habitats (laterally connected alluvial waters and side channels, flooded areas, structures in the mainstream) are still lacking. As a consequence, the number of individuals, in particular of rudd, pike, tench, Crucian carp, weather fish and bitterling, which depends on big mussels, is low.

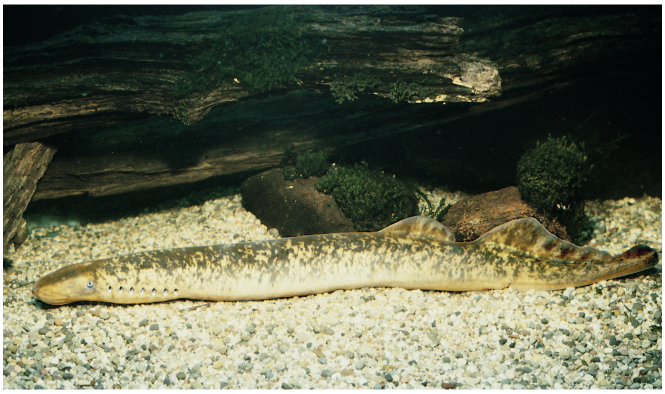
In the Iffezheim - Gambsheim river section, the consequence of the restoration of the up- and downstream river patency is that formerly absent anadromous migratory fish (salmon, sea trout, sea and river lamprey, occasionally allice shad) have returned.

Today, Rhine water quality is not a limiting factor for the fish fauna. However, localised higher water temperatures, fine sediment discharges and inputs may put a stress on fish.

Due to the prevailing species scarcity, the state of the fish fauna in the Alpine Rhine is classified as "bad". The status of the fish fauna in Lake Constance has not been assessed. From the High Rhine to the outlet into the sea it is assessed to be "good" to "poor". In the Rhine delta, in particular in its eastern part, a "poor status" is predominant. Further to the west, the status is generally "moderate". In Lake Ijssel, the status is "good".

12 Biological Monitoring Programme for the Rhine river 2006/2007, part II-D – The Macrozoobenthos in the Rhine (20062007), 2009, Koblenz – ICPR – Technical Report No. 172 – www.iksr.org – Technical Reports

13 Biological Monitoring Programme for the Rhine river 2006/2007, part II-E – Quality component fish – Monitoring the fish fauna of the Rhine (state 2007), 2009, Koblenz – ICPR – Technical Report No. 173 – www.iksr.org – Technical Reports



Sea lamprey. Photo: U. Weibel

Migratory fish

Water systems with restored river continuity nearly all show a positive trend in the number of salmonids returning from the sea and in the number of naturally reproducing salmon. Today, the main reproduction areas are to be found in the river systems of Wupper-Dhünn, Sieg, Ahr (presumably), Saynbach and in the Bruche (Ill river system). In 2007/2008, considerable reproduction was for the first time documented for the R. Wisper (Middle Rhine). For certain river systems on the Lower and Middle Rhine (R. Sieg, Saynbach, ev. Ahr and Wisper) it may be assumed that between 5 and 20 % of the adults which returned during 2007 and 2008 are offspring of natural reproduction of wild salmon.

Presumably, sea trout reproduce in the same habitats as salmon and profit from measures aimed at improving access to and quality of these habitats. Redds of sea lamprey have, among others, been found in the R. Ill system, in the R. Wieslauter, Murg, Wisper, Saynbach, Nette and in the river systems of Sieg and Wupper-Dhünn. It is highly probable that, on the High Rhine, the species also reproduces in the main stream (as far as the Strasbourg barrage). There is no proof of a reproduction or of juvenile allice shad; due to the low number of individuals, the species does not appear to be settling.

The eel stocks have diminished considerably. Since the beginning of the 1980s, the influx of glass eels to the European coasts has sunk to a few percent of the longstanding mean value. There are many reasons for this considerable decrease: loss of habitats due to river training, reduced upstream migration due to transverse constructions, loss of downstream migrating silver eel in hydropower plants, and parasites (*Anguillicola crassus*), fishing of glass eel, yellow eel, silver eel, etc. Additionally, modifications of the marine habitat which are presumably caused by climate change might have a negative impact on the population of the European eel.

Upstream of the natural barrier of the Rhine Falls at Schaffhausen, the lake trout is the only middle to long distance migratory fish. A programme of measures will continue to assign a considerable role to the lake trout for achieving the water protection objectives in the Lake Constance / Alpine Rhine area of operation. The successful implementation of the measures of the programme for the lake trout proves that such a programme leads to success.

Map K 13.1.4 presents the current national assessment of the fish fauna in the IRBD Rhine (basic network of water bodies, catchment area > 2 500 km^2) according to the WFD.

Coastal and transitional waters

For coastal and transitional waters, the phytoplankton (in particular the components chlorophyll-a and *phaeocystis*) are the most important quality components which indicate eutrophication phenomena at an early stage and may thus be considered as an early warning system. The evaluation for the period 2000-2008 carried out according to the Dutch system of assessment is summarised in Table 2.

Table 2: Evaluation of the biological quality component "phytoplankton" based on the Dutch assessment system[14] The assessment (very good: blue, good: green, moderate: yellow, poor: orange) is expressed as ecological quality quotient: The border between poor/moderate is around 0.4; between moderate/good around 0.6 and between good/very good around 0.8.

Monitoring station	Water body	2000	2001	2002	2003	2004	2005	2006	2007	2008
Noordwijk 2	**Dutch coast**	0.76	0.54	0.53	0.61	0.84	0.62	0.86	0.55	0.56
Boomkensdiep	**Wadden Sea coast**	0.71	0.64	0.75	0.63	0.49	0.39	0.80	0.60	0.52
Dantziggat (+Doovebalg West 2007+ 2008)	**Wadden Sea**	0.48	0.41	0.48	0.47	0.47	0.54	0.51	0.51	0.24

14 The assessment of the situation along the coast is limited to the 1-sea mile coastal zone and is based on European assessment criteria from the inter-calibration process. This leads to statements diverging from those according to OSPAR. OSPAR considers the state of the entire North Sea including the estuary and the coastal zone. Within OSPAR, programmes of measures are under implementation aimed at nitrogen reduction. The main statements made according to WFD and OSPAR are comparable.

The status along the coast of the Wadden Sea and the Dutch coast varies considerably: during some years, the status was good to very good, during others moderate to bad. A further stabilisation of the "good status" is required. During 2000 to 2007, the status of the Wadden Sea was continuously "moderate", in 2008 however, it was classified to be poor. This biological finding correlates to the working standard applied in the Netherlands: 0.46 mg DIN/l (DIN = dissolved inorganic nitrogen). In the coastal waters and in the Wadden Sea, this value is still exceeded by 10-40 %.

If the Dutch working standard is transposed to the situation in the Rhine, the average concentration in the Rhine at Bimmen/Lobith is 2.5 mg total N/l (total N = total nitrogen) during the summer, corresponding to an annual average concentration of 2.8 mg total N/l. The average value of 2.8 mg total N/l is considered to be the working unit for nitrogen in the IRBD Rhine.

Physical-chemical components and substances relevant for the Rhine supporting the assessment of the ecological status

The general **physical-chemical components** such as nutrients nitrogen and phosphorous and the substances defined as relevant for the Rhine river basin district support the assessment of the **ecological status** and are part of this assessment. Annex V of the WFD requires an assessment of these quality components together with the biological quality components. Annex 2 lists the results of the assessment at the 56 monitoring stations of the surveillance monitoring network for the IRBD Rhine. *The criteria for the choice of these monitoring stations were a) monitoring station in the main stream, b) outlets of big Rhine tributaries and c) survey over the ramified delta area. For the 56 monitoring stations, the Map K 10 includes the assessment of the chemical status (blue/red, see Chapter 4.1.2) and that of the substances relevant for the Rhine supporting the assessment of the ecological status. If one or more substances relevant for the Rhine are in excess of the environmental quality standards (EQS) at the monitoring station, the monitoring station is marked with a black diamond.*

Furthermore, the following principles apply:

a) For the 15 substances relevant for the Rhine: arsenic, chromium, zinc, copper, bentazone, 4-chloroaniline, chlorotolurone, dichlorvos, dichlorprop, dimethoat, mecoprop, MCPA, dibutyl-tin compounds, PCB and ammonium N, the monitoring results have been compared with national standards. The corresponding values from the national standards were classified according to "below EQS" or "above EQS". In the Netherlands, the environmental quality standards so far determined by the ICPR which are legally not binding[15] (EQS Rhine – see Annex 3) have largely been transposed into national law.

b) The assessment of the chemical-physical parameters of Annex 2 was equally based on national assessment standards or recommendations.

Among the substances listed under a), **dissolved zinc** is in excess of the EQS in the Rhine near Maassluis and in the tributary R. Vechte. At eight German monitoring stations in tributaries, the values are above the national EQS for zinc bound to suspended matter. At four monitoring stations in German tributaries, the values are above the assessment standard for **copper** bound to suspended matter.

For the substances **bentazone** and **dichlorprop,** values above the national EQS have been determined at two monitoring stations respectively (R. Main and R. Wiltz (LU), tributary to the Sauer, and Weschnitz and Schwarzbach). For **dichlorvos** it could not be assessed with certainty that values remain below the reference value (0.0006 µg/l for D and NL), as the detection limit of the method of analysis used was above this value at almost all monitored locations.

For the group of the **PCBs,** there are national legal standards for suspended matter. According to these standards, there are exceeding concentrations in the Dutch section of the Rhine and in six German tributaries of the Rhine, in particular with respect to higher chlorinated PCB. As regards **ammonium**, values above the EQS have been detected at two monitoring locations in tributaries (R. Alzette, tributary to R. Sauer und mouth of R. Emscher).

For the chemico-physical parameters under b) (see Annex 2) the national criteria of assessment under b) (see Annex 2) or the recommendations for **total phosphorous** are exceeded on the northern Upper Rhine, the Middle and Lower Rhine, Lake Ijssel as well as those for **ortho-phosphate-phosphorous** in almost all examined tributaries of the Rhine.

Total nitrogen values are in excess in the Dutch section of the Rhine and in R. Vechte. At thirteen monitoring stations located in the tributaries, values are below the guidance values for dissolved oxygen, at five monitoring stations in tributaries and in Lake Ijssel values for pH are outside the recommended guidance values. The parameter for **chloride** is higher than the EQS at the German monitoring stations on the R. Moselle at Palzem and Fankel as well as in the mouth of the R. Emscher.

15 Derivation of environmental quality standards for substances relevant for the Rhine – July 2009 – Koblenz – ICPR – Technical Report No. 164 – www.iksr.org – Technical Reports

In Lake Constance, the EQS are observed at the surveillance monitoring station.

In salt water, control of the ecological state is limited to the coastal waters, i.e. to the 1-mile-zone.

Total assessment of the ecological status / potential

Annex 1 lists the results at the monitoring stations of the "biology" surveillance monitoring for the IRBD Rhine, that is, the assessment of the individual quality components and the summary assessment for the substances relevant for the Rhine and the chemical-physical components (see individual results for the 56 surveillance monitoring stations for chemistry in Annex 2) supporting the ecological assessment.

Annex 1 shows that the results at the monitoring stations in Lake Constance and at one monitoring station on the High Rhine are generally assessed to be good. At most monitoring stations in the main stream and in the tributaries to the Rhine the situation is classified as poor or bad. Predominantly, the component "macrozoobenthos", at some monitoring stations the component "fish", is responsible for the poor and bad ecological assessment. **The ecological assessment for the monitoring stations in the impounded tributaries Moselle/Saar, Main and Neckar varies between moderate and bad.**

The most recent national assessment of the ecological status / the ecological potential for all water bodies in the IRBD Rhine according to the WFD (basic network of water bodies, catchment area > 2,500 km²) is shown in Map K 13.1. When one or more EQS (parameters relevant for the Rhine, physical-chemical parameters) are exceeded, this is indicated by a black dot in the middle of the water body.

The total ecological assessment of the standing water body of Lake Constance is good.

The total ecological assessment of the standing water body of Lake IJssel is moderate.

The total ecological evaluation of the coastal waters is moderate, that of the Wadden Sea is poor.

Further information is available in the corresponding parts of the B-reports.

4.1.2 Chemical status

The chemical status of a surface water body is assessed with the help of the **chemical quality components**. **To this end, the WFD lists priority and priority hazardous** – in other words, particularly problematic **substances in its Annex X WFD, the other substances are listed in Annex IX WFD.** With respect to these substances, compliance with the environmental objectives according to Directive 2008/105/EC on environmental quality standards for priority substances – see Annex 4 – must be controlled. This is not yet possible for the chloroalkane group of substances, as no procedure of analysis and assessment has been agreed upon yet.

Annex 5 to this report lists the results at 56 monitoring stations of the surveillance monitoring network in the IRBD Rhine, Part A for chemical quality components according to Annex I of Directive 2008/105/EC. The result is summarised in the colours of the monitoring stations represented in Map K10. *If all substances analysed respect (are below) the EQS, the monitoring station is represented in blue, if one or more substances are above the EQS, the monitoring station is represented in red.*

On the basis of the surveillance assessment, substances belonging to the group of the **polycyclic aromatic hydrocarbons (PAH)** present values above the EQS in almost all sections of the Rhine and most of the tributaries. This mostly concerns the substances indeno (1,2,3-cd)pyrene and benzo(ghi)perylene, for which the EQS-value of 0.002 µg/l (as sum of both substances) is partly exceeded many times over. For each of these two substances the EQS was exceeded at one monitoring station in the Wadden Sea and on the Dutch coast. In many cases the results for the substances were measured in the suspended matter phase monitored in some states.

Apart from the PAH, EQS are exceeded at the following monitoring stations:

- For **tributyltin** in the area around the mouth of the tributaries Wupper, Erft, Emscher and Lippe (results of analysis in the suspended matter phase) and at the estuary of the Rhine near Maassluis and the Dutch monitoring stations in the Wadden Sea and the North Sea.

- For the group of the **brominated diphenyl ethers**; this also concerns the mouth of the R. Lippe and Emscher and Lake Ijssel.
- For **DEHP** at the Wiltz, tributary to R. Sauer (Luxemburg) and the outlet of R. Emscher.
- For dissolved **cadmium** at the outlet of the R. Lahn and Emscher.
- For **hexachlorobutadien** at the mouth of R. Lippe.
- For **pentachlorobenzene** at the mouth of R. Alzette into R. Sauer (Luxemburg).
- For **diuron** at the mouth of R. Wiltz.

All EQS are respected at two monitoring stations in the Rhine (High Rhine and Alpine Rhine) and at seven monitoring stations in the tributaries.

No values above the EQS were recorded at the surveillance monitoring station of Lake Constance.

In salt water, surveillance is carried out to assess the chemical state in the territorial waters including the 12-miles-zone. There, values for tributyltin are above the EQS.

The assessment of the chemical status of all water bodies in the IRBD Rhine according to the WFD (basic network of water bodies, catchment area > 2,500 km^2) is shown in Map K 13.2.

4.2 Groundwater

According to WFD guidance, groundwater (its chemical and quantitative status) must basically achieve a "good quantitative status" and a "good chemical status" by the end of 2015.

Groundwater has at least been controlled according to WFD since 2007, normally in the main aquifer on the level of delimited groundwater bodies or groups of groundwater bodies.

Basically, the chemical status of each groundwater body is subject to surveillance monitoring. Operational monitoring is only carried out in those groundwater bodies which the survey and/or the surveillance monitoring have classified as "achievement unlikely" or "achievement not clear". Assessing the pollutant trends and demonstrating trend reversal serves the assessment of the state of groundwater bodies with "achievement unlikely".

The monitoring networks for the surveillance of the quantitative (Map K 11) and chemical status of groundwater bodies (Map K 12) were established on schedule by 22 December 2006.

The assessment of groundwater can be carried out with the help of different methods which are summarised in the following. Guidance on the assessment of the chemical groundwater status is given above all in the groundwater daughter directive (2006/118/EC).

Quantitative status

According to WFD Annex V, the quantitative status of groundwater is good if there is no excessive use of groundwater and no significant interference with terrestrial ecosystems or connected surface water bodies. Furthermore, there should be no signs of intrusion of salt and other substances.

The yardstick for the quantitative status of groundwater is primarily the groundwater level or the pressure height of groundwater in cases of non-confined aquifers. Furthermore, discharges from springs are considered. In general, groundwater levels are monitored monthly. Groundwater levels are analysed e.g. by calculating trends with the help of long time well hydrographs.

If the groundwater table cannot be monitored, e.g. in solid rocks or if the number of suitable monitoring stations is insufficient, water balances will be established in order to determine the groundwater status. Generally, the methods of assessment used in the survey have not been modified.

Another criterion used for the assessment of the quantitative groundwater status is the impairment of terrestrial ecosystems depending on groundwater. For the survey or the surveillance, those terrestrial ecosystems dependent on groundwater where chosen for which a risk of impairment exists. If required, the groundwater table will be monitored in these areas.

Chemical status

According to the WFD and the groundwater daughter directive (Directive 2006/118/EC), groundwater chemical status is good when EU quality standards are adhered to (nitrate[16] 50 mg/l, pesticides 0.5 µg/l and individual pesticides 0.1µg/l) and there is no impairment of terrestrial ecosystems dependent on groundwater or connected surface waters. Furthermore, there shall be no signs of intrusion of salt and other substances of anthropogenic origin. According to the groundwater daughter directive, a groundwater body has a good chemical status, if - besides other criteria - the above-mentioned quality standards and national threshold values (see Annex 6) are respected at all monitoring stations.

If the quality standard or threshold value is exceeded at one or more monitoring stations, the groundwater status is good if the excess values are not significant for the groundwater body. The daughter directive does not give precise information concerning the assessment of significance so that the states were obliged to make technically reasonable agreements (e.g.: Significant means that the polluted surface exceeds a certain percentage of the surface of the groundwater body or of the surface of land use concerned). Furthermore, in this case the requirements of WFD Article 7 (protection of drinking water) must be respected to achieve a "good" status, no terrestrial ecosystems or surface water bodies dependent on water may be impaired and the usability of the groundwater body must not be significantly impaired.

Another significant element of operational surveillance is the determination of trends in cases of significantly

[16] According to nitrates directive + groundwater daughter directive

increasing pollutant trends. The starting point for trend reversal is defined as 75 % of the quality standard or of the threshold value. The calculation of the trend is not decisive for the classification as good or bad status. However, when the starting point for trend reversal is achieved, measures must be taken.

With a view to assessing the effects of relevant point sources, additional trends must be determined for certain pollutants and it must be ensured that pollutant plumes will not spread and deteriorate the chemical status.

4.2.1 Quantitative groundwater status

On the whole, the quantitative groundwater status in the Rhine catchment can be characterised as good.

The result in Map 13.3 shows that the groundwater bodies classified as bad are largely the same as those which, according to the survey, were classified as "unlikely to achieve the objective".

There are individual cases of extensive falls in groundwater level, e.g. due to coal mining and which are of regional importance. In this connection, the coal-mining area in the Saarland and the open-cast lignite mines on the left banks of the Lower Rhine are to be mentioned.

4.2.2 Chemical groundwater status

The results of the assessment of the chemical groundwater status presented in Maps K 13.4.1 and K 13.4.2 show that compared to the survey, less groundwater bodies are classified as being in a bad chemical status than those originally classified as "unlikely to achieve the objective". This is, above all, due to modified assessment criteria. In the survey, some EU Member States or federal states/ regions were already classified as "achievement of objective unlikely" if the status was 50 % or 75% of the quality standard. Also, the newly established monitoring networks allow a more representative statement on the groundwater status.

Map K 13.4.1 of the overall assessment of the chemical status shows that numerous groundwater bodies in the entire Rhine catchment were classified in the category of "bad chemical status". However, the chemical status of most groundwater bodies is good.

In Map K 13.4.1 of the overall assessment, groundwater bodies with significantly increasing pollutant trend are highlighted by a black dot. Due to insufficient long-term data sets, some states or federal states have not indicated any trend while, in individual cases, even a trend reversal is being reported.

In the Rhine catchment area, the nitrate pollution of the upper main aquifer continues to be the main problem. Therefore, a separate map has been established for the nitrate contamination of groundwater (Map K 13.4.2). It is only slightly different from the map showing the overall pollution, as, due to the nitrate pollution, most of the groundwater bodies have a bad chemical status. The causes are, above all, fertilization in agriculture and intensive livestock farming.

Furthermore, inputs of pesticides (and their degradation products / metabolic products) lead to a bad chemical status of certain groundwater bodies. Also, due to these substances, national threshold values (Annex 6) classify the chemical status of certain groundwater bodies as bad.

5 Environmental objectives and adjustments[17]

Table 3: Environmental targets for water bodies according to WFD

Category: Water body		**Overriding objective**			
			Good status / good potential 2015		
			Qualitative objective		**Quantitative objective**
Natural	**Groundwater**	No deterioration		Good chemical status	Good quantitative status
	Surface waters	No deterioration	Good ecological status	Good chemical status	
Heavily modified	**Surface waters**	No deterioration	Good ecological potential	Good chemical status	
Artificial	**Surface waters**	No deterioration	Good ecological potential	Good chemical status	

Basically, WFD Article 4 determines the environmental objectives to be achieved for each class of water body (natural water bodies, NWB; artificial water bodies, AWB; heavily modified water bodies, HMWB). These objectives are summarised in Table 3.

If it proves to be impossible to achieve the objectives by 2015, deadlines may be extended to 2021 or 2027 upon submitting relevant reasons.

5.1 Environmental objectives for surface waters

In the IRBD Rhine, surface water bodies are partly natural, partly artificial or heavily modified (see Map K 5, basic network of water bodies, catchment area > 2 500 km^2).

During the past centuries, the training of the Rhine for purposes of navigation, flood protection and hydropower generation have resulted in a classification of almost 90 % of the network of water bodies of the IRBD Rhine as "heavily modified". Only the upper reaches or short sections of tributaries as well as coastal waters and the Wadden Sea are still classified as natural waters (about 10 %).

Information on the classification of the main stream of the Rhine as "heavily modified", "artificial" or "natural" is included in Figure 5 and Annex 7. Figure 5 indicates the percentages of water bodies in the main stream of the Rhine classified as "natural" (12 %), "heavily modified" (76 %) and "artificial" (12 %) depending on the number of water bodies.

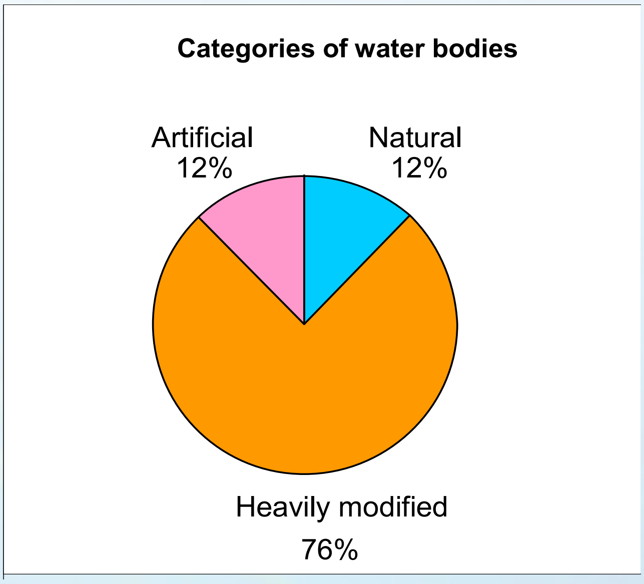


Fig. 5: Categories of the water bodies of the **main stream of the Rhine** based on the number of water bodies

5.1.1 Ecological status / ecological potential

Almost all water bodies of the basic network of water bodies dealt with on Level A are heavily modified, in some cases artificial. This means that the "good ecological potential" must be defined for each water body. As it proves to be very difficult to derive the "good ecological potential" from biological parameters, a pragmatic approach based on measures was discussed at EU level ith a view to deriving the good ecological potential. According to this so-called Prague approach, the good ecological potential is considered as achieved once all technically and economically feasible measures of improvement have been implemented which have a

[17] In Germany, "adjustments" are identical with "Exemptions and extensions of deadlines".

substantially positive effect on biological parameters without having to expect significant restrictions of the specific uses.

For heavily modified water bodies, many EU states or federal states/regions in the IRBD Rhine have established the good ecological potential exclusively with the help of the "Prague approach" (see Annex 8). In addition to the "Prague approach" which concentrates on measures, an approach based on assessment was applied.

During a CIS workshop on "Heavily modified water bodies" (Brussels, 12/13 march 2009), the equivalence of the "Prague approach[18]" and the "reference based approach" was demonstrated.

Definition of the good ecological potential (GEP)

The EU states or federal states/regions jointly stated that using the "Prague approach" to translate measures into biological parameters is extremely difficult. To this end, the combined effect of all measures on the biological parameters must be assessed, excluding interfering physical and chemical factors at the same time.

An additional complicating factor is that according to the monitoring systematics of the WFD, the assessment based on the first monitoring results and on the interpretation of monitoring data is only grounded on one single survey. Therefore, for some parameters, no deeper insight into today's situation on the basis of the new assessment criteria is possible as yet.

Furthermore, in particular experience on the ecological effects of measures with respect to aspects of quality and quantity and, as far as a surface water body is concerned, expansion in room and time is not available. In addition, in many cases the extent of hydro-morphological modifications and the restriction of hydro-morphological processes can only be roughly estimated. Also, discharge and temperature normally vary from one year to the next. This factor must particularly be taken into account when interpreting short time surveys.

For this complex transposition, the EU states or federal states/regions have chosen slightly differing, temporary approaches.

The majority of the German federal states temporarily still applies the biological parameters (measures) for the "good ecological status" of natural water bodies. In France, a partial system is applied which only permits an assessment of the ecological status, but not that of the ecological potential. A more complete assessment system (measure) is under development. Austria applies a "mixed system", verbally describing the biological objective of the good ecological potential. The Netherlands and Luxemburg have temporarily estimated the assessment criteria for the GEP. Based on surveillance and further investigations into effects of measures, the assessment criteria for the good ecological potential for each heavily modified water body will be further developed for the next management plan (2015-2021).

Measures taken by the EU states "according to the Prague approach", and aimed at improving the ecological status, are listed in Chapter 7.1.

The above-listed restrictions due to the uses of flood protection, navigation, water regulation and hydropower lead to less favourable living conditions thereby leading to lower values for the biological quality components than for the ecological status:

- Lower values are achieved for the quality component macrophytes/phytobenthos (aquatic plants) if the water body only has few shallow water areas, as shallow waters are preferably colonised by macrophytes. Additionally, lapping waves and current caused by navigation restrain the development of aquatic plants;
- The quality component of benthic invertebrates (macrozoobenthos) is impacted by a lack of variation and dynamics of river bed substrate (stones, gravel and sand), a higher substrate part with little organic material and a strong current and permanently shifting substrate in the navigation channel (partly caused by river training and navigation). In addition, benthic colonization in the navigation lane is clearly dominated by invasive species. The reasons may in particular be: spreading due to ships (among others attached to the hulks) and immigration through the canals interconnecting different catchments (e.g. Main-Danube-Canal);
- The quality component of "fish" is mainly affected by the presence and availability of the two quality components "food sources" and "habitats" (in particular spawning grounds). This situation is further aggravated by (heavily) restricted access to spawning waters and diversified habitats and the still restricted continuity of the water body (in particular along the coast, towards tributaries, between the high-water channel and low-water channel).

Even if the "good ecological status" for natural water bodies or the "good ecological potential" for heavily

[18] See Annex II – Alternative methodology for defining Good Ecological Potential (GEP) for Heavily Modified Water Bodies (HMWB) and Artificial Water Bodies (AWB), CIS Document: "TECHNICAL REPORT – Good practice in managing the ecological impacts of hydropower schemes; flood protection works; and works designed to facilitate navigation under the Water Framework Directive"

modified waters is possibly not achieved for all water bodies, the aquatic ecosystem of the basic network of waters of the Rhine will be considerably and sustainably improved by the implementation of measures. In this connection, the improvement of river continuity is one of the basic requirements for heavily modified water bodies.

For the main stream of the Rhine and based on the number of water bodies, Fig. 6 shows the present ecological status / potential in percent. According to this figure, 4 % of the surface water bodies of the main stream of the Rhine are classified as good, 37 % of the water bodies are classified as moderate, 34 % as poor and 14 % as bad. For 8 % there are no data, for 4 % no assessment is required according to WFD (territorial waters in the 1 – 12 mile zone).

Based on the same data, Figure 7 gives the prognosis for the ecological status/potential of the surface water bodies expected for the main stream of the Rhine in 2015. Thus, it is expected that in 2015 and as a result of the measures carried out in the meantime (see Chapter 7.1), 20 % of the surface water body of the main stream of the Rhine will be assessed to be good, 46 % as moderate and 10 % as bad. No prognosis was presented for 20 % of the water bodies. The total assessment of all water bodies in the IRBD Rhine results from the Level B reports.

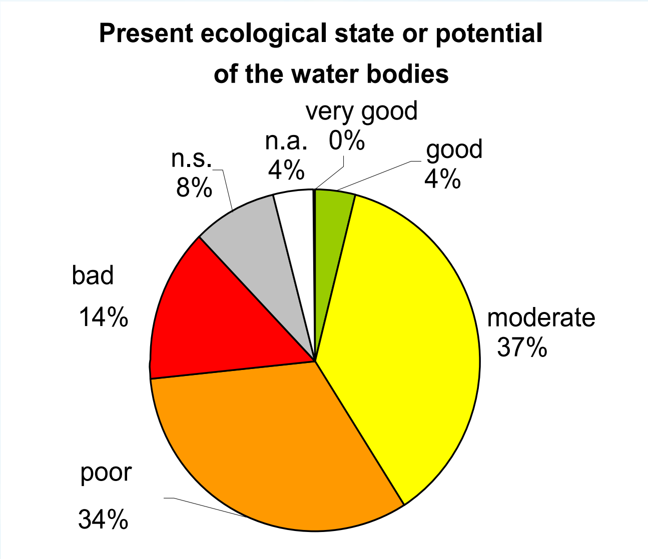


Fig. 6: Present ecological status or potential of the water bodies of the main stream of the Rhine based on the number of water bodies

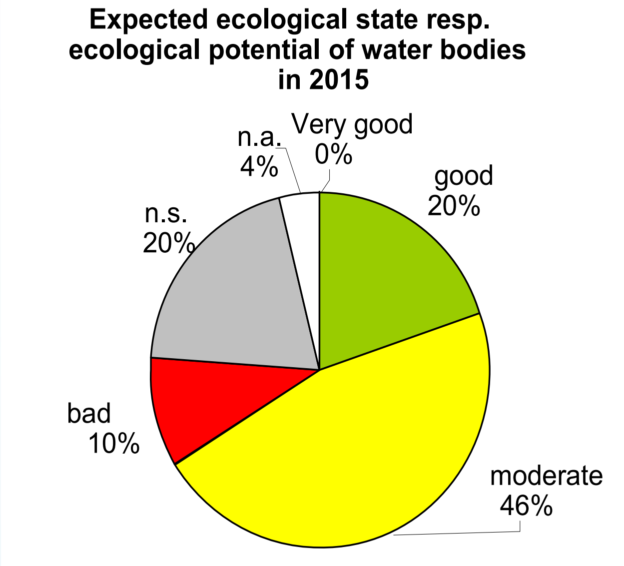


Fig. 7: Expected ecological status/potential in 2015 for the bodies of the main stream of the Rhine based on the number of water bodies.

Continuity of water bodies for fish

An intact river system including the possibility of moving into the marine environment is essential for the survival of migratory fish. So, for the distribution of migratory fish which spend part of their life cycle in fresh water and another in salt water, the continuity of a river system is an important factor. The migratory salmon is an indicator of the degree of upstream continuity of a water system as it reproduces in freshwater. The opposite applies to the eel reproducing in salt water.

Important management questions identified for the IRBD Rhine are the restoration of the continuity of waters (as far as possible) and increasing the habitat diversity.

The conference of Rhine Ministers on 18 October 2007 confirmed its determination to restore the continuity of the Rhine step by step as far as Basel and in the salmon programme waters, and to make every effort to ensure that the required financial means are made available.

The lake trout of Lake Constance as the indicator fish species for the Alpine Rhine / Lake Constance area of operation will also be considered within the management plans for this area.

For the eel, maturing in fresh water and spawning in the sea, the environmental objective set by the EC eel regulation[19] is to ensure that 40 % of the silver eel reach the sea. By the end of 2008, all EU Member States with

[19] Council Regulation (EC) No. 1100/2007 from 18 September 2007 establishing measures for the recovery of the stock of European eel

natural stocks of eel submitted eel management plans intended to secure a 40 % minimum survival rate of downstream migrating eel.

Reduction objectives for inputs of substances relevant for the Rhine and for chemical-physical components supporting the achievement of the "good ecological status"/potential

Physical-chemical components supporting biological findings are e.g. oxygen, the nutrients nitrogen and phosphorous as well as salts such as chloride and temperature. Negative impacts due to a lack of oxygen and elevated chloride concentrations are not (any longer) relevant in all areas of operation and, therefore, also not relevant at a higher level. However, elevated phosphorous concentrations are of regional importance and of consequence in some tributaries. Regarding questions of temperature, please refer to Chapters 6.2 and 7.1.2. As described below, the reduction target for nitrogen is based on the protection of the marine environment.

The schedule for reducing the discharge of substances relevant for the Rhine – as far as their relevance is confirmed – will be determined locally in coordination with the Rhine-bordering countries. A reduction at the source is striven for. As far as required, the specific level B reports address further specific pollutants or groups of pollutants that must meet national standards or must be taken into account as a matter of precaution.

Reduction targets aimed at marine protection

The average annual total nitrogen load discharged into the estuary of the Rhine, the coastal waters and the Wadden Sea between 2000 and 2006 amounts to about 273,000 metric tons.

According to present assessments, the "good ecological status", in particular of the sensitive ecosystem of the "Wadden Sea" may be achieved, if a maximum annual load of total nitrogen discharges from the Rhine catchment area into the North Sea and the Wadden Sea is not exceeded. Compared to 2005/2006, this would correspond to an average reduction of about 46,000 metric tons N/year (about 17 %). This calculation is based on an average discharge (2000-2006) from Haringvliet, Nieuwe Waterweg, North Sea canal and Spui from Lake IJssel.

The states, respectively federal states/regions, in the IRBD Rhine aim at reducing the total nitrogen load by 15 to 20%[20] by reducing the nitrogen discharges/inputs at the source.

[20] CH: Switzerland bases its measures for reducing nitrogen inputs into the North Sea via the Rhine on the corresponding agreements stated in the "Rhine 2020" ICPR programme and in the OSPAR Commission.

This load reduction will presumably be achieved when the annual average value for total N in the Rhine at Bimmen/ Lobith and in the North Sea estuary is not greater than 2.8 mg/l (working unit).

The values mentioned are highly uncertain. The results in Chapter 4 already show distinct variations in the biological system, also depending on weather conditions.

High percentages of nitrogen inputs of anthropogenic origin from the IRBD come from Germany, France, Switzerland and the Netherlands. The contribution of the other states in the Rhine catchment area to this load is relatively small as their surface percentage is low.

The measures of the states contributing to the nitrogen reduction planned until 2015 are presented in Chapter 7.1.2. It appears that until 2015, a 10 – 15% emission reduction is expected to be achieved. As the load calculations are very uncertain and there are distinct fluctuations in the biological system, and as the effect of this emission reduction on the loads in the North Sea is also uncertain, the Member States will monitor these effects. If required, the period until 2015 will be used for a more precise definition of the measures required and feasible after 2015.

Therefore, it is not possible to state with certainty today whether in 2015 the planned measures will result in a stable and "good ecological status" of the coastal waters and the Wadden Sea. Therefore, a deadline extension - in a first step until 2021 (see Chapter 5.4) - is assumed.

5.1.2 Chemical status

Regarding the objectives for the chemical status, please refer to Article 16, Par. 6, 7 and 8 WFD. The general objectives of the WFD when implementing the combined approach of the WFD with respect to pollution encompass specific emission and immission reduction objectives (reduction of inputs, losses and emissions).

These reduction targets concern surface water and groundwater bodies.

In the surface water bodies, 41 substances or groups of substances (i.e. all in all 51 individual substances) must be reduced at the source. For these substances or groups of substances, regulations exist in Annex IX and X WFD and EC Directive 2008/105/EC on environmental quality standards. These substances present a considerable risk for the aquatic environment or health.

- Annex X WFD directly concerns 33 of these substances and groups of substances and designates them as priority or priority hazardous on a European level. The WFD therefore stipulates that "the Member

States implement the measures required (…) in order to gradually reduce pollution due to priority substances and to phase out or gradually stop emissions, inputs and losses of priority hazardous substances."

- Eight further Annex IX WFD substances result from the daughter directive to EC Directive 2006/11/EC (formerly Directive 76/464/EEC) by 2013. Just as the priority hazardous substances, they must gradually be reduced at the source.

Fig. 8 illustrates the assessment of the chemical status of the main stream of the Rhine in percent based on the number of water bodies. Today, consequently, 12 % of the surface water bodies of the main stream of the Rhine are classified as "good", 88 % as "not good". In most cases, the cause is that the polycyclic aromatic hydrocarbons (PAH) exceed the environmental quality standards.

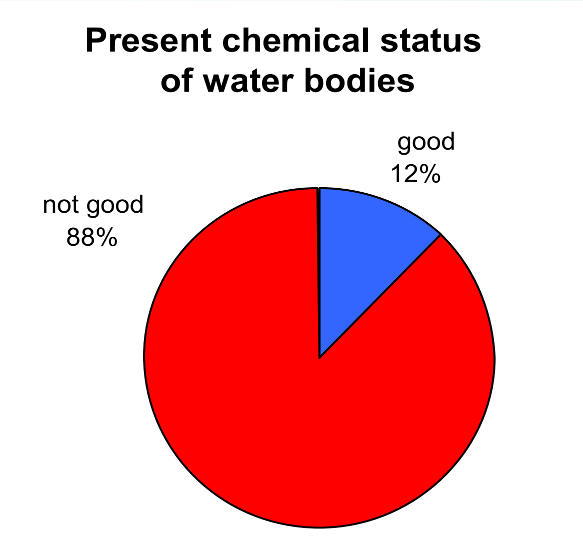


Fig. 8: Present chemical status of water bodies of the main stream of the Rhine (in percent based on the number of water bodies)

Fig. 9 illustrates the prognosis for the chemical status of surface water bodies of the main stream of the Rhine expected for 2015. As the PAH substance group mainly originates from combustion processes and constitutes a diffuse input into waters via the atmosphere, no improvement is expected by 2015. The total assessment of all water bodies in the IRBD Rhine results from the level B reports.

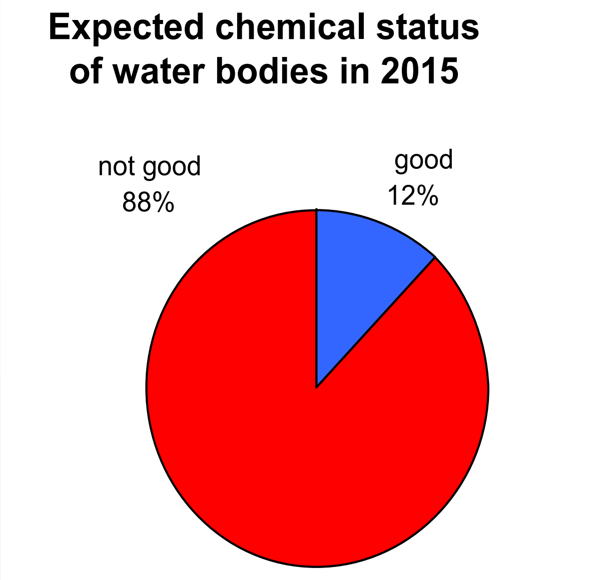


Fig. 9: Expected chemical state of water bodies of the main stream of the Rhine in 2015 (in percent based on the number of water bodies)

5.2 Groundwater

As far as groundwater is concerned, polluting inputs of any kind must be prevented or limited and a deterioration of the state of all groundwater bodies must be prevented.

The environmental objectives of the "good quantitative status" and "good chemical status" are explained in Chapter 4.2.

The general wording of the objectives will be specified by the states or federal states/regions. It has been discussed within the ICPR as to how implementation will be performed in the states or federal states/regions. As for the coordination required for this further elaboration, a distinction is made between surface waters and groundwater. Transboundary groundwater flow from one state to a neighbouring state (see Chapter 1.2) is only given at a limited number of locations. In most cases, groundwater bodies were limited to the state frontier in spite of transboundary conditions of flow.

Therefore, a coordination of objectives for groundwater is limited to neighbouring states (on Level B). A more detailed description of the targets for groundwater and the corresponding coordination is given in the relevant reports on level B.

Moreover, the WFD stipulates the requirement that the "Member States implement the required measures, in order to reverse the trend in all cases of sustained upward trends of pollutant concentrations due to human activities".

5.3 Protected areas

Article 4, Par. 1, Letter c WFD determines the objectives for protected areas: Member States shall "achieve compliance with any standards and objectives at the latest 15 years after the date of entry into force of this directive unless otherwise specified in the Community legislation under which the individual protected areas have been established".

Thus, two kinds of objectives must be achieved for protected areas: the specific objectives of the directive concerned and are decisive for the designation of an area (see WFD Annex 4) and the individual national standards of implementation and objectives of the WFD. The protected areas to consider are listed in WFD Annex IV. Some protected areas correspond to water bodies. They correspond to:

- On the one hand, (present and future) water bodies for human use and to be designated according to Article 7, par. 1 WFD. On a daily basis, these water bodies deliver more than 10 m^3 of water for human consumption or deliver such water to more than 50 people;
- On the other hand, water bodies used for bathing and water sports.

The other protected areas do not exclusively consist of water bodies:

- "Sensitive" areas in the sense of Directive 91/271/EEC on the treatment of municipal wastewater;
- "Areas at risk" in the sense of Nitrates Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates of agricultural origin;
- Habitat and species protection areas if, according to Habitats Directive 92/43/EEC from May 21 1992 concerning the protection of natural habitats and wildlife fauna and flora and the Bird Protection Directive 79/409/EEC of 2 April 1979 concerning the preservation of bird wildlife, conservation or improvement of the state of the water is an important protection factor.
- Protection areas for aquatic species of economic importance with respect to Directive 2006/44/EC of 6 September 2006 on the quality of fresh waters needing protection or improvement in order to support fish life and to Directive 2006/113/EC of 12 December 2006 on the required quality of shellfish waters.

Please refer to explanations given in Chapter 3 and relevant maps.

5.4 Adapting environment objectives for surface waters and groundwater, reasons

5.4.1 Extensions of deadline

The deadline set for 2015 to achieve the "good status" or the "good potential" of water bodies can, at maximum, be extended by 12 years (i.e. two revision periods of the management plan).

An extension of the deadline is only possible, if one of the following three reasons is given:

- Due to technical feasibility, the improvements required to achieve the "good status" can only be carried out in several steps exceeding the deadline set to 2015. If e.g. the preparatory phase for work (studies, designation of pilot) or implementation is too long to be able to achieve "good status" in 2015, this may justify an extension of deadline due to "technical feasibility";
- Natural conditions prevent improvement of the status of water bodies within the deadlines set. If improvement of the environment after implementing rehabilitation measures takes some time, this may justify an extension of deadline due to "natural conditions";
- Costs for the implementation of required improvement measures within the deadline set cannot be borne by the Community. In this case, an extension of the deadline may be filed due to "excessive costs". Another aspect to be taken into account is disproportionateness resulting from considerations of cost-effectiveness.

In the IRBD, extensions of deadline (A – network of water bodies, catchment area >2,500 km^2) are justified as follows:

To achieve the "good ecological status"/"potential" of the surface water body

To restore river continuity and increase the habitat diversity of natural, artificial and heavily modified surface waters, disproportionate costs or technical feasibility are taken into account when resorting to extensions of deadline.

For nitrogen in groundwater bodies and surface water bodies

- Natural conditions

Intensive agriculture today results in high concentrations of nitrate in many groundwater bodies. Due to natural conditions, these concentrations are only drained off very slowly by surface water bodies. Even if all measures aimed at reducing the surplus of the balance and resulting from EC laws supported by environmental measures in agriculture and supporting instruments of the states are successful, it will take longer than 2015 until these discharges via the groundwater pathway are reduced to such an extent that a distinct contribution to reducing the N load in the North Sea is achieved.

- Economic reasons

When resorting to deadline extensions for groundwater bodies, disproportionate costs for all of the measures to be implemented are also taken into account. Therefore, it is necessary to extend the measures aimed at achieving the objective to several management plans.

For phytoplankton in coastal waters

Some coastal waters already achieve the "good status" but the situation is not yet stable. Thus, the working units initially assumed necessary to reduce nitrogen loads are uncertain as are the effects of measures already implemented that contribute to the reduction of pollution in groundwater bodies in interaction with the surface water body.

Eventual additional measures required in the IRBD will be implemented from 2015 on.

For the substances relevant for the Rhine: zinc, copper, bentazone and the group of PCB as well as for phosphorous in the main stream of the Rhine

For technical reasons it is today not possible to replace the uses of copper and zinc by other, less polluting substances. Among others, water specific characteristics are relevant for the group of PCBs. Even though production and use of these substances as well as their discharges have been stopped, these substances will for a long time continue to be released from the water sediments and thus occur in waters. Diffuse inputs are also the reason for transgressing the national values or recommendations for the nutrient total phosphorous on the northern Upper, Middle and Lower Rhine and for ortho-phosphate-phosphorous in almost all tributaries of the Rhine analysed and in Lake Ijssel.

For priority (hazardous) substances

In particular the group of polycyclic aromatic hydrocarbons (PAH) is concerned in almost all surface waters of the A network of water bodies, followed by the group of phthalates (DEHP) and brominated diphenyether (PBDE) and by cadmium, hexachlorobutadien, diuron and tributyltin (TBT) in individual waters. These substance discharges are due to many widespread applications or to atmospheric deposition. Operational measures have already been taken. With respect to additional measures concerning these substances, a coordinated approach must be developed on a scale beyond the catchment area, comprising at least Europe.

Additionally, some of the above-mentioned substances have been designated as priority hazardous substances. The application of these substances must be phased out. For some substances this may mean that after phasing out, they will still occur in the environment.

5.4.2 Determination of less stringent objectives

For certain water bodies, less stringent objectives than the achievement of the good chemical, ecological or quantitative status or the good ecological potential may be determined. To this end it must be proven that, with respect to certain parameters or to the water quantity, these water bodies are impacted to such an extent by human activities or their natural state is such that it is not possible to achieve the objective or achievement would cause disproportionate costs.

This possibility is not being used for Part A surface water bodies.

In a few cases, less stringent environmental objectives according to Article 4, par. 5 and 7 WFD are required and explained briefly below:

Open-cast lignite mining areas on the left bank of the Lower Rhine is conducted in open pits with a depth of several hundreds of meters. In order to ensure safe mining activities, the groundwater table must be lowered considerably. In the long run, the decrease in groundwater level and the mining activities above all impact the quantitative groundwater status, but also the chemical groundwater status (e.g. sulphate, heavy metals, ammonium). Thus, in this area, some groundwater bodies will remain in a "bad" quantitative and qualitative state for decades to come (term of opencast mining: 2045).

Limestone mining in the Wuppertal area also involves draining measures so that, for the long term (mining activities until 2048), two small groundwater bodies present a "bad" quantitative status.

Subsequent to discontinuation of iron ore mining in Lorraine and implementation of the corresponding draining measures, sulphates are accumulating in the groundwater of the "Bassin ferrifère Lorraine" water body and pose a threat to water treatment for drinking water production. Presumably, this water body will only achieve the "good status" beyond the year 2027, which justifies this less stringent objective.

5.4.3 Exceptional status deterioration

Exceptions from the environmental targets due to changes of or impacts on the water bodies are possible, if the deterioration corresponds to an "overruling general interest". At present, this does not apply to Part A.

6 Economic analysis

The WFD integrates economic aspects into European water policy.

For the inventory and the management plan the WFD requires:

1. Identification of the uses of water and description of their economic importance (WFD Article 5).
2. Analysis of the development of different pollutions predictable by end 2015 (development scenario) (WFD Article 5, recommendations of the CIS-guideline no. 1 WATECO).
3. Analysis of the recovery of costs (WFD Article 9 and Annex III).

With the help of economic analyses, the economic "driving forces" behind present uses and pollutions of waters are to be described and economic data on water use must be collected and taken into account when planning measures. This analysis was comprehensively integrated into the survey in March 2005. The following chapters summarise this economic analysis.

6.1 Water use

The economic description of water use underlines the economic importance (use and value added) and material extent of water use (quantities abstracted or recharge) in a catchment area. This establishes a connection between economic activities and the environment.

Population

About 58 million people live in the nine states of the international RBD Rhine. The average population density in the IRBD Rhine amounts to about 290 inhabitants/km^2. With its 120 inhabitants/km^2, the area of operation of the Alpine Rhine / Lake Constance has the lowest and that of the Lower Rhine with its 680 inhabitants/km^2 has the highest population density.

Almost the entire population (99.4%) living in the international RBD Rhine is connected to public drinking water works.

Households and small businesses in the IRBD Rhine consume about 2.6 billion m^3 drinking water annually. On average, this corresponds to about 130 l per inhabitant per day.

The major part (about 96%) of the population in the IRBD Rhine is connected to a sewerage system. Only in the Moselle-Saar area of operation is this percentage slightly lower (85%).

On average, 2 % of the population in the RBD Rhine have septic tanks and thus their own treatment system.

Today, the capacity of the sewerage treatment plants in the international RBD Rhine amounts to about 98 million population equivalents. This capacity covers the present requirements of the population and of industry connected to a public sewerage treatment plant.

Agriculture

During the second half of the last century, agriculture in Europe, and therefore also in the RBD Rhine, was considerably intensified.

Today, some 500,000 people corresponding to some 2-3 % of the working population in the RBD Rhine work in agriculture. The total added value in agriculture today amounts to some 27 billion Euros.

99,380 km^2 of the international RBD Rhine are agricultural areas in use. More than 60 % of the agricultural areas in use are cultivated along the rivers Main, Moselle, Saar and Delta Rhine.

Industry

Over the last few centuries, industrial activities in the IRBD Rhine concentrated particularly on the metal processing and chemical industry. During the last century, coal and nuclear power plants producing energy and refineries settled in the area.

On average, industrial plants in the international RBD Rhine use 21,535 million m^3 of water, which is eight times the quantity used by households and small businesses in the RBD.

More than six million people corresponding to about 20-30 % of the working population living in the entire RBD, work in industry.

The total added value of industry in 2000 amounted to about 543 billion Euros.

Hydropower plants for power generation

Today, the hydropower of the IRBD Rhine is intensively used for power generation. There are 24 hydropower plants along the Rhine between the confluence of the Anterior and Posterior Rhine to the estuary of the North Sea.

The installed power of the hydropower plants along the

Rhine and its most important tributaries is more than 2 200 MW.

Even in the tributaries hydropower plays an important role.

According to an incomplete count, a total of about 2,000 big and small hydropower plants are operating in the entire Rhine catchment area. The installed power and the average output in the RBD Rhine are estimated at 5,000 – 6,000 MW, that is approx. 15 to 20 TWh/a.

Navigation and transport

Navigation has long been an important use of the Rhine. As early as 1831, regulations were determined for navigation (acts on navigation on the Rhine, Act of Mannheim 1868).

Over a stretch of more than 800 km, from the estuary into the North Sea as far as Basel, the Rhine has been trained into a navigation lane. It is today the most important shipping lane in Europe. Rhine and Moselle/Saar have been designated as international waterways; their use has been defined in international treaties. Additionally, the Neckar, Main and the network of canals in western Germany are important waterways.

The transported volume and the transport capacity of navigation on the Rhine (traffic of goods between Rheinfelden and the Dutch-German border) amounted to about 200 million metric tons/year in 2001 and 2002 and about 22 billion tkm/year.

Between 2002 and 2015, the transportation of goods per ship will increase by several dozens of percent, that is, by two to three percent per year.

Flood protection

The increased flood risk along the Rhine is due, among others, to the fact that subsequent to river training, rectification and diking, natural flooding areas along the Rhine have been reduced by more than 85% (reference year 1889).

At the same time, population density has increased and the utilisation of the floodplains at risk of flooding has been intensified. And it is precisely in these areas that the high flood damage risks are concentrated. This trend has not been stopped or reversed as yet. According to the ICPR Atlas of the Rhine 2001, the possible flood damage caused by an extreme flood of the Rhine amounts to some 165 billion Euros, should the entire main stream be concerned, which constitutes a considerable economic challenge.

In 1998, the Rhine bordering countries estimated the required financial means for implementing the Action Plan on Floods to be 12.3 billion euros. By the end of 2005, more than 4.4 billion euros had been spent on flood prevention measures. The "International Government Commission Alpine Rhine" (IRKA) and the "International Regulation of the Rhine" (IRR) have commissioned a "Development concept for the Alpine Rhine". It will equally comprise measures aimed at improving flood protection and reducing the risk of flood damage.

Based on implementation of the Action Plan on Floods so far, the implementation of the EC directive on Flood Risk Management (2007/60/EC) will have a decisive influence on future flood prevention in the IRBD Rhine.

Fishery, tourism, sand and gravel pits

In the Netherlands, the production volume of marine fisheries in 2002 amounted to 269 million euros, while coastal fisheries and mussel farming came to eight, respectively 14 million euros. With 5 million euros, inland fishing has the smallest share in the production volume.

Other uses, such as water tourism, e.g. on the Moselle and Lahn rivers, the operation of sand and gravel pits are only of regional importance.

6.2 Baseline scenario

The "baseline scenario" with its 2015 deadline is to provide insights into the presumable development of water uses with decisive impact on the status of the water bodies. The starting point concerning water uses is based on information of the population, the economic sector and land use as well as on the description of the economic importance of water uses. The development of relevant socio-economic parameters as well as on-going measures, i.e. the effect of basic measures according to WFD and that of additional measures implemented independently of the WFD, are being considered.

According to estimates, the population in Austria, Belgium and the Netherlands will increase by 6 % between 2000 and 2015, the French population will increase by 14 %, that of Luxemburg by 6 % between 2008 and 2015 while the population in Germany will remain approximately stable. This means that, for the entire RBD, a population increase of less than 3 % is expected.

The gross added value of business in all states should increase by more than 20 % by 2015. At present, the impact of the worldwide financial crisis on these estimates is unpredictable.

Increasing demand for biomass products and exportation of foodstuff are expected to lead to increased production in agriculture. It is assumed that this rising production will respect existing environmental standards and consequently not detrimentally impact the water household.

Navigation as well as the percentage of hydropower generation might also increase. Here, too, it is assumed that the prohibition of deterioration will be respected so that the expected development will not detrimentally impact the water household.

6.3 Aspects of climate change

Due to climate change, water household and water quality (in particular temperatures) are liable to change in the medium to long term. In the long term, this may impact the status of waters and might require mitigation measures.

The conference of Rhine ministers in 2007 commissioned the ICPR to improve the recording of changes of flow behaviour in the Rhine catchment area caused by climate changes. In connection with the work of the "Floods" working group, the ICPR has set up a 'Climate' expert group (KLIMA) with a specific mandate.

In a first step, this expert group has evaluated literature on the Rhine catchment area[21]. Analysis of air temperature monitoring data has resulted in clear statements from all regions of the Rhine catchment area. During the past 100 years, air temperature has risen both in winter (approx. + 1.0°C to +1.6°C) and in summer (approx. + 0.6°C to + 1.1°C). This results in an annual average rise in temperature in the Rhine catchment area from about + 0.5°C to +1.2°C, which is in the same order of magnitude as the mean global rise in temperature of up to approx. 0.9°C/100 years. With rising temperatures, glaciers are retreating in the Alps. In the Rhine catchment area, temperature and precipitation monitoring data already now indicate climate change.

Due to rising temperatures and increased precipitation and little snow storage in winter, the monthly average runoff data for the entire Rhine catchment area in the winter half-year are higher than what they used to be. At the same time, maximum runoff in winter is rising, while average runoff in summer is falling. The annual average runoff remains constant.

Natural water temperature is governed by the same factors of influence as air temperature. Thus, climate change has also contributed to a rise in water temperature (about 1°C to 2.5°C in the Rhine). But water temperature is also influenced by factors such as discharge of cooling water and urbanisation.

Climate projections made so far to assess the impacts of possible climate changes show that, during the coming 50 to 100 years, the sum of winter precipitation will increase, while that of summer precipitation will fall. With regional variations, the trends for air temperatures indicate a rise in winter and summer air temperature by 1.1 to 2.8°C by 2050.

For the period until 2050, most of the hydrological model results using climate projections show a distinct increase of the average runoff in the winter half-year and a decrease of the average runoff in the summer half-year.

In a second working step, the KLIMA expert group will draft a scenario study. This study, to be accomplished by 2010, will establish common consistent scenarios for climate and runoff in the international catchment and include temperature developments of Rhine water by 2050 (in all, analysis of climate scenarios until 2100).

The objective of the study is to estimate the effects of possible climate changes (3rd working step) on the water household in order to assess future development (knowledge of possible extreme values: floods and draughts) and on the water temperature of the Rhine (extreme values, seasonal variations, long term developments).

In a fourth working step beginning after 2010, the ICPR will develop internationally coordinated interdisciplinary adjustment strategies for the use of water quantity and for aspects of water quality and ecology. These strategies may become part of the second international management plan for the IRBD Rhine.

[21] Analysis of the state of knowledge on climate changes so far and on the impact of climate changes on the water regime in the Rhine catchment area; 2009, Koblenz, ICPR – Technical Report No. 174 – www.iksr.org – Technical Reports

7 Summary of the programmes of measures

7.1 Summary of measures to solve the major management problems in the international Rhine river basin district

The measures of the EU states resp. federal states/ regions summarised in Chapter 7.1 to solve the major management problems in the IRBD Rhine mainly concern the period from 2010-2015. In their first management plans pursuant to WFD Art. 4, Par. 4d), most EU Member States or federal states/regions include a non-binding outlook on measures aimed at progressively achieving the required "good ecological status" or "good ecological potential" by the end of the extended deadline. Following an evaluation of the effectiveness of the measures under the first management plan, these planned measures will be further developed for the second or third cycle of the WFD until 2027.

7.1.1 Restoration of biological river continuity, increase of habitat diversity

As a result of the successful restoration of Rhine water quality under the Rhine Action Programme, the biocoenosis of the Rhine has recovered. However, the ecological performance of the Rhine is not been granted everywhere. Further action is required to achieve the "good ecological status" or potential. In the following, general and specific measures are described which may further improve the conditions of life for flora and fauna in the Rhine and its tributaries, in other words, which may improve the ecological performance of the entire water system.

The concept presented in the "Habitat connectivity along the Rhine"[22] report and atlas published by the ICPR, describing the potential for preserving, improving and interconnecting the valuable types of habitats along the Rhine between Lake Constance and the North Sea, includes possible measures to achieve a higher variety of habitats and species along the main stream. It defines precise development targets for Rhine sections as well as spatial focal points and indicates action needed for the entire Rhine to restore an extensive habitat patch connectivity. The concept simultaneously serves water protection, nature protection as well as flood protection. Measures aimed at restoring the ecological performance based on the principle of stepping stones (e.g. measures within the habitat connectivity) concern the assurance of the required minimum discharge, vitalising the water body (among others river bed, variability, substratum) within the existing profile and habitat improvement in the water body by changing its course. Further measures concern the design of river banks and the river bed with accompanying measures as well as the improvement of habitats in the corridor of water body development including that of alluvial areas. The connection of lateral waters, oxbow lakes (transverse networking) and the improvement of the bed load balance are part of this context.

For restoration of a self-sustained stock of salmon and lake trout, access to a maximum number of identified spawning and juvenile habitats in the Rhine must be restored or these habitats must be re-vitalised. Among others things, upstream migration must be improved. Equivalent measures aimed at improving river continuity and at increasing structural diversity are of greatest importance for the Level A network of water bodies in the Rhine river basin district.

A **"Master Plan Migratory Fish Rhine"**[23] lists further details on measures particularly aimed at the migratory fish serving as pilot and indicator species for the conditions of life of numerous other organisms. The "Comprehensive fish-ecology analysis including an assessment of the effectiveness of ongoing and planned measures in the Rhine area with respect to the re-introduction of migratory fish"[24] is an important basis for the Migratory Fish Master Plan. This global analysis is available in a short and an extended version.

The concept of the habitat network and the Rhine 2020 programme were examined within the management plan.

With respect to the restoration of the **continuity of the**

[22] Habitat connectivity along the Rhine, Atlas of the Habitat Connectivity along the Rhine, IPCR - Brochure and Atlas 2006, Koblenz - www.iksr.org - brochures

[23] Master Plan Migratory Fish Rhine, 2009, Koblenz – ICPR –Technical Report No. 179 - www.iksr.org - Technical Reports

[24] Effectiveness of measures for successful and sustainable reintroduction of migratory fish in the Rhine catchment area – Summary of the "Comprehensive fish-ecology analysis including an assessment of the effectiveness of ongoing and planned measures in the Rhine catchment area with respect to the reintroduction of migratory fish", 2009, Koblenz – ICPR – Technical Report No. 166 - www.iksr.org - Technical Reports

"Comprehensive fish-ecology analysis including an assessment of the effectiveness of ongoing and planned measures in the Rhine catchment area with respect to the reintroduction of migratory fish", 2009, Koblenz – extensive version – ICPR – Technical Report No. 167 - www.iksr.org - Technical Report

main stream of the Rhine and the programme waters (see Map 14.2), certain measures will be implemented by 2015 (see survey in Annex 9) (marked green) or begun (marked yellow). As a matter of principle, the restoration of river continuity concerns the up- and downstream migration of fish. However, few technical measures are known with respect to the question of how to protect downstream migrating fish at hydropower plants. Therefore, in a first approach, measures aimed at improving upstream migration will be considered for the main stream of the Rhine. For smaller rivers, including some tributaries of the Rhine, functioning fish protection devices already exist, so that downstream migration through these waters will be included in the Master Plan. Annex 9 includes a non-binding outlook on further such measures until 2027 (light brown), but they will not be put into more concrete terms before the second or third management plan for the IRBD Rhine.

Annex 10 includes the measures planned within the 1st management plan for the IRBD Rhine until 2015 and aimed at achieving the objective of "Increasing species diversity" in the **main stream of the Rhine.** It equally includes a non-binding outlook for the period until 2027 for most states or federal states/regions in the IRBD Rhine. The measures concentrate particularly on the main stream of the Rhine; similar measures along tributaries are not included. Activities listed in this outlook are to be developed further in the future management plans.

Restoration of river continuity

The restoration of ecological river continuity, including that of tributaries, not only opens the way for migratory fish, but equally enables faunal exchange for other fish species (middle distance migrating fish) and for the macrozoobenthos. Apart from constructing and optimising existing installations for up- and downstream fish migration, the construction of by-passes and the near-natural connection of tributaries are important measures.

On 18 October 2007, the Conference of Rhine Ministers confirmed its intent to gradually restore river continuity in the Rhine upstream as far as Basel and in the waters under the salmon programme.

For the Lake Constance lake trout spawning in the Alpine Rhine and its tributaries, a successful programme aimed at preserving the migratory fish species has been in place for about twenty years.

The **Master Plan Migratory Fish Rhine** indicates how self sustaining, stable populations of migratory fish can again be settled in the *Rhine catchment area as far as the Basel area* within reasonable time and at reasonable costs. The salmon is the symbol species and represents many more migratory fish species such as sea trout, sea lamprey and eel. For the Alpine Rhine, the lake trout is the indicator species. As many programme waters as possible should again be made accessible as potential habitats. In particular, the salmon with its strong (so-called homing) capacity to return to its home waters depends on the accessibility and revitalisation of as many identified spawning and juvenile habitats as possible in order to restore self-sustaining stocks. Similar conditions apply to the lake trout in the Alpine Rhine.

Map K 14.1 indicates historically proven salmon waters and waters for the Lake Constance lake trout in the Rhine catchment area.

Map K 14.2 illustrates upstream continuity of the Rhine system for migratory fish species, using the example of salmon and sea trout and known spawning and juvenile habitat potential as well as the situation for the Lake Constance lake trout in the areas around the tributaries to Lake Constance and to the Alpine Rhine.

Map K 14.3 shows the present distribution of the eel in the Rhine catchment area and the impacts of transverse constructions, hydropower plants, pumps etc. on up- and downstream eel migration.

To ensure the most targeted implementation of measures possible, the main stream and its tributaries were divided into sections. In the programme waters, a total of more than 1000 ha of spawning and juvenile habitats could be opened in the Rhine catchment area.

From the North Sea, fish migration into the Rhine system mainly passes by the most important continuous migration route of the **Nieuwe Waterweg** into the R. **Waal**. Upstream migration through the sluices of the Haringvliet and the Waal is only possible to a limited extent. Until 2010, the improvement of river continuity in the Netherlands will concentrate on partly opening the Haringvliet sluices with a fish-friendly sluice regime (expenses: 36 million €). Even though the R. **IJssel** (only 1/9 of the discharge of the Rhine) is of little importance, the closure embankment of **Lake IJssel** will be made easier to pass by constructing three fish passages and adapting the regime of the sluiceway and navigation sluice in a fish-friendly manner (expenses about 2.5 – 5 million €).

Between 2001 and 2004, by-passes / fish passages were built at the three weirs in R. **Lek / Nederrijn**: Hagestein, Maurik/Amerongen and Driel. For eel spawning in the sea, downstream migration from the Rhine catchment area into the North Sea is important.

On the Lower Rhine, the R. **Wupper** tributary and its tributary, R. **Dhünn,** and the R. **Sieg** with its tributaries R.

Agger and **Bröl** with more than 200 ha juvenile salmon habitats are of great importance for the reproduction of the migratory fish and for establishing a stable salmon population.

Along the Middle Rhine, R. **Moselle** and **Lahn** are the biggest tributaries. They connect water bodies and their main function is to grant the greatest possible freedom of fish migration to the spawning grounds and juvenile habitats of migratory fish further upstream. The continuity of the Moselle at the 10 barrages at Koblenz, Lehmen, Müden, Fankel, St. Adelgund, Enkirch, Zeltingen, Wintrich, Detzem and Trier (upstream direction from the confluence) will be systematically improved due to compensatory payments for the construction of two lock chambers at six barrages. In co-operation with Luxemburg, a long term project is being implemented to re-open habitats in R. Sauer (70 ha). For further details please refer to the management plan for the Moselle-Saar area of operation (Part B).

Nineteen barrages in the lower section of the R. **Lahn** in Rhineland-Palatinate block this river. Upstream of this section, river continuity of the Hessian part of the Lahn was successively achieved at seven weirs or drop structures.

Further measures have been implemented or are planned for the Rhine tributaries **Ahr, Nette, Saynbach, Wisper** and **Nahe**.

Accessibility of spawning and juvenile habitats in the Hessian tributaries to the R. Main, the Schwarzbach, Nidda and Kinzig and to the Bavarian R. Main and its tributaries, among other R. Sinn and the Fränkische Saale are interrupted by impoundments of the R. Main. Bavaria is developing an overall concept in co-operation with the operators of hydropower plants and the administration of the federal German waterways aimed at improving this situation. By the end of 2009, Hesse will accomplish work on the bypass at the lowermost barrage in the R. Main at Kostheim. Equivalent construction measures will begin at the next barrage on the R. Main at Eddersheim by 2015. Once both these measures have been implemented, R. Schwarzbach will again be accessible for spawning.

The R. **Neckar** and its tributaries are not central migration routes and habitats for anadromous fish species.

Since middle-distance migratory fish such as nase and barbell are typical fish species in the R. Neckar and its catchment area, measures aimed at restoring river continuity are considered to be an important part towards achieving the "good ecological status" or potential.

The lower, navigable section of the R. Neckar from the outlet into the Rhine near Mannheim to the mouth of the R. **Enz** has a much higher fish-ecological potential than the following section. River continuity will be entirely restored for this reason. The objective further upstream is to restore longer continuous sections of the Neckar in order to open up access to habitats and tributaries.

The lowermost transverse structure at Ladenburg has already been equipped with a fish passage. When determining the order of construction for the required fish passages in the river section between the outlet of the R. Neckar into the Rhine and the outlet of the R. Enz into the R. Neckar, the construction programme for prolonging the sluices will be taken into account. This also applies to the construction of the three fish passages required in the river section between the mouth of the R. Enz and the end of the federal waterway at Plochingen. Construction of the first two facilities (Kochendorf and Lauffen) will presumably begin before 2015.

Other important tributaries of the Upper Rhine are R. **Wieslauter, Murg, Ill** with its tributary Bruche, R. **Alb, Rench, Kinzig** and R. **Elz** with its tributary Dreisam.

On the **southern Upper Rhine,** barrages interrupt the continuity of the Rhine. A fish passage was put into operation at the downstream barrage at Iffezheim in 2000 and at Gambsheim in 2006. As a consequence, upstream tributaries of the Rhine including the R. Kinzig in Baden-Württemberg are again accessible.

A study carried out during 2003-2006 examined the feasibility of the "Restoration of the ecological continuity of the Upper Rhine for the fish fauna"[25] as far as the Basel area.

The next important measures on the Upper Rhine aim at restoring further upstream migration of migratory fish into the Elz-Dreisam catchment area presenting 59 ha spawning and juvenile habitat. Until 2015, river continuity will be restored along 90 km, until 2027 along 109 km (total expenses: 25.8 million €).

In order to make the Elz-Dreisam area of the Upper Rhine accessible, fish passages must be built both at the Strasbourg and at the Gerstheim barrage, as well as at the agricultural weirs in the Gerstheim and Rhinau loops **on French territory.**

According to **French plans, fish will be able to pass the Strasbourg barrage by 2015; work on the Gerstheim barrage will begin before 2015.** Measures aimed at surmounting the cultural weirs in the Gerstheim and Rhinau loops will be co-ordinated on a bilateral basis as they concern French as well as German territory. These

[25] Restoration of the ecological continuity of the Upper Rhine for the fish fauna, short version, 2006 – ICPR – Technical Report No. 158 – www.iksr.org – Technical Reports

measures will open a further section for river continuity into the tributaries and towards Basel. The total costs for this section are estimated to about 39 million €.

Presently, at each of the hydropower plants at the barrages of Iffezheim and Gambsheim, a 5th turbine is being integrated. Once this work has been concluded (i.e. after 2011), telemetric studies are planned to examine the traceability of existing fish passages. This efficiency control will allow assessment of the respective measures implemented and further implementation steps may be planned.

At the cultural weirs at Kehl and Breisach, fish protection and downstream fish migration installations were built as part of the construction of small hydropower plants and performance of the existing fish passages has been improved.

Among other things, the new concession for the Kembs power plant includes the obligation to construct a new fish passage at the bypass weir of the Märkt power plant towards the Grand Canal d'Alsace and to increase minimum discharge into the old bed of the Rhine. The French concession provides for increased residual flow with seasonal variations. The basic flow from November to March has been fixed at 52 m^3/s (Decree No. 2009-721 dated 17 June 2009). The concession includes a review clause with respect to a possible increase of the residual flow as of 2020. The Swiss concession has not yet been granted.

Additionally, further hydro-morphological processes will again be made possible on the French bank (sediment yield due to controlled gravel input). An Interreg project, in which technical institutes from Alsace (F) and Baden-Württemberg (D) participate, will support the pilot project. On the German bank, measures aimed at flood protection are planned which, during the years to come, will sustainably improve the ecological quality of water and floodplain habitats in this important section of the river between Kembs and Breisach (50 km). These measures are expected to considerably enhance the entire ecosystem of the old bed of the Rhine (among others: reactivation of 88 ha of spawning and juvenile habitats).

Further measures may be taken after 2015 in order to open up the migration route further upstream towards Basel. The "Master Plan Migratory Fish Rhine" lists details on these future measures.

Along the High Rhine, in the Basel area, the continuity of the water systems of **Wiese, Birs** and **Ergolz** is being improved (see Annex 8).

On the **High Rhine,** the power plants at Birsfelden, Augst-Wyhlen, Rheinfelden, Ryburg-Schwörstadt, Bad Säckingen, Laufenburg, Albruck-Dogern, Eglisau, Reckingen and Schaffhausen are equipped with largely functioning fish passages. Only the Rheinau power plant downstream of the Rhine Falls at Schaffhausen is not yet equipped with any fish passage. During 2008 to 2010, river continuity at the power plants at Rheinfelden, Albbruck-Dogern and Eglisau will be further improved. By 2012, the Ryburg-Schwörstadt power plant will be equipped with a by-pass. The fish passage at the Rheinau power plant is part of an ongoing procedure. Existing fish passages in Birsfelden, Säckingen, Laufenburg and Reckingen will be improved step by step within the implementation of the WFD.

The Swiss parliament is discussing a counterproposal to the popular initiative "Living Water", aimed at accelerated renaturation of brooks and rivers, filed by the Commission for Environment, Spatial Planning and Energy of the Council of States. The legal basis is being prepared to enhance the revitalisation of waters, to reduce the negative impact of discharge fluctuations downstream of power stations with reservoirs, to reactivate the bed-load balance and to restore fish migration at power plants. At the same time, a basis will be created to secure the financing of measures. The following approach is planned in order to implement this regulation:

- The Cantons plan the revitalisation of waters and implement corresponding measures according to their priorities.
- The Cantons plan restoration measures in the fields of hydropeaking, bed-load balance and fish migration and present their plans to the federal government by the end of 2014.
- The operators of installations concerned will implement these measures according to the schedule valid for the canton,

at the latest 20 years after the new regulations come into effect.

The measures aimed at restoring river continuity will also have a positive effect on other fish species and the entire aquatic fauna and flora.

Since 2008 and within a EU LIFE project, comprehensive stocking measures aimed at reintroducing the allice shad into the Rhine system have been implemented in the Upper and Lower Rhine as well as in the R. Sieg (NRW). The above-mentioned measures will benefit the allice shad just as much as the other migratory fish species so that, in the medium term, a sustainable re-introduction of this species in the Rhine system may be expected.

Once the deficits in terms of river continuity have been remedied, **further need for action** will still remain. In the entire Rhine catchment area and in the Dutch coastal area, catching and possessing salmon and sea trout is forbidden by law. Nevertheless, from today's point of view, fishery must be considered as a limiting factor for large salmonids and allice shad. Problems remain with respect to implementing the prohibition of catching and removing salmon and sea trout. For sea lamprey, negative effects can be excluded as this species is of no interest for fishery. Losses of all other migratory fish concern the entire Rhine catchment area and the coastal area and are due to mortality during catches, e.g. injuries and stress, to accidental catches (including inadvertent by-catches) and to poaching. In particular, there are no reliable data on targeted illegal catches. With information campaigns, intensive control measures and the consequent application of criminal law, attempts are being made to reduce the rate of salmonid mortality caused by fishery (see ICPR recommendations on the improvement of legal execution to reduce by-catches and forbidden salmon catches by professional and leisure anglers[26]).

In the **Alpine Rhine / Lake Constance** sub-basin**,** the sea trout (*Salmo trutta lacustris*) is the only long-distance migratory fish. All in all, compared to its historic distribution, the habitat of the Lake Constance lake trout has been heavily reduced. In Lake Constance, consisting of the "Obersee" (Upper Lake) and "Untersee" (Lower Lake) water bodies, and of which the chemical and ecological status today is good, the free water constitutes the preferred habitat of the lake trout. Here it grows up until it is mature to spawn and migrates upstream to the Alpine Rhine and its tributaries to spawn.

The successful programme aimed at saving Lake Constance lake trout is being co-ordinated by the Alpine Rhine working group of the Internationale Bevollmächtigtenkonferenz für die Bodenseefischerei (IBKF) (International Conference of Plenipotentiaries for Fishery in Lake Constance). For the lake trout, the continuity of the Alpine Rhine is provided from the outlet into Lake Constance at River Kilometre 94 to the confluence of the Posterior Rhine and the Anterior Rhine at River Kilometre 0. The river bed sills at Buchs (River-Km 49.6) and Ellhorn (River-Km 33.9) are surmountable for the lake trout but constitute artificial limits of distribution for other fish species. In 2000, a technical fish passage was constructed at the Reichenau power plant (River-Km 7). Permanent monitoring proved that this plant does not obstruct upstream migration of the sea trout.

The basis report, "Habitat for the Lake Constance lake trout", commissioned by the IBKF includes a framework programme integrating and co-ordinating all programmes of measures aimed at enhancing the sea trout and other migratory fish species as well as programmes with similar water protection and water development objectives based on a common (transboundary) objective.

The measures proposed by the report for the tributaries of the Alpine Rhine will be implemented according to national priorities from 2015 on (see Annex 8).

Further details on the above-mentioned measures in the Rhine tributaries are listed in the Master Plan Migratory Fish Rhine.

Contrary to other migratory fish, **eel** do not reproduce in fresh water but in the sea (Caribbean Sea, presumably Sargasso Sea). From there, the eel spawn drifts with the gulf stream across the Atlantic Ocean; the glass eels then develop in the European coastal waters, before they migrate upstream in the rivers, brooks and still waters, where they partly spend more than 10 years before returning into the sea to spawn and die. During the past years, the stock of eel has strongly declined. Since the beginning of the 1980s, only a few percent of the long-time average of glass eel numbers migrating upstream into the rivers return. There are many reasons for this considerable decrease: the commercial fishing of glass eel in river estuaries, loss of habitat caused by river training, limitation of upstream migration due to transverse constructions, the loss of silver eel migrating downstream at hydropower plants, and parasites (*Anguillicola crassus*), fishing for yellow eel, silver eel, etc. so that, today, comparatively few specimens are able to reach the sea again.

Map K 14.3 illustrates how eel migration – in particular downstream migration through the Delta Rhine, in the southern Upper Rhine and almost all Rhine tributaries – is affected by transverse constructions. Eels migrating downstream are in particular danger, as they move along the river bed: They are often caught in the turbines of power plants, intake constructions, pumps, etc.. Due to the length of their bodies they may suffer from grievous, mostly lethal injuries; the cumulated mortality may be considered substantial if several transverse constructions follow one another.

For protection purposes and future management of the endangered eel populations in Europe, the EU issued a regulation (EC No. 1100/2007) focussing on a reduction of eel mortality of anthropogenic origin. This regulation lists possible measures aimed at protecting eels, such as restricting fishery and restoring or improving up- and

[26] Comprehensive fish-ecology analysis including an assessment of the effectiveness of on-going and planned measures in the Rhine watershed with respect to the reintroduction of migratory fish, 2009, Koblenz – extensive version – ICPR – Technical Report No. 167 - www.iksr.org - Technical Report

downstream river continuity. According to this regulation, eel management plans were drafted and presented to the EU Commission by the end of 2008. The environmental objective set by the EC eel regulation is to secure 40 % survival as compared to the natural stock. By means of their eel management plans, all EU Member States with natural eel stocks must ensure that when this survival rate of eels migrating downstream is not achieved, the eel stock is replenished.

In particular, the national eel management plans of the Rhine-bordering countries provide for the following measures aimed at stabilising the stock of eel in the Rhine catchment area:

1. improvement of up- and downstream river continuity
2. limitation of fishery
3. stocking
4. hydro-morphological measures
5. limitation of predation

Detailed information on the threat posed to the eel and planned measures in the different states in the Rhine catchment area are listed in the Rhine Migratory Fish Master Plan[27].

Increasing habitat diversity

The species diversity of a river mainly depends on the diversity of its morphological structures. Therefore, above all, structural diversity in the river bed and along its banks must be increased and waterway maintenance must be environmentally compatible.

These measures will contribute towards opening up further habitats to the flora and fauna living in the water, on its banks and on the floodplains.

Within the framework of the Rhine 2020[28] programme, 100 oxbow lakes and backwaters will, for example, be reconnected with the dynamics of the Rhine by 2020, and former hydraulic and biologically effective connections between the river and its floodplains will be restored. Along suitable sections of the Rhine, the structural diversity will be increased along 800 km at a minimum, taking into account aspects of security for navigation and people.

Until 2015, many different measures will be implemented, in particular to **increase habitat diversity** in the stream channel and its surroundings. The same is true of measures along the great navigable tributaries, Moselle, Main and Neckar, and of the R. Lippe. These measures aim at achieving the "good ecological status" in the case of natural waters or the good ecological potential in case of heavily modified waters. Similar measures will also be part of further management plans, as everything will not have been implemented by 2015.

For example, measures concerning the beds of the navigation lanes are to be designed so that they contribute to improving the bed-load balance and to reducing streambed erosion; in the different states, those sections presenting deficits in the bed-load balance must be identified in which natural bed load displacement (due to lateral erosion) may be permitted or enhanced without interfering with navigation.

Measures aimed at increasing habitat diversity in the riverbank area are:

a) Revitalisation of river bank stabilisations not required for safety or maintenance reasons; improved access to waters, even with simple measures; creation of alluvial areas in impoundment areas, wherever possible;
b) Optimisation of river constructions, greater ecological design of the groynes, parallel diversion structures where space permits;
c) Protection against lapping of waves; including problems due to sudden changes in high and low water;
d) Increasing runoff diversity;
e) Revitalisation of spawning and juvenile habitats.

Measures aimed at increasing habitat diversity in the riverbank area and floodplains are:

a) Improvement of lateral connections with the water environment, where possible by creating and connecting bypasses (with sufficient rate of flow and different runoff patterns) so that the stepping stone function of the river bank and the water environment is optimized in the habitat network;
b) Enhancement of near-natural connections of tributaries in the Rhine estuary;
c) Where possible, integration of dike relocations into the extension of alluvial areas when planning measures (also makes sense for reasons of flood protection);

[27] Master Plan Migratory Fish Rhine, 2009, Koblenz – ICPR – Technical Report No. 179 - www.iksr.org - Technical Reports

[28] Conference of Rhine Ministers 2001, Rhine 2020, Programme on the sustainable development of the Rhine, 28 pages, ICPR 2001, Koblenz - www.iksr.org - brochures

d) Enhancement of near-natural vegetation in the alluvial area, creation of riverbank strips, above all below sloping surfaces without vegetation (fields, etc.); Enhancement of environmentally compatible agriculture and extensive agriculture to reduce inputs of fine sediments and of nutrients and pesticides of diffuse origin.

These proposals indicate general possibilities for the implementation of measures aimed at enhancing habitat diversity. Annex 9 provides an overview of the specific measures planned by the states resp. federal states/regions along the main stream of the Rhine. These measures differ in nature and extent. Therefore, further details are included in Parts B of this international management plan for the IRBD Rhine (Part A).

7.1.2 Reduction of diffuse inputs impacting surface water and groundwater (nutrients, pesticides, metals, noxious substances from historic pollution and others) and further reduction of classical pollution of industrial and municipal origin

Physico-chemical components

The EC Directives 91/676/EEC (nitrates directive), 91/271/EEC (urban waste water directive) and, to a lesser degree, Directive 96/61/EG (IPPC directive) are important instruments for further reduction and avoidance of nitrate emissions into water bodies. Furthermore, during the past decades, the implementation of additional political programmes, such as the Rhine Action Programme and the considerable investments associated with its implementation as well as OSPAR recommendations were of great importance. These programmes contributed to a distinct reduction of phosphorous and nitrogen concentrations in the entire catchment area during the past twenty years.

The states, respectively federal states/regions, in the IRBD Rhine will continue to implement the measures already taken to reduce the nitrogen load, taking the polluter-pays principle into account as well as applicable EU legislation, previous achievements and aspects of appropriateness. It is moreover assumed that the countries bordering the North Sea in charge of other catchments pouring into the North Sea will make equivalent reduction contributions.

Within implementation of the nitrates directive, the EU Member States of the IRBD Rhine have drafted nitrate action programmes. Apart from adapting fertilisation standards, further measures are to be implemented or planned, such as:

- Good agricultural practice which may include information on and introduction of certification systems.
- Prohibition of fertiliser distribution in autumn or winter or on water-saturated, frozen soil or soil covered with snow;
- Keeping bank areas free of fertiliser or cultivation;
- Prohibition of grassland ploughing during autumn and winter;
- Cultivation of swamp areas and helophyte fields;
- Extensification of livestock breeding;
- Improvement of the rate of implementation and fertilisation;

Additionally, specific programmes are targeted for further reduction of nitrogen emissions. Furthermore, different regulations apply to water conservation areas protecting drinking water supplies against inputs of nitrate and other substances such as pesticides. The intention is to tighten up these regulations in the most polluted drinking water abstraction areas in certain parts of the catchment. Also, the discussions on the "Common agricultural policy" (CAP) will play its part in the further implementation of measures.

As far as emissions from wastewater treatment plants are concerned, the degree of nutrient elimination has continued to improve since 2000. This trend is expected to continue.

Additional measures within implementation of the WFD by 2015 should further reduce nutrient pollution. Existing concepts for wastewater elimination often form the basis for further measures, such as optimising the operation of wastewater treatment plants. Other measures are, for example, new sites for wastewater treatment plants or transfer/diversion of wastewater flow and/or merging wastewater treatment plants.

The IPPC directive entered into force in 1999. The deadline for adapting existing industrial plants to the requirements of reducing environmental impacts by applying the best available techniques ended 30 October 2007. Considering the state of implementation of the IPPC directive and the fact that only a small percentage of nutrient inputs is of industrial origin, no further significant improvement of the Rhine water quality is to be expected from measures aimed at a further reduction of direct inputs from industry.

Table 4 presents the nitrogen inputs from agricultural acreage, wastewater treatment plants and industry in the states of the Rhine catchment area in 2000, the emissions today and a prognosis for 2015.

For the marine environment, particular requirements apply to nitrogen. Considering the prognosis for nitrogen emissions in the IRBD Rhine, a 10 – 15 % reduction of inputs (see Table 4) is today considered to be feasible.

Table 4: Nitrogen emissions from agriculture, wastewater treatment plants and industry in the river basin district Rhine[29] and prognosis for 2015 (kilotons/year)

Country	Emission 2000 (in kt)	Emission today (in kt)	Prognosis 2015 (in kt)
Agriculture*			
Austria	2	2	2
Switzerland**	12 (2001)	11 (2005)	11
Germany	113	113	99
France	23	14 (2006)	10
Luxemburg	3.7	3.1	n.s.
Belgium/Wallonia	n.s.	1.18	n.s.
Netherlands**	42	34 (2006)	31
Rhine catchment area	> 196	> 178	> 153
Wastewater treatment plants (including diffuse urban)			
Austria	0.8	0.6	0.5
Switzerland**	13 (12+1)	12(11+1)(2005)	< 11 (10+1)[i]
Germany	72 (63+9)	60	57
France	18 (15+3)	4 (2006)	3
Luxemburg	1.8	1.7	n.s.
Belgium/Wallonia	n.s.	0.06	n.s.
Netherlands	22 (20+2)	15 (2006)	13
Rhine catchment area	> 128	> 93	>85
Industry			
Austria	n.s.	0	0
Switzerland**	1	1 (2005)	< 1
Germany	15	15	14
France	5	5 (2005)	5
Luxemburg	0.007	0.003	n.s.
Belgium/Wallonia	n.s.	0.06	n.s.
Netherlands	3	2 (2006)	2
Rhine catchment area	> 24	> 23	> 22
Total IRBD Rhine	**> 348*******	**> 294**	**> 260**

* As well as all diffuse inputs of anthropogenic origin

** Implementation of equivalent measures in Switzerland as a non-EU member; all Swiss data concern the Rhine catchment area downstream of the lakes.

*** Excluding atmospheric depositions

**** According to the survey for 2000, the total nitrogen input into the IRBD Rhine amounted to 437 kilotons, including other sources such as atmospheric deposition and natural background contamination

n.s. Not specified

In certain situations, temperature is a critical parameter. High temperatures in summer (≥ 25°C water temperature) may be a stress factor for migratory fish and imply an increased risk of infections and a temporary interruption of upstream migration[30].

Studies on the impact of climate change on runoff and temperature of the Rhine are currently underway. As soon as the results are available, possible additional measures may be included in the second management plan for the river basin district. This means that future work will take temperature issues into account.

Substances relevant for the Rhine

Of the 15 substances relevant for the Rhine[31] which were defined in 2003 as being relevant for the river basin district, zinc, copper and PCB continue to be problematic.

As far as **zinc** and **copper** are concerned, measures will have to be taken at the source in order to counteract inputs of these substances, particularly as wastewater treatment plants were not designed to eliminate heavy metals from wastewater. Some emissions are limited to small areas so that ecological impact is of regional, but not necessarily of overall relevance. No obvious measures can be recommended for rehabilitation purposes. In the construction industry, alternatives for the use of copper and zinc are being looked into. Other studies concern the application of emission standards for formed metals or the requirements for drainage of precipitation water. The processing of zinc in car tyres cannot be easily substituted. No European initiatives are known of in this field. The wear of break pads releases copper. As is the case for zinc, copper enters wastewater treatment plants via the sewage systems in urban areas and it is partly eliminated in these plants. It would be desirable to investigate the possibilities of an environmentally friendly alternative for copper in break pads, preferably at a European level. Efforts towards finding an alternative to the use of zinc in shipping (and sluices) continue. Anti-fouling biocide agents are applied as growth-inhibiting paint, in particular to the outside shell of leisure boats.

29 Table drafted on the basis of the data supplied by the states in the IRBD Rhine based on national model calculations (MONERIS, MODIFFUS, STONE, PEGASE) for 2000 and 2005 with longstanding mean hydrological data.

30 "Comprehensive fish-ecology analysis including an assessment of the effectiveness of ongoing and planned measures in the Rhine catchment area with respect to the reintroduction of migratory fish", 2009, Koblenz – extensive version – ICPR – Technical Report No. 167 - www.iksr.org - Technical Report

31 List of Rhine substances 2007, 2008, Koblenz, ICPR – Technical Report No. 161 – www.iksr.org - Technical Reports

However, this product rarely appears on the market.

In agriculture, copper is used as a disinfectant for the hoofs of dairy cattle. Often, residues of the so-called copper baths are mixed with manure. Different possibilities of reducing the copper emissions are being looked into.

As far as agriculture is concerned, harmonised EU standards apply to the maximum application of these metals in fodder (fertiliser and fodder containing copper). To a greater extent, the assessment of additives must take into account the impact of these substances on the soil and waters.

On the whole, the available operational measures for reducing the diffuse inputs of copper and zinc at the source have already been taken or started. Apart from the regulations on reducing point source discharges of these metals, there no additional measures are available that target diffuse inputs. At present, possibilities in this area are limited to investigations and innovative projects.

PCB, like HCB, belongs to the category of pollutions causing a negative impact on sediment quality. All measures have been taken, no other direct PCB discharges are known. Indirect pollution is due to polluted water sediments. As far as possible, heavily polluted water sediments must be remediated. As releases from water body sediments continue, achievement of the objective does not appear to be inherent.

Furthermore, inputs of substances recently gaining in importance, e.g. due to modified consumer behaviour, must be addressed. The ICPR has established the MIKRO project group to address the relevance of micro-pollutions for the Rhine, e.g. due to residues of pharmaceuticals, and to develop strategies towards their reduction. First results are expected for 2010.

Priority (hazardous) substances and substances figuring in WFD Annex IX

Only some of the 33 priority (hazardous) substances and of the other eight substances figuring in WFD Annex IX are problematic in the IRBD Rhine:

1. Problematic substances are as follows: PAH, TBT, brominated diphenylethers (PBDE), cadmium, hexachlorobutadien, pentachlorobenzene, diuron
2. Substances, for which the classification is uncertain due to their detection limit: phthalates (DEHP)

PAH compounds: A reduction amounting to 80-100% can be deduced for the sum of BghiPe and InP. As far as the sum of the BbF and BkF is concerned, no certain statement can be made on the required reduction, since the threshold value lies above the standard. PAH concentrations exceeding threshold values are not directly bound to a local source of emission but are, above all, caused by diffuse emissions from combustion plants and motors, car tyres, shipping and the use of coal tar and creosote, primarily as wood protection agents in hydraulic engineering. The atmosphere is the main pathway of emissions. Influence on this pathway of emission is above all possible by means of an international approach towards impacting air quality. As of 2009, the EU has stricter requirements with respect to the emission of soot particles. In a first approach, these requirements only concern new models, as of 2011 they will apply to all diesel-driven vehicles. Measures concerning the runoff of precipitation water from roads are other possibilities for further reduction of emissions into waters. According to EU Directive 2005/69/EC (earlier 76/769/EC), as of 2010, no process oil containing PAH may be used in the rubber processing industry or for the production of tyres.

In most states belonging to the IRBD Rhine, it is prohibited to include PAH in coal tar coating used for ships in inland navigation. The contract on waste originating from navigation of the Central Commission for the Navigation of the Rhine (CCNR) includes regulations for PAH from bilge water and other wastes. This contract entered into force on 1 November 2009.

At European level, there are requirements concerning the use of creosote for wood conservation purposes in construction and water engineering. In the Netherlands, e.g., several kilometres of river bank stabilisation are being removed in order to avoid (further) leaching out of among others PAH.

The sources of PAH are very varied. The objective will not be achieved, but international measures may still contribute to a considerable reduction.

Within the EU and the IMO, a prohibition on the use of tributyltin (TBT)-compounds as anti-fouling agents in ship-bottom paint became effective in 2003. As of September 2008, this prohibition applies to all ocean-going vessels sailing under EU/IMO flag and calling at EU ports. If ocean-going vessels are considered to be the most important source of TBT-compound emissions, the values in excess stated in marine and transitional waters in the past years are easy to explain. However, this does not explain excess threshold values in inland waters, which must be further investigated.

Releases from water sediments may be a long-term problem. Therefore, the objective will possibly not be achieved.

The sampling and analysis methods to determine phthalates (DEHP, softening agent in plastics) do not yet deliver sufficiently testable results for a correct appreciation of the problem.

Isoproturon and diuron were detected in 2007. In order to reduce diuron and isproturon pollution, some measures have already been implemented: e.g. small prepacks containing diuron no longer being sold, field crop sprayers with less drift when spraying pesticides are being used, application advice has been improved and, based on permission policy, applications re-evaluated.

Substances not detected in 2007 but detected in the years before: Phenols (4-para-nonylphenol, 4-tert-octylphenol), HCB

Since 2005, pursuant to EU Detergents Directive 2003/53/EC, phenols (4-para-nonylphenol, 4-tert-octylphenol) may no longer or hardly be processed in consumer goods.

Just as HCB, PCB belongs to the category of pollutions with a negative impact on the sediment quality (see next section). All measures have been taken, no more direct HCB discharges are known. Indirect pollution is due to polluted water sediments. As far as possible, heavily polluted water sediments must be remediated. As releases from water body sediments continue, achievement of the objective does not appear to be inherent.

Contaminated areas

Human interferences with the water system (construction of dikes and impoundments) have caused a thorough change of the sediment household of the Rhine (see survey). Apart from these hydro-morphological changes, considerable discharges of pollutants over recent decades have generated great amounts of polluted sediments. This still continues to negatively impact sediment quality as old, polluted sediments in the Rhine and its tributaries may be whirled up during floods or dredging. The ICPR has drafted an overall strategy for sediment management along the Rhine[32] aimed at sustainable management of sedimentation and dredging. The only pollutant responsible for the "bad" classification of the sediments of the Upper Rhine is HCB.

Measures aimed at improving the quantitative groundwater status

In the brown-coal mining area along the German-Dutch border, percolation and compensatory measures ensure that ecosystems on both sides of the frontier depending on groundwater are not at risk.

[32] Sediment Management Plan Rhine, 2009, Koblenz – ICPR – Technical Report No. 175 - www.iksr.org - Technical Reports

7.1.3 Harmonisation of water uses (navigation, energy production, flood protection, space-relevant uses and others) with environmental objectives

This fourth important management issue in the IRBD Rhine is more concerned with processes. The functions of drinking water, water for agriculture and factories, water and transportation, inland fishery, recreation and tourism must be harmonised with ecosystem protection.

The ICPR can look back upon a long tradition when cooperating with groups protecting and using the water environment. Already when implementing the Rhine Action Programme, the exchange of information with drinking water works, industry, navigation and ports was intensive. Since 1998, non-governmental organisations (NGO) have had an observer status with the ICPR. Once these organisations are acknowledged as observers, they may not only participate in the plenary assemblies, but also in working and expert groups.

The present list of acknowledged NGO is attached as Annex 11. Therefore, by participating in the work of the ICPR, the representatives of environment organisations, industrial federations, drinking water works and scientific associations are aware of current issues and decisions and have taken part in discussions on the different levels of work.

During the last years, more and more congresses and workshops have been staged with participants from different user groups in order to sensitize them for the achievement of environmental objectives and to search for common solutions to the problems at stake.

In particular, the following events have been staged:

- 1st International Rhine Symposium of the ICPR, "Living with the Rhine", 1995, Koblenz
- 2nd International Rhine Symposium of the ICPR "Salmon 2000", 1999, Rastatt
- 3rd International Rhine Symposium of the ICPR "Ecology and Flood Prevention", 2000, Cologne
- 4th International Rhine Symposium of the ICPR, "The River, the Port and the Sea", 2000, Rotterdam
- 5th International Rhine Symposium of the ICPR "Up- and downstream fish migration", Bonn, 2005 (in particular water protection, hydropower use, fisheries associations)
- International workshops within the TIMIS Flood project (Mainz, Trier, Zolikon, Schengen during 2005-2008)
- Workshop "Water protection and navigation", April

2006, Bonn, CCNR – ICPR (water protection and navigation in general)

- Workshop, May 2007, Bonn, Micro-pollutions (water protection, drinking water works and industry)
- Round Table on the Master Plan Migratory Fish Rhine, June 2007, Bonn
- Workshop, April 2008, Strasbourg, CCNR-ICPR on ecological design of the banks of shipping lanes (water protection, navigation, hydropower).

It is important that all users and stakeholders are involved in decision-making processes on measures to be taken in order to achieve sustainable development of the river system according to the requirements of the WFD. In all states, federal states or regions there are different bodies (e.g. representatives of local authorities, farmers, industry, consumers, NGO, power producers, chambers of commerce) which are informed at different levels of detail and are thus involved in the planning of measures.

7.2 Summary of measures according to Annex VII A, No. 7 WFD

7.2.1 Implementation of EU regulations on water protection

Attention is drawn to the information on the implementation of EU regulations on water protection in the programmes of measures of the EU member states in the international Rhine river basin district.

7.2.2 Recovery of costs for water use

Except for Luxemburg, the national approaches in the EU member states described in the survey largely still apply. That is why the new situation concerning Luxemburg is explained in more detail.

In Luxemburg, initial investment subsidies are granted by the fund for water management for investments concerning wastewater treatment, management of precipitation water, water body maintenance and renaturation; this fund is financed by fees for water abstraction and wastewater fees charged by the state as well as by the state budget and loans. As of 1.1.2010, the global costs for planning, constructing, operating, maintaining and servicing water supply and wastewater disposal infrastructures and their depreciation will be covered by the water fees for human consumption and wastewater. The water price results from these two fees collected by the municipalities and their agencies. In addition, there is the state fee for water abstraction and the wastewater fee. This means that there are as many different water prices as there are municipalities. It must also be noted that before 1 January 2010, the rate of costs recovery for drinking water amounted to about 80% and to about 50 % for wastewater.

7.2.3 Water bodies for drinking water abstraction

In the states, resp. federal states/regions of the Rhine catchment area, a large share of the drinking water supplied comes from groundwater. As a result, many groundwater bodies must be protected for drinking water supply purposes and because the relevant daily abstraction quantities amount only to 10m³.

The definition of water conservation areas is one particular means of protecting drinking water supplies. See Map K 5-1 of the survey.

7.2.4 Water abstraction or impoundment

There are no relevant (drinking) water abstractions or impoundments at Level A. Reference is made, therefore, to the national regulations and the B parts.

7.2.5 Point sources and other activities impacting on the state of waters

With respect to overall consideration of the international Rhine river basin district, attention is drawn to the four major management issues dealt with in Chapter 7.1.

7.2.6 Direct discharges into groundwater

In the Rhine river basin, authorisations for direct discharges into groundwater are only of local, rarely of regional importance. Therefore, these measures are not relevant at river basin district level (Level A). A detailed description of the effects of cases in which authorisation was given for direct discharges into groundwater is provided in the reports in Part B.

This also applies to artificial filling in or recharge of groundwater bodies.

7.2.7 Priority substances

Please refer to details of Chapter 7.1.2 concerning Management Issues 2 and 3.

7.2.8 Accidental pollution

Prevention of accidents and security of industrial plants

In practice, accidents in industrial plants may result in far-reaching, transboundary effects on waters – in particular restrictions on their use as drinking water or industrial water, and may damage the aquatic ecosystem.

Therefore, "Recommendations of the International Commission for the Protection on the Rhine on the prevention of accidents and security of industrial plants" were drafted during recent years and can be downloaded from the ICPR homepage (www.iksr.org) In all Rhine-bordering countries, the national regulations correspond to these recommendations.

An analysis of accidents along the Rhine today reveals a considerable reduction of accidents in such plants.

Warning and Alarm Plan for the Rhine

In 1986, the ICPR introduced a Warning and Alarm Plan to avert danger due to water pollution and to detect and prosecute the originators of pollution incidents (discharges, accidents in industry or navigation).

Seven international main warning centres collect and distribute the messages (see Fig. 10). When assessing an alarm, the international main warning centres and the competent authorities have a flow time model, a set of guidance values for "alarm-relevant" concentrations and loads, lists of experts, substance data banks and further means at their disposal.

Within the Rhine WAP, the messages are passed on upstream (search messages) and downstream (information or warning) with standardised forms in three languages (German, French, Dutch).

Some of the areas of operation in the Rhine river basin district (e.g. the International Commissions for the protection of Moselle and Saar) have their own warning and alarm plans in place which are detailed in the B reports.

Fig. 10 Main international warning centres

7.2.9 Additional measures for water bodies which will presumably not achieve the objectives set out in WFD Article 4

At present, nothing can be said in respect to additional measures according to Articles 11, Par. 5 WFD, as these will only be determined should the objectives not have been achieved by implementing the measures planned in the programmes of measures.

7.2.10 Additional measures

As for additional measures concerning the main management issues, reference is made to Chapter 7.1. Further details can be obtained in the B parts.

7.2.11 Pollution of the marine environment

The qualitative improvement of the marine environment, in particular of the coastal areas of the North Sea and Wadden Sea, is mainly achieved by inshore emission measures. Restoration and structural measures implemented in the delta and further upstream increase the self-purifying capacity of surface waters. This also applies to the restoration of natural transitions (freshwater – salt water, wet – dry) and increased water detention time due to longer water retention. In the long run, this will also be beneficial for the marine environment.

With respect to many priority substances and other pollution, the water quality of the marine environment corresponds to the environment objectives. Among the priority substances, tributyltin, the sum of the benzo(ghi)perylen and indeno(1,2,3-cd)pyren exceed these objectives. For some substances, a thorough test is not possible, as the current reporting value is too high. Among other things, this concerns flame retardants and dichlorvos. As far as these substances are concerned, an eventual risk for the marine environment can not yet be sufficiently translated into a reduction objective.

Regarding the protection of the marine environment against nitrogen, reference is made to Chapter 5.1.1, for measures to Chapter 7.1.2.

15 July 2008, the European marine strategy framework directive (Directive 2008/56/EC) came into force. It includes different dispositions aimed at granting coordination with other European regulations. Among others, the WFD is concerned. It also includes international cooperation at river basin district level.

8 Detailed list of programmes and management plans

Within the framework of ICPR or other international cooperations, the following programmes have been drafted: Rhine 2020, Programme for Lake Constance lake trout, Habitat Connectivity. They correspond to the measures detailed in Chapter 7.1.

Furthermore, reference is made to the websites of the states and regions/federal states (Part B).

Belgium: http://environnement.wallonie.be

Germany:

Baden-Württemberg: www.wrrl.baden-wuerttemberg.de

Bavaria: www.wrrl.bayern.de

Hesse: www.flussgebiete.hessen.de

Northrhine-Westphalia: www.flussgebiete.nrw.de;

wiki.flussgebiete.nrw.de

Lower Saxony: www.nlwkn.de

Rhineland-Palatinate: www.wrrl.rlp.de

Saarland: www.saarland.de

Thuringia: http://www.flussgebiete.thueringen.de.

France: www.eau2015-rhin-meuse.fr

Liechtenstein: www.llv.li/amtsstellen/llv-aus-wasserwirtschaft.htm

Luxemburg: www.waasser.lu

Netherlands: www.kaderrichtlijnwater.nl

Austria: wisa.lebensministerium.at; www.vorarlberg.at

Switzerland: www.bafu.admin.ch/wasser

Further background information is available on the websites of the ICPR (www.iksr.org), the IKSMS for the international Moselle-Saar district (www.iksms.de) or of the IGKB for Lake Constance (www.igkb.org).

9 Information of the public and public hearings as well as their results

Article 14 of the WFD requires that the public be informed and its responses taken into consideration. It also charges the Member States with the task of furthering the active participation of all concerned.

In the Rhine river basin, the public is informed at national as well as at international level. Hearings have been or are being organised by the member states resp. federal states/ regions. Details are included in the Part B reports.

At international level, information is, above all, disseminated by the website of the ICPR, www.iksr.org. This website informs the public about the Rhine river basin district and the WFD. Moreover, all reports, in particular those issued at international level, (reports required under Article 3, 5 and 8 WFD) and publications ("Rhine unlimited" brochure) are available as downloads. There are links to the (national) hearings.

The WFD places great value on the integration of the public – i.e. all inhabitants of the Rhine river basin - in the process. For the most important phases of implementation the directive provides for hearings in three phases:

- Hearing concerning schedule and work programme;
- Hearing concerning the most important water management issues;
- Hearing concerning the management plan.

At international level, the acknowledged observers from the diverse water utilisation and protection sectors are represented in the working groups and the plenary assembly/coordination committee and can, therefore, participate in the discussions and present their issues.

In the third phase of the hearing on the first management plan for the RBD Rhine, the IAWR, the BUND and the GRÜNE LIGA as well as the port of Rotterdam made statements. Aspects addressed by the non-governmental organisations have been explained in more detail or worded in more precise terms in the management plan where required. Among other things, these statements concerned the application of the "Prague Approach" and of the "Reference-based approach" or the interpretation of the "good ecological quality", how to treat diffuse nutrient inputs, statements on salt contamination and on including further micro-pollutants. Furthermore, by the end of 2008, the draft of the management plan did not provide precise statements on measures aimed at improving river continuity and structure which have now been included in the final version of the management plan or detailed in the corresponding Annexes.

The states resp. federal states/regions co-operating in the ICPR have addressed a coordinated document to the non-governmental organisations concerning these aspects; it has also been published on the ICPR website (www.iksr.org).

The states, resp. federal states/regions have chosen different approaches to further active participation, in particular of the organised public (associations in agriculture, environmental protection, of hydropower production, etc) within the implementation of the WFD. In several cases, temporary or permanent discussion groups to assist the implementation process were established at national or regional level at an early stage. Further details are included in the Part B reports.

10 List of competent authorities according to Annex I

See Annex 12

11 Contact addresses and procedures for obtaining background documents

We refer to the list of competent authorities in Annex 12.

Furthermore, reference is made to the ICPR website (www.iksr.org) and to the detailed information – including the procedure of how to procure background documents – on Part B level.

Internationally Coordinated Management Plan for the International River Basin District of the Rhine

Annexes

Ecological assessment of the monitoring stations incorporated in the surveillance monitoring programme according to WFD

Annex 1 *State: December 2009*

Legend: Ecological assessment according to WFD		Specific pollutants *		Category of the water body where the monitoring station is located	
very good		* These parameters support the biological components when assessing the ecological state. In FR, LU and NL the physical-chemical parameters have been taken into account in the assessment indicated.		natural (**N**atural)	**N**
good		**All environmental quality standards respected**		artificial (**A**rtificial)	**A**
moderate		One or more environmental quality standards **not respected** (see annex 2)		heavily modified (**H**eavily **M**odified)	**HM**
poor		Assessment of quality component **not required**	**./.**	** Angiospermae (seaweeds and common salt marsh grass) in the Wadden Sea	*** Phytobenthos on the Moselle: Degradation from IV to V as the halobic index indicates salinization
bad		**No inventory or assessment** of the component / insufficient data			

Section of the main stream of the Rhine / tributaries	Responsibility	Location of the monitoring station	Biological quality component: Phytoplankton	*Partial component Macrophytes*	*Partial component Phytobenthos (benthic diatoms)*	Macrophytes / Phytobenthos	Makrozoo-benthos	Fish	Specific pollutants *	Total ecological assessment	Category of the water body where the monitoring station is located
Rhine	AT	Alpine Rhine near Fussach	./.								HM
Lake Constance	DEBW	Upper Lake near Fischbach-Uttwil									N
Lake Constance	DEBW	Lower Lake (Zellersee)									N
Rhine	DEBW, CH	High Rhine near Öhningen									N
Rhine	DEBW	Upper Rhine near Weil am Rhein									HM
Rhine	FR	Old Rhine near Kembs / Weil am Rhein	./.								HM
Rhine	FR	Upper Rhine near Rhinau	./.								HM
Rhine	FR	Upper Rhine near Gambsheim	./.								HM
Rhine	FR	Upper Rhine near Lauterbourg / Karlsruhe	./.								HM
Rhine	DEBW	Upper Rhine near Karlsruhe									HM
Rhine	DERP	Upper Rhine near Worms									HM
Rhine	DERP	Upper Rhine near Mainz-Wiesbaden									HM
Rhine	DERP	Middle Rhine near Koblenz									HM
Rhine	DENW	Lower Rhine near Cologne-Godorf									HM
Rhine	DENW	Lower Rhine near Düsseldorf (port)									HM
Rhine	DENW	Lower Rhine near Duisburg-Walsum / Orsoy									HM
Rhine	DENW	Lower Rhine near Niedermoermter / Rees									HM
Rhine	NL	Bovenrijn, Waal near Lobith									HM
Rhine	NL	Nieuwe Waterweg near Maassluis									A
Lake IJssel	NL	Lake IJssel near Vrouwenzand									HM
Wadden Sea	NL	Wadden Sea near Doove Balg west									N
Wadden Sea	NL	Wadden Sea near Dantziggat				**					N
Dutch coast	NL	Dutch Coast near Noordwijk (2)						./.			N
Wadden Sea coast	NL	Wadden Sea coast near Boomkensdiep						./.			N
Neckar	DEBW	Neckar near Deizisau									HM
Neckar	DEBW	Neckar near Kochendorf									HM
Neckar	DEBW	Neckar near Mannheim									HM
Weschnitz	DEHE	Weschnitz near Biblis-Wattenheim	./.								N
R. Main	DEBY	Regnitz near Hausen									N
R. Main	DEBY	Main near Erlabrunn									HM
R. Main	DEBY	Main near Hallstadt									N
R. Main	DEBY	Main near Kahl									HM
R. Main	DEHE	Schwarzbach near Trebur-Astheim	./.								N
R. Main	DEHE	Nidda near Frankfurt - Nied	./.								HM
R. Main	DEHE	Kinzig near Hanau	./.								N
R. Main	DEHE	Main near Bischoffsheim									HM
Nahe	DERP	Nahe near Dietersheim									N
Lahn	DEHE	Lahn near Limburg-Staffel									HM
Lahn	DEHE	Lahn near Solms-Oberbiel									HM
Lahn	DERP	Lahn near Lahnstein									HM
Moselle-Sarre	DESL	Blies near Reinheim									N
Moselle-Sarre	DESL	Saar near Güdingen									HM
Moselle-Sarre	DESL	Nied near Niedaltdorf									N
Moselle-Sarre	DESL	Sarre near Fremersdorf									HM
Moselle-Sarre	DERP	Sarre near Kanzem									N
Moselle-Sarre	LU	Alzette near Ettelbruck									N
Moselle-Sarre	LU	Wiltz near Kautenbach									N
Moselle-Sarre	LU and DERP	Sauer, outlet at Wasserbillig									N
Moselle-Sarre	LU and DERP	Moselle near Palzem			***						HM
Moselle-Sarre	DERP	Moselle near Fankel			***						HM
Moselle-Sarre	DERP	Moselle near Koblenz			***						HM
Sieg	DENW	Sieg near Menden (St. Augustin)									N
Ruhr	DENW	Ruhr near Fröndenberg	./.								HM
Ruhr	DENW	Ruhr-outlet (Duisburg Ruhrort)									HM
Lippe	DENW	Lippe near Lippborg	./.								N
Lippe	DENW	Lippe near Wesel	./.								N
Vechte	DENI	Vechte near Laar									HM
Vechte	NL	Vechte upstream of Vechterweerd									HM

Assessment results for the monitoring stations incorporated in the “Chemistry” surveillance monitoring programme according to WFD

(River specific) substances relevant for the Rhine and physical-chemical parameters

Annex 2 14.12.2009

(yellow)	In excess of EQS/guidance value
(green)	Lower than EQS/guidance value
x	no decision possible because of too high limit of determination
-	no measurements available
*	Coastal waters outside the 1-mile zone: No classification required
Number	No EQS determined as yet
(white)	Monitoring stations at Standing inland surface waters
(grey)	Monitoring stations at "other bodies of surface water"

rhr = substance figuring on the list of Rhine substances (ICPR report no. 161)

Substance	Code Germany	Unity	Status WFD
Physical-chemical parameters (supporting the assessment of the ecological state/potential) according to WFD, Annex V			
Dissolved oxygen		mg/l	Annex V
Water temperature	1011	°C	Annex V
pH	1061		Annex V
Conductivity	1082	µS/cm	Annex V
Cl⁻	1331	mg/l	Annex V
Total nitrogen	1241	mg/l	Annex V
Nitrate nitrogen	1245	mg/l	Annex V
Orthophosphate phosphorous	1264	mg/l	Annex V
Total phosphorous	1269	mg/l	Annex V
In excess of one or more national reference value(s)			
Lower than all national reference values			
(River specific) substances relevant for the Rhine			
Inorganic substances			
NH_4-N	1249	mg/l	rhr
Heavy metals and metalloids (solute)			
As sol.	1142	µg/l	rhr
Cr sol.	1151	µg/l	rhr
Cu sol.	1161	µg/l	rhr
Zn sol.	1164	µg/l	rhr
Non-volatile hydrocarbons			
4-chloroaniline	2516	µg/l	rhr
Pesticides			
bentazone	2290	µg/l	rhr
chlorotolurone	2235	µg/l	rhr
dichloroprop (2.4 DP)	2254	µg/l	rhr
dichlorvos	2723	µg/l	rhr
dimethoate	2730	µg/l	rhr
MCPA	2253	µg/l	rhr
mecoprop	2255	µg/l	rhr
PCB			
PCB 28	2071	µg/l	rhr
PCB 52	2072	µg/l	rhr
PCB 101	2073	µg/l	rhr
PCB 118	2079	µg/l	rhr
PCB 138	2074	µg/l	rhr
PCB 153	2076	µg/l	rhr
PCB 180	2077	µg/l	rhr
PCB 28 in suspended matter	2071	µg/kg	rhr
PCB 52 in suspended matter	2072	µg/kg	rhr
PCB 101 in suspended matter	2073	µg/kg	rhr
PCB 118 in suspended matter	2079	µg/kg	rhr
PCB 138 in suspended matter	2074	µg/kg	rhr
PCB 153 in suspended matter	2076	µg/kg	rhr
PCB 180 in suspended matter	2077	µg/kg	rhr
Organo-tin compounds			
dibutyltin-cation	2767	µg/l	rhr
Calculation based on suspended matter:			
PCB			
PCB 28	2071	ng/l	rhr
PCB 52	2072	ng/l	rhr
PCB 101	2073	ng/l	rhr
PCB 118	2079	ng/l	rhr
PCB 138	2074	ng/l	rhr
PCB 153	2076	ng/l	rhr
PCB 180	2077	ng/l	rhr
Measured in suspended matter:			
Heavy metals and metalloids			
As		mg/kg	rhr
Cr III+VI		mg/kg	rhr
Cu		mg/kg	rhr
Zn		mg/kg	rhr
Organo-tin compounds			
dibutyltin-cation		µg/kg	rhr
In excess of one or more EQS for substances relevant for the Rhine			
Below all EQS for substances relevant for the Rhine			

Monitoring station no. / River / Station:

Substance	Ach near Bregenz 61 Fussach	Rhine 60 Fussach/Alpine Rhine	Rhine 5 Öhningen	Rhine 1 Rekingen	Rhine 2 Weil am Rhein	Rhine 7 Karlsruhe/Lauterbourg	Rhine 11 Worms	Rhine 12 Mainz	Rhine 13 Koblenz	Rhine 32 Bad Honnef	Rhine 34 Düsseldorf-Flehe	Rhine 35 Bimmen	Rhine 41 Lobith	Rhine 43 Kampen	Rhine 42 Maassluis
Dissolved oxygen				11,2											
Water temperature				12,3											
pH				8,2											
Conductivity				349		376	451		442	528	542	616			
Cl⁻				9,5											
Total nitrogen				1,5		1,9	2,2		2,6	3,1	3,0	3,1			
Nitrate nitrogen				1,4	1,5	1,6	1,9		2,4	2,5	2,5	2,4			
Orthophosphate phosphorous				0,008											
Total phosphorous				0,023		0,043									
NH_4-N				0,025											
As sol.			0,78	-	-	0,92	-	-	-						
Cr sol.			0,3	-	-	0,5	-	-	-						
Cu sol.			0,8	-	-	1,4	-		1,5						
Zn sol.			< 2	-	-	< 2	-	-	-						
4-chloroaniline	-	-	-	-						x	x	x			
bentazone	-	-		-											
chlorotolurone	-	-		-											
dichloroprop (2.4 DP)	-	-		-											
dichlorvos	-	-	x	-	-	x	-	x	x	x	x	x	x	x	x
dimethoate	-	-		-			-		-						
MCPA	-	-		-											
mecoprop	-	-		-											
PCB 28–PCB 180 (µg/l)	-	-	-		-	-	-	-	-	-	-	-	x	x	x
PCB 28 in suspended matter							-								
PCB 52 in suspended matter							-								
PCB 101 in suspended matter							-								
PCB 118 in suspended matter	-	-	-	-			-								
PCB 138 in suspended matter							-								
PCB 153 in suspended matter							-								
PCB 180 in suspended matter							-								
dibutyltin-cation (µg/l)			-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 28 (ng/l)	-	-	-	-	-	-	-	-	-	-	-	-			
PCB 52 (ng/l)	-	-					-	-	-						
PCB 101 (ng/l)	-	-					-	-	-						
PCB 118 (ng/l)	-	-					-	-	-				-	-	-
PCB 138 (ng/l)	-	-					-	-	-						
PCB 153 (ng/l)	-	-					-	-	-						
PCB 180 (ng/l)	-	-					-	-	-						
As (mg/kg)	-	-					-								
Cr III+VI (mg/kg)	-	-					-								
Cu (mg/kg)	-	-					-								
Zn (mg/kg)	-	-					-								
dibutyltin-cation (µg/kg)	-	-					-								

Substance	Neckar 8 Deizisau	Neckar 9 Kochendorf	Neckar 10 Mannheim	Weschnitz 31 Biblis-Wattenheim	Schwarzbach 28 Trebur-Astheim	Main 54 Hallstadt	Main 24 Erlabrunn	Main 23 Kahl a. Main	Main 25 Bischofsheim	Regnitz 55 Hausen	Kinzig 26 Hanau	Nidda 27 Nied	Nahe 19 Dietersheim (Grolsheim)	Lahn 29 Solms-Oberbiel	Lahn 30 Limburg	Lahn 20 Lahnstein
Conductivity	741	751	728			425	610	532		560						
Total nitrogen	5,0	5,1	5,0			4,3	5,1	4,9		-						
Nitrate nitrogen	4,3	4,5	4,5			3,7	4,8	4,5		5,6						
Total phosphorous	0,16	0,23	0,21													
As sol.	0,58	0,8	0,98			-		-		-			-			-
Cr sol.	0,6	0,8	0,9			-		-		-			-			-
Cu sol.	2,1	2,9	2,5			-		-		-						
Zn sol.	3,7	4,4	2,9			-		-		-			-			-
4-chloroaniline	-	-										-				-
bentazone						-										
chlorotolurone						-										
dichloroprop (2.4 DP)						-										
dichlorvos	x	x	x	x	x	-	-	-	x	-	x	x	x	x	x	x
dimethoate						-										
MCPA						-										
mecoprop						-										
PCB 28–PCB 180 (µg/l)	-	-	-	-	-			-	-		-	-	-	-	-	-
PCB 28–PCB 180 in suspended matter											-					
dibutyltin-cation (µg/l)	-	-	-	-	-	-		-	-		-	-	-	-	-	-
PCB 28 (ng/l)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB 52 (ng/l)				-	-	-	-	-		-			-			-
PCB 101 (ng/l)				-	-	-	-	-		-			-			-
PCB 118 (ng/l)				-	-	-	-	-		-			-			-
PCB 138 (ng/l)				-	-	-	-	-		-			-			-
PCB 153 (ng/l)				-	-	-	-	-		-			-			-
PCB 180 (ng/l)				-	-	-	-	-		-			-			-

Substance	Moselle 15 Palzem	Moselle 17 Fankel	Moselle 18 Koblenz	Saar 21 Saarbrücken	Saar 22 Fremersdorf	Saar 14 Kanzem	Blies 52 Reinheim	Nied 53 Niedaltdorf	Alzette 56 Ettelbruck	Wiltz 57 Kautenbach	Sauer 16 Wasserbillig	Sieg 36 Menden	Wupper 37 Leverkusen-Rheindorf	Erft 40 Neuss	Ruhr 38 Duisburg-Ruhrort	Emscher 33 Mouth R. Emscher	Lippe 39 Wesel	Vecht 51 Vecht stuw Vechterweerd	Lake IJssel 44 Vrouwezand	Wadden Sea 45 Doove Balg west	Wadden Sea 46 Dantziggat	Dutch coast 47 Noordwijk 2	Dutch coast 48 Noordwijk 10*	Waddenkust 49 Boomkensdiep	Waddenkust 50 Terschelling 10*
Dissolved oxygen			9,9																						
Water temperature			13,8																						
Conductivity			853									230	359	859	461	2649	1368								
Cl⁻			160																						
Total nitrogen			3,7									3,4	4,6	2,3	3,5	5,4	6,2								
Nitrate nitrogen			3,2									2,9	3,9	1,9	3	3,3	5,4								
As sol.	-	-	-	1,23	1,51	-	0,92	1,78			-										-	-		-	
Cr sol.	-	-	-	1,38	1,57	-	0,70	2,10			-										-	-		-	
Cu sol.			1,8	2,78	3,38		2,54	3,76																	
Zn sol.	-	-	-	9	19	-	14	10			-														
4-chloroaniline		-	-						-		-	x	x	x	x	x	x				-	-		-	
bentazone																					-	-		-	
chlorotolurone																									
dichloroprop (2.4 DP)									-	-											-	-		-	
dichlorvos	x	x	x	-	-	x	-	-				x	x	x	x	x	x		x	x	x			x	
dimethoate			-						-	-															
MCPA									-	-											-	-		-	
mecoprop									-	-											-	-		-	
PCB 28 (µg/l)				x	x		x	x																	
PCB 52 (µg/l)				x	x		x	x																	
PCB 101 (µg/l)				x	x		x	x																	
PCB 118 (µg/l)	-	-	-	x	x	-	x	x	-		-	-	-	-	-		-	x	x	x	x	x	x	x	x
PCB 138 (µg/l)				x	x		x	x																	
PCB 153 (µg/l)				x	x		x	x																	
PCB 180 (µg/l)				x	x		x	x																	
PCB 28 in suspended matter									-																
PCB 118 in suspended matter																			-				-	-	-
dibutyltin-cation (µg/l)	-	-	-			-			-		-	-		-	-							x		x	
PCB 28 (ng/l)	-	-	-			-						-	-	-	-		-								
PCB 52 (ng/l)	-	-				-																			
PCB 101 (ng/l)	-	-				-																			
PCB 118 (ng/l)	-	-				-																			
PCB 138 (ng/l)	-	-				-																			
PCB 153 (ng/l)	-	-				-																			
PCB 180 (ng/l)	-	-				-																			

Annex 3: Environmental quality standards for the Rhine (EQS Rhine) – scientific status 2007 – for substances relevant for the Rhine according to CC 17-03 rev. 09./10.10.03 *

Substance	Annual mean value EQS Rhine Inland surface waters according to WFD (in µg/l)	Acceptable maximum concentration EQS Rhine Inland surface waters according to WFD (in µg/l)	EQS Rhine inland surface waters "Water for human consumption" (98/83/EC) 5) (in µg/l)	Annual mean value EQS Rhine Coastal and transitional waters according to WFD (in µg/l)	Acceptable maximum concentration EQS Rhine Coastal and transitional waters according to WFD (in µg/l)
arsenic 1)	BC 2) + 0.5	BC 2) + 8.0	10	BC 2) + 0.6	BC 2) + 1.1
chromium 1)	BC 2) + 3.4	- 6)	50	BC 2) + 0.6	- 6)
zinc 1)	BC 2) + 7.8	BC 2) + 15.6	-	BC 2) + 3	-
bentazone	73	450	0.1	7.3	45
4-chloroaniline	0.22	1.2	0.1 4)	0.057	0.12
chlorotolurone	0.4	2.3	0.1	0.04	0.23
dichlorvos	0.0006	0.0007	0.1	0.00006	0.00007
dichloroprop	1.0	7.6	0.1	0.13	0.76
dimethoate	0.07	0.7	0.1	0.07	0.7
mecoprop	18	160	0.1	1.8	16
MCPA	1.4	15	0.1	0.14	1.5
dibutyl-tin compounds (related to cation)	0.09	-	-	0.09	-
ammonium-N 3)	Depending on temperature and pH; see table a	Depending on temperature and pH; see table b	390	-	-
PCB 28, 52, 101, 118, 138, 153	Wait for termination of work on EU level.	Wait for termination of work on EU level.	-	Wait for termination of work on EU level.	Wait for termination of work on EU level.

EQS-Rhine = Environmental quality standard Rhine

* The ICPR target values for the main stream (see www.iksr.org: ICPR - document no. 159) continue to apply. On the long term, concentrations may not significantly rise (interdiction of deterioration). More exacting national standards are not concerned. There is no EQS-Rhine for copper.

1) The EQS concern the dissolved share (filtered sample); for chromium they concern the sum of chromium (III and VI)

2) BC = Background concentration
Arsenic: BC = 1 µg/l (Rhine and tributaries)

Chromium (sum Cr III and VI): BC = 0.38 µg/l (Rhine and tributaries), ca. 0.02 – 0.5 µg/l (other waters)
Zinc: BC = 3 µg/l (Rhine and tributaries), 1 µg/l other waters

3) See substance data sheet with corrected values for pH and temperature
4) 4-chloroaniline is not only a chemical substance applied in industry but also a pesticide degradation product.
5) For surface water bodies used for drinking water abstraction the maximum value of the directive "Water for human consumption" (98/83/EC) must be strived for, if this value is below the EQS-Rhine value according to WFD derived for inland surface water bodies.
6) The derived value cannot be applied. The mean annual value of EQS Rhine confers sufficient protection.

Table a: Mean annual value EQS Rhine for inland surface waters according to WFD NH3-N, Transposed into total ammonium nitrogen (NH4-N + NH3-N) in mg/l

		Temperature						
		0	5	10	15	20	25	30
pH	5.5	157.467	104.122	69.862	47.529	32.763	22.869	16.153
	6	49.798	32.929	22.095	15.033	10.363	7.237	5.111
	6.5	15.750	10.416	6.990	4.757	3.280	2.291	1.619
	7	4.984	3.297	2.213	1.507	1.040	0.727	0.515
	7.5	1.579	1.045	0.703	0.479	0.332	0.233	0.166
	7.6	1.255	0.831	0.559	0.382	0.264	0.186	0.132
	7.7	0.998	0.661	0.445	0.304	0.211	0.148	0.106
	7.8	0.793	0.526	0.354	0.242	0.168	0.119	0.085
	7.9	0.631	0.419	0.282	0.193	0.135	0.095	0.068
	8	0.502	0.333	0.225	0.154	0.108	0.076	0.055
	8.1	0.400	0.266	0.180	0.123	0.086	0.062	0.045
	8.2	0.318	0.212	0.143	0.099	0.069	0.050	0.036
	8.3	0.254	0.169	0.115	0.079	0.056	0.040	0.030
	8.4	0.202	0.135	0.092	0.064	0.045	0.033	0.024
	8.5	0.162	0.108	0.074	0.052	0.037	0.027	0.020
	9	0.054	0.037	0.026	0.019	0.014	0.011	0.009

Grey background: In excess of the imperative value of the Directive for Fish Waters:
0.778 mg/l NH_4-N + NH_3-N resp. 1 mg/l Ammonium

Table b: Maximum permitted concentration - EQS Rhine for inland surface waters according to WFD NH3-N, Transposed into total ammonium nitrogen (NH4-N + NH3-N) in mg/l

		Temperature						
		0	5	10	15	20	25	30
pH	5,5	314.950	208.243	139.724	95.057	65.526	45.737	32.306
	6	99.597	65.858	44.190	30.065	20.727	14.469	10.222
	6,5	31.501	20.838	13.980	9.513	6.560	4.581	3.238
	7	9.967	6.593	4.426	3.014	2.080	1.454	1.030
	7,5	3.157	2.091	1.405	0.959	0.663	0.465	0.331
	7,6	2.510	1.662	1.118	0.763	0.529	0.371	0.265
	7,7	1.995	1.322	0.890	0.608	0.422	0.297	0.212
	7,8	1.587	0.780	0.708	0.485	0.337	0.237	0.170
	7,9	1.262	0.979	0.564	0.387	0.269	0.190	0.137
	8	1.004	0.667	0.450	0.309	0.215	0.153	0.110
	8,1	0.799	0.535	0.359	0.247	0.173	0.123	0.089
	8,2	0.637	0.424	0.287	0.198	0.139	0.099	0.073
	8,3	0.507	0.338	0.230	0.159	0.112	0.081	0.059
	8,4	0.405	0.270	0.184	0.128	0.091	0.066	0.049
	8,5	0.323	0.216	0.148	0.103	0.074	0.054	0.040
	9	0.108	0.074	0.052	0.038	0.029	0.023	0.018

Grey background: exceeds of the imperative value of the Directive for Fish Waters:
0.778 mg/l NH_4-N + NH_3-N resp. 1 mg/l ammonium

Annex 4: Environmental quality standards for priority substances and certain other pollutants (Part A, Annex I of EC Directive 2008/105/EC)

MAV: Mean annual value; PMC: Permitted maximum concentration; unity: [µg/l]

1	2	3	4	5	6	7
Number	**name of the substance**	CAS Number[i]	MAV-EQS[ii] Inland surface waters[iii]	MAV-EQS[ii] Other surface waters	PMC-EQS[iv] Inland surface waters[iii]	PMC-EQS[iv] Other surface waters
1	alachlor	15972-60-8	0.3	0.3	0.7	0.7
2	anthracene	120-12-7	0.1	0.1	0.4	0.4
3	atrazine	1912-24-9	0.6	0.6	2.0	2.0
4	benzene	71-43-2	10	8	50	50
5	brominated diphenylether[v]	32534-81-9	0.0005	0.0002	Not applicable	Not applicable
6	cadmium and compounds (according to water hardness) [vi]	7440-43-9	≤ 0.08 (Kl. 1) 0.08 (Kl. 2) 0.09 (Kl. 3) 0.15 (Kl. 4) 0.25 (Kl. 5)	0.2	≤ 0.45 (Kl. 1) 0.45 (KL. 2) 0.6 (Kl. 3) 0.9 (Kl. 4) 1.5 (Kl. 5)	
6bis	carbon tetrachloride [vii]	56-23-5	12	12	Not applicable	Not applicable
7	C10-13-chloroalkanes (SCCP)	85535-84-8	0.4	0.4	1.4	1.4
8	chlorofenvinphos	470-90-6	0.1	0.1	0.3	0.3
9	chloropyriphos	2921-88-2	0.03	0.03	0.1	0.1
9bis	cyclodien pesticides: aldrin [vii] dieldrin [vii] endrin [vii] isodrin [vii]	 309-00-2 60-57-1 72-20-8 465-73-6	Σ=0.01	Σ=0.005	Not applicable	Not applicable
9ter	total DDT [vii, viii] p.p.'-DDT [vii]	Not applicable 50-29-3	0.025 0.01	0.025 0.01	Not applicable Not applicable	Not applicable Not applicable
10	1,2-dichlorethane	107-06-2	10	10	Not applicable	Not applicable
11	dichloromethane (methylene chloride)	75-09-2	20	20	Not applicable	Not applicable
12	bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	1.3	1.3	Not applicable	Not applicable
13	diurone	330-54-1	0.2	0.2	1.8	1.8
14	endosulfan	115-29-7	0.005	0.0005	0.01	0.004
15	fluoranthene	206-44-0	0.1	0.1	1	1
16	hexachlorobenzene	118-74-1	0.01[ix]	0.01[ix]	0.05	0.05
17	hexachlorobutadien	87-68-3	0.1[ix]	0.1[ix]	0.6	0.6
18	hexachlorocyclohexane	608-73-1	0.02	0.002	0.04	0.02
19	isoproturone	34123-59-6	0.3	0.3	1.0	1.0
20	lead and lead compounds	7439-92-1	7.2	7.2	Not applicable	Not applicable
21	mercury and mercury compounds	7439-97-6	0.05[ix]	0.05[ix]	0.07	0.07

1	2	3	4	5	6	7
Number	**name of the substance**	CAS Number[i]	MAV-EQS[ii] Inland surface waters[iii]	MAV-EQS[ii] Other surface waters	PMC-EQS[iv] Inland surface waters[iii]	PMC-EQS[iv] Other surface waters
22	naphthalene	91-20-3	2.4	1.2	Not applicable	Not applicable
23	nickel and nickel compounds	7440-02-0	20	20	Not applicable	Not applicable
24	nonylphenol (4-nonylphenol)	104-40-5	0.3	0.3	2.0	2.0
25	octylphenol (4-(1,1′,3,3′-tetramethylbutyl)-phenol))	140-66-9	0.1	0.01	Not applicable	Not applicable
26	pentachlorobenzene	608-93-5	0.007	0.0007	Not applicable	Not applicable
27	pentachlorophenol	87-86-5	0.4	0.4	1	1
28	polycyclic aromatic hydrocarbons (PAH) [x] benzo(a)pyrene (benzo(b)fluoranthene (benzo(k)fluoranthene (benzo(ghi)perylene Indeno(1,2,3-cd)pyrene	Not applicable 50-32-8 205-99-2 207-08-9 191-24-2 193-39-5	Not applicable 0.05 Σ=0.03 Σ=0.002	Not applicable 0.05 Σ=0.03 Σ=0.002	Not applicable 0.1 Not applicable Not applicable	Not applicable 0.1 Not applicable Not applicable
29	simazine	122-34-9	1	1	4	4
29bis	tetrachloroethylene[vii]	127-18-4	10	10	Not applicable	Not applicable
29ter	trichloroethylene [vii]	79-01-6	10	10	Not applicable	Not applicable
30	tributyltin compounds (tributyltin-cation)	36643-28-4	0.0002	0.0002	0.0015	0.0015
31	trichlorobenzenes	12002-48-1	0.4	0.4	Not applicable	Not applicable
32	trichloromethane	67-66-3	2.5	2.5	Not applicable	Not applicable
33	trifluralin	1582-09-8	0.03	0.03	Not applicable	Not applicable

i CAS: Chemical Abstracts Service.

ii This parameter corresponds to the environmental quality standard expressed as mean average value (MAV-EQS), If nothing else is indicated it applies to the total concentration of all isomers.

iii Surface water bodies comprise rivers and lakes as well as connected artificial or heavily modified water bodies.

iv This parameter corresponds to the environmental quality standard expressed as permitted maximum concentration (PMC-EQS). If the PMC-EQS is indicated as “not applicable”, the MAV-EQS values also apply as sufficient level of protection during short pollution peaks due to continuous discharges, as they are considerably lower than values determined on the basis of acute toxicity.

v For the group of priority substances belonging to the brominated diphenylethers (nr. 5) listed in Decision Nr. 2455/2001/EC an environmental quality standard is only determined for the congeners of the numbers 28, 7, 99, 100, 153 and 154.

vi For cadmium and cadmium compounds (nr. 6) the EQS depends on water hardness presented in five categories (class 1: <40 mg $CaCO_3$/l, class 2: 40 to <50 mg $CaCO_3$/l, class 3: 50 to <100 mg $CaCO_3$/l, class 4: 100 to <200 mg $CaCO_3$/l and class 5: ≥200 mg $CaCO_3$/l).

vii This is not a priority substance but a substance belonging to the other pollutants for which environmental quality standards are identical to those determined in legal provisions applicable before 13 January 2009.

[viii] Total DDT comprises the sum of isomers 1,1,1-trichloro-2,2-bis-(p-chlorophenyl)ethane (CAS Nr. 50-29-3; EU Nr. 200-024-3), 1,1,1-trichloro-2(o-chlorophenyl)-2-(p-chlorophenyl)ethane (CAS Nr. 789-02-6; EU Nr. 212-332-5), 1,1-Dichloro-2,2-bis-(p-chlorophenyl)ethylene (CAS Nr. 72-55-9; EU-Nr. 200-784-6) and 1,1-dichloro-2,2-bis-(p-chlorophenyl)ethane (CAS Nr. 72-54-8; EU Nr. 200-783-0).

[ix] If a Member State does not apply the environmental quality standard for biota it introduces more stringent environmental quality standards for water, so that the same level of protection is achieved as would have been the case when applying the environmental quality standards for biota determined in Article 3, Paragraph 2 of this Directive. The Member State informs the Commission and the other Member States by through the Committee addressed in Article 21 of the Directive 200/60/EC about the reasons for why this approach is chosen and the alternative environmental quality standards determined for water as well as the data and methods for deriving the alternative environmental quality standards and the category of surface waters for which they are applicable.

[x] As far as the group of polycyclic aromatic hydrocarbons (PAH) (Nr. 28) is concerned, each individual environmental quality standard applies. That means that the environmental quality standard for benzo(a)pyrene and the environmental quality standard for the sum of benzo(b)fluoranthene and benzo(k)fluoranthene and the environmental quality standard for the sum of benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene must be respected.

Assessment results for the monitoring stations incorporated in the "Chemistry" surveillance monitoring programme according to WFD

Priority substances

DIRECTIVE 2008/105/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL
on environmental quality standards in the field of water policy amending
Directive 2000/60/EC
(in force since beginning 2009)

(red)	In excess of UQN Directive 2008/105/EC
(blue)	Below UQN Directive 2008/105/EC
x	no decision possible because of too high limit of determination
-	no measurements available
Numbe	No EQS determined as yet
(white)	Monitoring stations at Standing inland surface waters
(grey)	Monitoring stations at "other bodies of surface water"

Annex 5 14.12.2009

p = priority substance
pg = priority hazardous substance
76/464 = additional substance in daughter directive

River	Monitoring station no.	Name of monitoring station
Ach near Bregenz	61	Fussach
Rhine	60	Fussach/Alpine Rhine
Rhine	5	Öhningen
Rhine	1	Rekingen
Rhine	2	Weil am Rhein
Rhine	7	Karlsruhe/Lauterbourg
Rhine	11	Worms
Rhine	12	Mainz
Rhine	13	Koblenz
Rhine	32	Bad Honnef
Rhine	34	Düsseldorf-Flehe
Rhine	35	Bimmen
Rhine	41	Lobith
Rhine	43	Kampen
Rhine	42	Maassluis
Neckar	8	Deizisau
Neckar	9	Kochendorf
Neckar	10	Mannheim
Weschnitz	31	Biblis-Wattenheim
Schwarzbach	28	Trebur-Astheim
Main	54	Hallstadt
Main	24	Erlabrunn
Main	23	Kahl a. Main
Main	25	Bischofsheim
Regnitz	55	Hausen
Kinzig	26	Hanau
Nidda	27	Nied
Nahe	19	Dietersheim (Grolsheim)
Lahn	29	Solms-Oberbiel
Lahn	30	Limburg
Lahn	20	Lahnstein
Moselle	15	Palzem
Moselle	17	Fankel
Moselle	18	Koblenz
Saar	21	Saarbrücken
Saar	22	Fremersdorf
Saar	14	Kanzem
Blies	52	Reinheim
Nied	53	Niedaltdorf
Alzette	56	Ettelbruck
Wiltz	57	Kautenbch
Sauer	16	Wasserbillig
Sieg	36	Menden
Wupper	37	Leverkusen-Rheindorf
Erft	40	Neuss
Ruhr	38	Duisburg-Ruhrort
Emscher	33	Emscher-Mündung
Lippe	39	Wesel
Vecht	51	Vecht stuw Vechterweerd
Lake IJssel	44	Vrouwezand
Wadden Sea	45	Doove Balg west
Wadden Sea	46	Dantziggat
Dutch coast	47	Noordwijk 2
Dutch coast	48	Noordwijk 10
Waddenkust	49	Boomkensdiep
Waddenkust	50	Terschelling 10

Substance	Code Germany	Unity	No. WFD	Status WFD	EQS WFD Inland surface waters	EQS WFD other surface waters
Chemical parameter (chemical status)						
Heavy metals and metalloids (solute)						
Cd sol.	1165	µg/l	6	pg	<= 0,08-0,25	0,2
Hg sol.	1166	µg/l	21	pg	0,05**	0,05**
Hg		µg/l	21	pg	20 µg/kg WW	20 µg/kg WW
Ni sol.	1188	µg/l	23	p	20	20
Pb sol.	1138	µg/l	20	p	7,2	7,2
Volatile hydrocarbons						
dichloromethane	2000	µg/l	11	p	20	20
trichloromethane	2001	µg/l	32	p	2,5	2,5
1,2-dichlorethane	2005	µg/l	10	p	10	10
benzene	2048	µg/l	4	p	10	8
tetrachloromethane	2002	µg/l	6a	76/464	12	12
trichloroethene	2020	µg/l	29b	76/464	10	10
tetrachloroethene	2021	µg/l	29a	76/464	10	10
Non-volatile hydrocarbons						
hexachlorobutadien	2030	µg/l	17	pg	0,1**	0,1**
hexachlorobutadien	2030	µg/l	17	pg	55 µg/kg WW	55 µg/kg WW
Sum trichlorobenzenes	1774	µg/l	31	p	Σ=0,4	Σ=0,4
1.2.3-trichlorobenzene	2059					
1.2.4-trichlorobenzene	2060					
1.3.5-trichlorobenzene	2061					
hexachlorobenzene	2070	µg/l	16	pg	0,01**	0,01**
hexachlorobenzene	2070	µg/l	16	pg	10 µg/kg WW	10 µg/kg WW
pentachlorobenzene	2069	µg/l	26	pg	0,007	0,0007
4-nonylphenol	2888	µg/l	24	pg	0,3	0,3
para-tert.-octylphenol	2593	µg/l	25	p	0,1	0,01
bis(ethylhexyl)phthalate (DEHP)	2679	µg/l	12	p	1,3	1,3
brominated diphenylether	4030	µg/l	5	pg	Σ=0,0005	Σ=0,0002
BDE 28	4029					
BDE 47	2153					
BDE 99	2155					
BDE 100	2154					
BDE 153	2157					
BDE 154	2156					
C_{10-13}-chloroalkanes	1955	µg/l	7	pg	0,4	0,4
Chloropesticides						
endosulfan		µg/l	14	pg	Σ=0,005	Σ=0,0005
α-endosulfan	2205					
β-endosulfan	2206					
pentachlorophenol	2140	µg/l	27	p	0,4	0,4
Sum HCH (α- to δ-HCH)	2956	µg/l	18	pg	Σ=0,02	Σ=0,002
γ-HCH (lindane)	2200					
α-HCH	2110					
β-HCH	2115					
δ-HCH	2117					
Total DDT	4034	µg/l	9b	76/464	Σ=0,025	Σ=0,025
4,4'-DDD	2213					
4,4'-DDE	2212					
2,4'-DDT	2298					
4,4'-DDT	2214					
4,4'-DDT	2214	µg/l	9b	76/464	0,01	0,01
Phenylurea derivatives						
diurone	2230	µg/l	13	p	0,2	0,2
isoproturone	2251	µg/l	19	p	0,3	0,3
Phosphorous acid esters						
chlorofenvinphos	2627	µg/l	8	p	0,1	0,1
chloropyrifos	2693	µg/l	9	p	0,03	0,03
Triazines						
atrazine	2231	µg/l	3	p	0,6	0,6
simazine	2242	µg/l	29	p	1	1
Other plant protection agents						
alachlor	2123	µg/l	1	p	0,3	0,3
trifluralin	2547	µg/l	33	p	0,03	0,03
Drins						
cyclodien pesticides	2957	µg/l	9a	76/464	Σ=0,01	Σ=0,005
aldrin	2201					
dieldrin	2208					
endrin	2210					
isodrin	2218					
PAH						
anthracene	2335	µg/l	2	pg	0,1	0,1
fluoranthene	2300	µg/l	15	p	0,1	0,1
naphthalene	2305	µg/l	22	p	2,4	1,2
benzo(a)pyrene	2320	µg/l	28	pg	0,05	0,05
(1) benzo(b)fluoranthene	2301	µg/l	28	pg	Σ=0,03	Σ=0,03
(2) benzo(k)fluoranthene	2302	µg/l	28	pg		
(3) benzo(ghi)perylene	2310	µg/l	28	pg	Σ=0,002	Σ=0,002
(4) indeno(1.2.3-cd)pyrene	2330	µg/l	28	pg		
Organo-tin compounds						
tributyltin-cation	2768	µg/l	30	pg	0,0002	0,0002

In excess of one or more EQS (water phase)

Below all EQS

Assessment results for the monitoring stations incorporated in the “Chemistry” surveillance monitoring programme according to WFD

Priority substances

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(blue)	Below UQN Directive 2008/105/EC
x	no decision possible because of too high limit of determination
-	no measurements available
Number	No EQS determined as yet
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Annex 5 14.12.2009

p = priority substance
pg = priority hazardous substance
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River	Monitoring station no.	Name of monitoring station
Ach near Bregenz	61	Fussach
Rhine	60	Fussach/Alpine Rhine
Rhine	5	Öhningen
Rhine	1	Rekingen
Rhine	2	Weil am Rhein
Rhine	7	Karlsruhe/Lauterbourg
Rhine	11	Worms
Rhine	12	Mainz
Rhine	13	Koblenz
Rhine	32	Bad Honnef
Rhine	34	Düsseldorf-Flehe
Rhine	35	Bimmen
Rhine	41	Lobith
Rhine	43	Kampen
Rhine	42	Maassluis
Neckar	8	Deizisau
Neckar	9	Kochendorf
Neckar	10	Mannheim
Weschnitz	31	Biblis-Wattenheim
Schwarzbach	28	Trebur-Astheim
Main	54	Hallstadt
Main	24	Erlabrunn
Main	23	Kahl a. Main
Main	25	Bischofsheim
Regnitz	55	Hausen
Kinzig	26	Hanau
Nidda	27	Nied
Nahe	19	Dietersheim (Grolsheim)
Lahn	29	Solms-Oberbiel
Lahn	30	Limburg
Lahn	20	Lahnstein
Moselle	15	Palzem
Moselle	17	Fankel
Moselle	18	Koblenz
Saar	21	Saarbrücken
Saar	22	Fremersdorf
Saar	14	Kanzem
Blies	52	Reinheim
Nied	53	Niedaltdorf
Alzette	56	Ettelbruck
Wiltz	57	Kautenbch
Sauer	16	Wasserbillig
Sieg	36	Menden
Wupper	37	Leverkusen-Rheindorf
Erft	40	Neuss
Ruhr	38	Duisburg-Ruhrort
Emscher	33	Emscher-Mündung
Lippe	39	Wesel
Vecht	51	Vecht stuw Vechterweerd
Lake IJssel	44	Vrouwezand
Wadden Sea	45	Doove Balg west
Wadden Sea	46	Dantziggat
Dutch coast	47	Noordwijk 2
Dutch coast	48	Noordwijk 10
Waddenkust	49	Boomkensdiep
Waddenkust	50	Terschelling 10

Substance	Code Germany	Unity	No. WFD	Status WFD	EQS WFD	EQS WFD
Calculation based on suspended matter:						
hexachlorobenzene	2070	µg/l	16	pg	0,01**	0,01**
hexachlorobenzene	2070	µg/l	16	pg	10 µg/kg WW	10 µg/kg WW
total DDT	4034	µg/l	9b	76/464	Σ=0,025	Σ=0,025
4,4'-DDD	2213					
4,4'-DDE	2212					
2,4'-DDT	2298					
4,4'-DDT	2214					
4,4'-DDT	2214	µg/l	9b	76/464	0,01	0,01
cyclodien pesticides	2957	µg/l	9a	76/464	Σ=0,01	Σ=0,005
aldrin	2201					
dieldrin	2208					
endrin	2210					
isodrin	2218					
brominated diphenylether	4030	µg/l	5	pg	Σ=0,0005	Σ=0,0002
BDE 28	4029					
BDE 47	2153					
BDE 99	2155					
BDE 100	2154					
BDE 153	2157					
BDE 154	2156					
PAH						
anthracene	2335	µg/l	2	pg	0,1	0,1
fluoranthene	2300	µg/l	15	p	0,1	0,1
naphthalene	2305	µg/l	22	p	2,4	1,2
benzo(a)pyrene	2320	µg/l	28	pg	0,05	0,05
(1) benzo(b)fluoranthene	2301	µg/l	28	pg	Σ=0,03	Σ=0,03
(2) benzo(k)fluoranthene	2302	µg/l	28	pg		
(3) benzo(ghi)perylene	2310	µg/l	28	pg	Σ=0,002	Σ=0,002
(4) indeno(1.2.3-cd)pyrene	2330	µg/l	28	pg		
Organo-tin compounds						
tributyltin-cation	2768	µg/l	30	pg	0,0002	0,0002

1.75 µg/kg

Excess of one or more EQS***

Below all EQS

** = See footnote IX of the daughter directive
*** = The global state was partly determined without data on suspended matter which, on the whole, gives a better result.

Annex 6: Groundwater quality standards and threshold values

Substances and values of this survey may, in future, be modified.

Parameter			**Quality standards / 2006 / 118 / EC)**						
nitrate	NO_3	mg/l	50 (CH: 25)						
sum pesticides		µg/l	0.5						
individual pesticide		µg/l	0.1						
			Threshold values						
			FR	**NL**	**DE**	**AT#**	**BE / WAL**	**LU**	**CH****
conductivity	K_20	µS/cm				2500	2100	n.s.	n.s.
chloride	Cl	mg/l		140 - 1990*	250	200	150	250	40
sulphate	SO_4	mg/l			240	250	250	250	40
sodium	Na	mg/l					150	150	25
ammonium	NH_4	mg/l	0.5		0.5	0.5	0.5	0.5*****	0.1*** 0.5****
total phosphorous	P	mg/l P_2O_5		0.1 - 9 mg P/l*			1.15	n.s.	n.s.
copper	Cu	µg/l				2000	200	1000	2
zinc	Zn	µg/l					500	n.s.	5
arsenic	As	µg/l	10	15	10	10	10	10******	0.05
cadmium	Cd	µg/l	5	0.5	0.5	5	5	1	2
chromium	Cr	µg/l				50	50	50	0.01
mercury	Hg	µg/l	1		0.2	1	1	1	5
nickel	Ni	µg/l		30	Only NRW14	20	20	20	5
lead	Pb	µg/l	10	11	7	10	10	10	1
antimon	Sb	µg/l					5	n.s.	n.s.
cyanure (total)	CN	µg/l					50	50	25
oxidability KmnO4)	M.O.	mg/l O_2					5	n.s.	n.s.
total organic carbon	COT	mg/l C					6	5	2 (DOC)
trichloroethylene	C_2HCl_3	µg/l	10					10	n.s.
tetrachloroethylene	C_2Cl_4	µg/l	10					10	n.s.
sum trichloroethylene and tetrachloroethylene		µg/l			10	10		10	n.s.

Geogenic pollution does not result in a bad groundwater status.

* The value depends on the background value in the groundwater body concerned
** Requirements to groundwater used as drinking water or intended for use as such. The values correspond to a positive divergence from the natural state.
*** Under oxic ratios
*** Under anoxic ratios
***** A transgression of this threshold value due to geogenic circumstances is possible in very deep groundwater bodies.
***** depending on the geology, this threshold value may be exceeded
# The present Austrian values are those taken from a national regulation draft and have not yet been definitely legally determined.
n.s. Not specified

Annex 7: Achieving the environmental objectives for the main stream of the Rhine by 2015 (status: December 2009)

State (Country)	Name of the water body	1 = natural 2 = heavily modified 3 = artificial	Chemical status 1 = good; 2 = not good		Ecological status / ecological potential 1 = very good; 2 = good; 3 = moderate; 4 = poor 5 = bad The classification from 1 to 5 applies to natural waters. The classification from 2 to 5 applies to considerably modified and artificial waters.	
		Status	**today**	**2015**	**today**	**2015**
AT/CH	Alpine Rhine, OWK AT 10121000	2	1	1	5	5
AT/CH	Alpine Rhine, OWK AT 10157000	2	1	1	5	5
AT/CH	Alpine Rhine, OWK AT 10109000	2	1	1	5	5
D(BW)	High Rhine Eschenzer Horn until upstream River Aare	1	1	1	3.	n.s.
D(BW)	High Rhine downstream river Aare until R. Wiese inclusive	2	2*	2*	n.s.*	n.s.*
D(BW)	Old Rhine, Basel to Breisach (OR 1)	2	2*	2*	n.s.*	n.s.*
FR	Rhine 1 (OR 1)	2	2	2	4	2
D(BW)	Loop of the Rhine, Breisach to Strasbourg (OR 2)	2	2*	2*	n.s.*	n.s.*
FR	Rhine 2 (OR 2)	2	2*	2*	4	2
D(BW)	Regulated section of the Rhine, Strasbourg to Iffezheim (OR 3)	2	2	2	n.s.*	n.s.*
FR	Rhine 3 (OR 3)	2	2	2	5	2
D(BW)	Iffezheim barrage until upstream mouth of R. Lauter	2	2*	2*	> 2	n.s.*
FR	Rhine 4 (OR 4)	2	2	2	5	≤ 5
D(BW)	Freely flowing section of the Rhine downstream mouth of R. Lauter until upstream mouth of R. Neckar (OR 5)	2	2*	2*	> 2	k.A*
D(RP)	Upper part of the Upper Rhine (OR 5)	2	2	2.	3 (-)	n.s.
D(BW)	Freely flowing section of the Rhine downstream the mouth of the tributaries Neckar and Main (OR 6)	2	2*	2*	>2	k.A*
D(HE)	Rhine from Neckar to Main (OR 6)	2	2	n.s.	4	n.s.
D(RP)	Middle Upper Rhine (OR 6)	2	2	2.	4 (+)	n.s.
D(HE)	Rhine from Main to Nahe (OR 7)	2	2	n.s.	4	n.s.
D(RP)	Lower Upper Rhine (OR 7)	2	2	2	4	n.s.
D(HE)	Upper Middle Rhine	2	2	n.s.	4	n.s.
D(RP)	Middle Rhine	2	2	2	4	n.s.

State (Country)	Name of the water body	1 = natural 2 = heavily modified 3 = artificial	Chemical status 1 = good; 2 = not good		Ecological status / ecological potential 1 = very good; 2 = good; 3 = moderate; 4 = poor 5 = bad The classification from 1 to 5 applies to natural waters. The classification from 2 to 5 applies to considerably modified and artificial waters.	
		Status	**today**	**2015**	**today**	**2015**
D(NW)	Rhine, Bad Honnef to Leverkusen	2	2	2	4	>2
D(NW)	Rhine, Leverkusen to Duisburg	2	2	2	4	>2
D(NW)	Rhine, Duisburg to Wesel	2	2	2	5	>2
D(NW)	Rhine, Wesel to Kleve	2	2	2	5	>2
NL	Boven Rijn, Waal	2	2	2	4	3
NL	Maas-Waalkanaal	3	2	2	3	2
NL	Nederrijn/Lek	2	2	2	3	3
NL	Dortsche Biesbosch, Nieuwe Merwede	2	2	2	4	2
NL	Beneden Merwede, Boven Merwede, Sliedrechtse Biesbosch, Waal, Afgedamde Maas-Noord	2	2	2	4	3
NL	Oude Maas (upstream Hartelkanaal), Spui, Noord, Dordtsche Kil, Lek until Hagestein	2	2	2	4	3
NL	Hollandsche IJssel	2	2	2	4	3
NL	Nieuwe Maas, Oude Maas (downstream Hartelkanaal)	2	2	2	3	3
NL	Nieuwe Waterweg, Hartel-, Caland-, Beerkanaal	3	2	2	3	2
NL	Amsterdam-Rijnkanaal Betuwepand	3	2	2	4	3
NL	Amsterdam-Rijnkanaal Noordpand	3	2	2	4	3
NL	Noordzeekanaal	3	2	2	3	3
NL	IJssel	2	2	2	4	3
NL	Twentekanalen	3	2	2	3	3
NL	Overijsselse Vecht	2	1	1	3	3
NL	Vecht-Zwarte Water	2	1	1	3	3
NL	Zwartemeer	2	2	2	3	3
NL	Ketelmeer + Vossemeer	2	2	2	4	3
NL	Markermeer	2	2	2	3	3
NL	Randmeren-Oost	2	2	2	3	3

State (Country)	Name of the water body	1 = natural 2 = heavily modified 3 = artificial	Chemical status 1 = good; 2 = not good		Ecological status / ecological potential 1 = very good; 2 = good; 3 = moderate; 4 = poor 5 = bad The classification from 1 to 5 applies to natural waters. The classification from 2 to 5 applies to considerably modified and artificial waters.	
		Status	**today**	**2015**	**today**	**2015**
NL	Randmeren-Zuid	2	2	2	3	3
NL	Lake IJssel	2	2	2	3	3
NL	Wadden Sea continental coast	2	2	2	3	3
NL	Wadden Sea	1	2	2	4	3
NL	Dutch coast (coastal waters)	1	2	2	3	3
NL	Dutch coast (territorial waters)	n.a.	2	2	n.a.	n.a.
NL	Coast of Wadden Sea (coastal waters)	1	2	2	3	3
NL	Coast of Wadden Sea (territorial waters)	n.a.	2	2	n.a.	n.a.

2*: PAH compounds, no direct water management measures

n.s.*: Achievement of objective Prague Approach directed towards measures

n.a.: not applicable

Annex 8: Explanation of the "Prague approach"

The "Prague Approach" bases considerations of measures to be taken in order to improve the ecological status on the present situation. The good ecological potential (GEP) is achieved, once the major part of the feasible efficient morphological measures have been taken that can be taken without considerably impacting uses.

The following points were considered when assessing whether artificial or considerably modified water bodies in the Rhine catchment will achieve the good ecological potential:

1. Which measures may be taken without considerably impacting use?
2. Which measures will considerably impact on use?
3. Which of these measures mentioned under 1 are particularly efficient from an ecological point of view and therefore particularly cost efficient?

To 1) Measures which may be taken without considerably impacting use

Apart from the individual measures mentioned under 2 which cannot be taken, a great number of possible measures may be taken.

As far as the basic network of water bodies is concerned, these measures are mainly:

- Measures in riverbank areas
  - Extension of constricted sections of water bodies and creation of natural and nature-near banks including, if possible, areas with important requirements as to bank stability
  - Protection of the banks with diversion structures against lapping of waves caused by navigation
  - Enhancement of natural vegetation
  - Win-win situations due to maintenance measures for the shipping lane
- Measures along diked sections and in the foreshores
  - Improve transverse connections with alluvial areas and alluvial waters, reconnect oxbow lakes
  - Create backwaters and shallow furrows
  - Relocate dikes
- Measures aimed at improving bed load dynamics
  - Bed load management aimed at improving the permeability of dams for solid matter
  - Restore the bed load transportation in suitable areas in order to maintain and control the eroding forces of the river. This is planned in certain sections of the Old bed of the Rhine.
  - Redesign groynes
- Measures aimed at improving river continuity
  - Construction of fish passages
  - Creation of bypasses
  - Alteration of drop structures in block ramps (rock cascades)
  - Improvement of the connection of tributaries
  - Further measures aimed at improving the stocks of fish (among others limited stocking of juvenile fish, fishery)
- Measures aimed at improving the water household (further natural retention; minimum flow)

When choosing the measures it must be granted that the achievement of objectives in upstream/downstream water bodies of the IRBD Rhine is not permanently excluded or impaired. Further discussions of this item are required at an international level.

The above list of measures does not mean that all measures must be implemented everywhere. The starting point for the good ecological potential is to take measures in places where this is possible from a geo-morphological point of view and under land use aspects and where they make sense form an ecological point of view. A prerequisite for many measures is that the corresponding surfaces can be made available in the surroundings of waters (banks). The biotope network the Rhine bordering countries created along the Rhine points out focal areas for the implementation of suitable measures.

The measures listed give a practical definition of the good ecological potential, that is, the ecological objective for heavily modified water bodies in the basic network of water bodies. This simplified and operative definition is presently applied in all states and federal States/regions.

The good ecological potential is defined as the ecological state which is created when the above mentioned types of measures have been implemented everywhere where this is possible under geo-morphological and land use aspects and where they make sense from an ecological point of view.

The starting point is that present and known water pollution will not further deteriorate the ecological status.

Ad 2: Measures which cannot be implemented for water bodies of the basic network of water bodies

The Member States, federal States and regions apply the same principles to measures, which cannot be implemented without considerable detrimental effects on the uses. Thus, improvements which could be achieved by implementing such measures are not taken into account for the good ecological potential.

Due to the functions mentioned, the following measures cannot be implemented for the main stream and major waters of the basic network of water bodies:

- Flood protection
  - Remove dikes along the rivers
  - Remove dikes along the coast
- Navigation
  - Limit navigation for the transportation of goods
  - Remove barrages and sluices required for navigation
  - Remove groynes required for the shipping lane
  - Remove diversion structures
  - Stop dredging for water maintenance (granting the depth of the shipping lane)
  - Remove river bank stabilizations in places where the resistance and stability of the banks would be at risk. Renovation or consolidation of existing structures should, if possible, gradually imply so called “mixed techniques” which partly aim at re-naturating the banks.
- Water regulation
  - Remove barrages and dams in the basic network of water bodies required for regulating water quantities for (drinking) water abstraction and water levels for agricultural use
- Hydropower
  - Remove hydropower plants in the basic network of water bodies

In individual cases such measures may be considered for smaller rivers (in particular IRBD Rhine < 2.500 km²).

Master Plan Migratory Fish Rhine

Implemented and planned hydro-morphological measures
in programme waters for anadromous migratory fish in the Rhine catchment

Implementation accomplished (state 2009)		Measures implemented, ongoing and planned until 2015
Ongoing implementation (state 2009)		
Implementation planned by 2015		
Begin of work planned before 2015		
Implementation by 2027 planned		Non-binding forecast

* The costs indicated for ongoing and planned measures are largely based on estimates and only partly concern specific measures for migratory fish.

Expenses for accomplished and on-going measures aimed at improving habitat quality are not separately listed but added to measures planned by 2015.

Country	Section of the Rhine / tributary system	Waters/section, construction/s	Transformation transverse structure (number)	Improvement of habitat quality (=x) and further measures	Expenses (million Euros)*
NL	Delta Rhine	Lek/ Nederrijn: Hagestein, Amerongen, Driel	3		7
		Haringvliet, sluice	1		36
		Lake IJssel, closure embankment (expenses: 2,5 - 5 Mio. €)	1		5
D-NW	Wupper-Dhünn	Wupper and tributary Dhünn, total system	8	Structural improvement	1
D-NW	Sieg	Rhenish Sieg and Agger (lowermost 30 km): Monitoring station exists already	5	Structural improvement	10,5
		Bröl (pilot project): including storm water treatment	2	Structural improvement	12
D-RP		Sieg, middle section	5		1
		Sieg, middle section: Weir Hösch, Freusburger Mühle, weir Scheuerfeld (RWE)	3		
		Nister, downstream region (23 km)	8		0,64
		Nister, upstream region (22.5 km)	4		
D-RP	Ahr	Ahr, downstream region (70 km)	46		3
		Ahr, upstream	3	x	
D-RP	Nette	Nette, downstream region (6.6 km)	7		0,45
		Nette, upstream	3		0,21
		Nette, upstream section (50 km)	14		
D-RP	Saynbach	Saynbach-Brexbach	12	x	0,5
D-RP	Moselle	Moselle, downstream (Koblenz to Enkirch)	6		20
		Moselle, upstream (Zeltingen to Trier)	4		
		Elzbach, downstream	1		
		Elzbach, upstream	12		
Lux		Sauer, Rosport (construction beginning: 2011)	1		1,6
		Sauer, upstream (the lowermost weir is already under transformation)	3		0,54
D-RP	Lahn	Lahn, downstream (Lahnstein to Diez)	1		
D-HE		Lahn, Wetzlar (mouth r. Dill) to Limburg	2	x	2,1
		Lahn, upstream mouth of R. Dill	19	x	29
		Lahn, upstream mouth of R. Dill	26	x	28,1
D-RP		Mühlbach, downstream region (6 km)	2		0,18
D-HE		Elbbach (downstream, 10 km to Hadamar)	6		1,1
		Elbbach, upstream to mouth of R. Lasterbach	9	x	1,5
		Dill	5	x	2
		Dill	14	x	4,9
		Weil	2		0,24
		Weil	1	x	0,85
		Weil	1	x	3,3
D-RP	Nahe	Nahe, downstream, 5 km undisrupted	8		
		Nahe, upstream (105 km)	14		
		Nahe, remaining obstacles	11		
D-HE	Wisper	Wisper, downstream and middle section	1		0,19
		Wisper, downstream and middle section	1	x	0,3
D-HE	R. Main	Main: Kostheim	1		0,97
		Main: Eddersheim	1		2,6
		Main: Griesheim, Offenbach, Mühlheim, Krotzenburg	4		10,95
		Main: Measures for structural improvement		x	94,43
		Schwarzbach near Hattersheim (mouth)	1	x	1,9
		Schwarzbach (Eppstein)	1	x	0,02
		Schwarzbach (Eppstein)	3	x	3,5
		Nidda (with Usa and Nidder)	17	x	18
		Nidda (with Usa and Nidder)	35	x	10
		Kinzig (with Bracht, Salz, Bieber and Schwarzbach/Kinzig (= upstream Kinzig)	3		0,09
		Kinzig (with Bracht, Salz, Bieber and Schwarzbach/Kinzig (= upstream Kinzig)	11	x	2,4
		Kinzig (with Bracht, Salz, Bieber and Schwarzbach/Kinzig (= upstream Kinzig)	32	x	3,6
D-BY		Main upstream Aschaffenburg to Gemünden	11		
D-BW		Tauber	n.s.		
D-BY		Kahl, Aschaff, Elsava, Mömling, Haslochbach, Hafenlohr, Gersprenz, Lohr, Mud, Erf		x	
		Sinn (and Kleine Sinn) and Fränkische Saale (with Schondra and Thulba)		x	
		Entire Bavarian Main with tributaries	Total concept for continuity		
D-HE	Weschnitz	Weschnitz	6	x	35,7
D-BW	Neckar **	Neckar: lowermost transverse structure near Ladenburg	1		
		Neckar: Kochendorf, Lauffen	2		(5,4)
D-BW		Neckar downstream to mouth of R. Enz	9	x	(13,5)
D-HE		Neckar: Hessian part downstream	2	x	(4,7)
D-BW		Neckar: Mouth R. Enz to Plochingen	3	x	(4,8)

Table „Master Plan Migratory Fish Rhine“ continued

Country	Section of the Rhine / tributary system	Waters/section, construction/s	Transformation transverse structure (number)	Improvement of habitat quality (=x) and further measures	
D-BW	**Rhine**	northern Upper Rhine downstream of Iffezheim		x	12,2
D-BW	**Alb**	Alb downstream	4	x	1,5
		Alb upstream to mouth of R. Maisenbach in Marxzell	19	x	2,1
F	**(Wies)Lauter**	(Wies)Lauter, Lauterbourg mill	1		0,16
D-RP		(Wies)Lauter, Berizzi mill	1		0,17
		(Wies)Lauter downstream	2		0,42
F		(Wies)Lauter, French section near Wissembourg	3	Inventory	
D-RP		(Wies)Lauter, upstream section upstream of Wissembourg	1		
D-BW	**Murg**	Murg, downstream region (20 km)	1	x	4,9
		Murg, middle and upstream section to mouth of Elbbach in Baiersbronn	39	x	8,5
F / D-BW	**Rhine**	southern Upper Rhine: Iffezheim, Gambsheim	2		
		Optimize fish passages Iffezheim, Gambsheim	Telemetric study		
		southern Upper Rhine: Strasbourg	1 + x		20
		Dreisam***	1 + x		20
		southern Upper Rhine: Vogelgrün		Research	
		Old Rhine: Interreg project "Feasibility study on restoring the dynamics of the Old Rhine*, implementation eventually by lowering the river forelands on the right bank of the Rhine		Only feasibility study	3
F		Old Rhine (renewal of the concession Kembs): Restoration of controlled erosion of the left bank of the Rhine between Kembs and Breisach (if feasibility is proven)		Alluvial habitats	
		southern Upper Rhine, Kembs (renewal of concession): Construction of a new fish passage	1		
		southern Upper Rhine, Kembs: potential extension of the reproduction surface for salmonids by increasing the residual flow in the Old Rhine and construction of a 7 km long bypass on the Kembs island		Compensatory measures	
D-BW	**Rench**	Rench	5	Structural improvement	5
			2	Structural improvement	
			19	Structural improvement	
F	**Ill**	Ill to mouth of R. Doller	4	x	
		Bruche, Giessen, Liepvrette, Fecht, Weiss, Doller	66	x	
D-BW	**Kinzig**	Kinzig (Baden-Württemberg)	18	Structural improvement	26
			83	Structural improvement	
			34	Structural improvement	
D-BW	**Elz-Dreisam**	Elz and Dreisam, downstream	12	Structural improvement	25,8
		Elz and Dreisam, to km 90	18	Structural improvement	
		Elz and Dreisam, upstream	37	Structural improvement	
D/CH	**High Rhine**	High Rhine: improve existing fish passages	4		
CH		High Rhine, Rheinau: Construction of a new fish passage (procedure ongoing)	1		
CH	**Wiese**	Wiese, downstream	1		
D-BW		Wiese, middle section and upstream	4	Structural improvement	9
			16	Structural improvement	
			15	Structural improvement	
CH	**Birs**	Birs: Downstream: improved fish migration and revitalisation	several	x	
		Birs, upstream: improved fish migration	2		
	Ergolz	Ergolz	n.s.		
D-BW	**High Rhine tributaries**	Hasel, Hauensteiner Alb, Hauensteiner Murg, Wutach, Biber		Connection	
AT	**Tributaries to Lake Cons**	Old Rhine, Höchst to outlet into Lake Constance		x	
	(Lake trout)	Bregenzerach: improve fish passage and ramps (existing)	4	Feasibility study	
		Upper and Lower Argen, lowermost hydropower plants	2		
		Upper and Lower Argen, upstream hydropower plan	n.s.		
		Schussen, flood measuring post Lochbrücke / Gerbertshaus	1		
		Schussen, hydropower plant Berg (accessibility Wolfegger Ach and Ettishofer Ach)	1		
		Seefelder Aach, hydropower plant Mühlhofen, improve river continuity	1		
D-BW		Stockacher Aach	5	x	
			5		
			6		
		Radolfzeller Aach	8	x	
			4		
			6		
D-BY		Leiblach, Oberreitnauer Ach	k.A.		
		Leiblach, Oberreitnauer Ach: remaining constructions	n.s.	x	
CH	**Alpine Rhine**	Fish passage power plant Reichenau	1		
	(Lake trout)	Lake Constance to mouth of R. Ill		Development concept	
AT/FL/CH		Confluence Posterior Rhine/Anterior Rhine to outlet into Lake Constance		Development concept	
AT	**Alpine Rhine - tributaries**	Ill: 1 weir, make 2 water fall structures surmountable	3	x	
	(Lake trout)	Dornbirner Ach, Schwarzach, Frutz, Ehbach, Ill	Feasibility study	Feasibility study	
AT/FL		Spirsbach	1	x	
FL		Liechtenstein inland canal	1	x	
Entire Rhine catchment			**880**		**480,34**

** The R. Neckar and its tributaries are not central migration routes and habitats for anadromous fish species.

*** Upper Rhine upstream Strasbourg (F): Apart from the big barrages in the main stream, a number of cultural weirs must be made surmountable in coordination with Baden-Württemberg (indicated by '+x')

Measures planned to achieve the ecological objectives for the main stream of the Rhine

Annex 10 — *State: December 2009* — Non-binding forecast of measures planned for after 2015 (last 8 columns)

Period of planned implementation	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2015	2010-2027	2010-2015	2010-2027	2010-2015	2010-2027	2010-2027	2010-2015	2010-2027	2010-2027	2015-2027	2015-2027	2015-2027	2015-2027	2015-2027	2015-2027
State	AT	AT, CH, D-BW	CH[1]	D-BW	F	F	F	F	D-BW	D-BW	D-RLP	D-BW	D-RLP	D-HES	D-RLP	D-HES	D-RLP	D-HES	D-NRW	NL	AT	AT, CH, D-BW	D-BW	D-BW	D-BW	D-RLP	D-RLP	NL
River section	Alpine Rhine	Lake Constance	High Rhine		German-French Upper Rhine upstream Iffezheim			German-French Upper Rhine downstream Iffezheim	Upper Rhine, Lauter to Neckar			Upper Rhine, Neckar to Main			Upper Rhine, Main to Nahe		Middle Rhine		Lower Rhine	Delta Rhine, Lake IJssel	Alpine Rhine	Lake Constance	High Rhine		Upper Rhine to Neckar		Upper Rhine, Neckar to Main	Delta Rhine, Lake IJssel
Water body			2-01, 2-02		Rhine 1	Rhine 2	Rhine 3	Rhine 4	3-OR4	3-OR5	upper Upper Rhine	middle Upper Rhine (3-OR6)			lower Upper Rhine		Middle Rhine						2-01, 2-02	3-OR4	3-OR5	upper Upper Rhine	middle Upper Rhine	
PLANED MEASURE																												
River continuity																												
Construction or optimization of fish passages						2																						
Increase residual flow (ecologically justified minimal flow)																												
Improvement of the connection of tributaries																												
Improvement of habitats in the stream channel (river bank, river bottom, glacial drift)																												
Remove bank stabilizations					4	5		3																				
Structuring and improvement of the stream channel and the banks					4	5		3	6	6														7	7			
Improve spawning habitats					4	3	3	3	6	6														7	7			
Enhance natural vegetation (among others macrophytes)					3	3	3	3	6	6														7	7			
Restore transportation of glacial drift					4																							
Redesign groynes and longitudinal structures									6	6														7	7			
Protect the banks against lapping of waves									6	6		6																
Improvement of habitats in the surroundings of waters (alluvial areas, dike foreshores, dikes)																												
Improve lateral connections with the alluvial areas and alluvial waters																												
Connect cut-off river branches (including de-silting and creation of shallow furrows)						4																						
Relocate dikes, create slits in dikes and put dikes out of operation					5															8								
Lower dike foreshores																												
Develop alluvial vegetation																												
Extensive management of alluvial areas or foreshores																												
Acquisition of land / allocating surfaces for the above mentioned measures																												

Colour legend

- Individual measures planned
- Measures planned at several locations (2 to 5)
- Many or extensive measures planned in the water body concerned (> 5 locations or > 10 km)
- Eventual measures are analysed in feasibility studies; not quantified as yet

1 CH: Indications for 2010-2015 concern the maps of measures drafted by the Regierungspräsidium Freiburg (April 2007). When updating the inventory according to WFD (2013) Switzerland will inventory the measures the cantons plan for 2015-2027.

2 The barrage Strasbourg will be modified before 2015; for the barrage Gerstheim work is planned to begin before 2015.

3 F: These proposed measures must be put into more precise terms during a total feasibility study in particular concentrating on hydraulic engineering security.

4 F: Subject to feasibility according to the results of tests and studies within the framework of compensatory measures for the renewal of the Kembs concession and the project "Restore the dynamics of the Old Rhine" in water body Rhine 1 in coordination with Baden-Württemberg

5 F: Measures in bypass rivers in the Rhine water body 2

6 DE-BW: Implementation as pilot measure subject to hydraulic proof (no negative impact on navigation and flood protection).

7 DE-BW: Implementation according to findings of the pilot measure and subject to hydraulic proof.

8 NL: The Netherlands implement measures within the framework of other programmes, e.g. "Room for the River". These measures contribute to achieving the objective according to WFD.

Annex 11: Non-governmental organisations with observer status in the ICPR

WWF Auen-Institut
Josefstraße 1
D - 76437 Rastatt
www.auen.uni-karlsruhe.de

Hochwassernotgemeinschaft Rhein Gemeinde- und Städtebund
Deutschhausplatz 1
D - 55116 Mainz
hochwassernotgemeinschaft-rhein.de

Arbeitsgemeinschaft der Internationalen Wasserwerke im Rheineinzugsgebiet IAWR
Parkgürtel 24
D-50823 Köln
www.iawr.org

Bund für Umwelt und Naturschutz Deutschland
Landesgeschäftsstelle Rheinland-Pfalz
Hindenburgplatz 3
55118 Mainz
www.bund-rlp.de

Arbeitsgemeinschaft Renaturierung des Hochrheins
c/o Schweizerischer Fischerei-Verband
Postfach 8212
CH - 3001 Bern
www.rheinaubund.ch/Rheinaubund/AG_Renat_Hochrhein.html

Rheinkolleg
Steubenstraße 20
D - 68163 Mannheim
www.rheinkolleg.de

Greenpeace International
Keizersgracht 176
NL - 1016 DW Amsterdam
www.greenpeace.org/international

Stichting Reinwater
Vossiusstraat 20
NL - 1071 AD Amsterdam
www.reinwater.nl

NABU-Naturschutzstation NABU-Koordinationsstelle Rhein
Bahnhofstraße 15
D - 47559 Kranenburg
www.nabu.de und www.nabu-naturschutzstation.de/v1

European Union of National Associations of Water Suppliers and Waste Water Services
EUREAU
Rue Colonel Bourg 127
B - 1140 Bruxelles
www.eureau.org

Alsace Nature
8, rue Adèle Riton
F - 67000 Strasbourg
www.alsacenature.org

Conseil Européen de l'Industrie Chimique (CEFIC)
Avenue E. Van Nieuwenhuyse 4
B - 1160 Bruxelles
www.cefic.be

DWA Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V.
Theodor-Heuss-Allee 17
D - 53773 Hennef
www.dwa.de

VGB Power Tech e.V.
Klinkestraße 27-31
D - 45136 Essen
www.vgb.org

AK Wasser im BBU
Walter-Gropius-Straße 22
D - 79100 Freiburg
www.akwasser.de

EBU - UENF
Postbus 23210
NL - 3001 KE Rotterdam
www.ebu-uenf.org

Verband Deutscher Sportfischer e.V.
VDSF Siemensstr. 11-13
D - 63071 Offenbach
www.vdsf.de

Annex 12: List of competent authorities for river management in the IRBD Rhine according to WFD; Article 3, Par. 8 (Annex I)

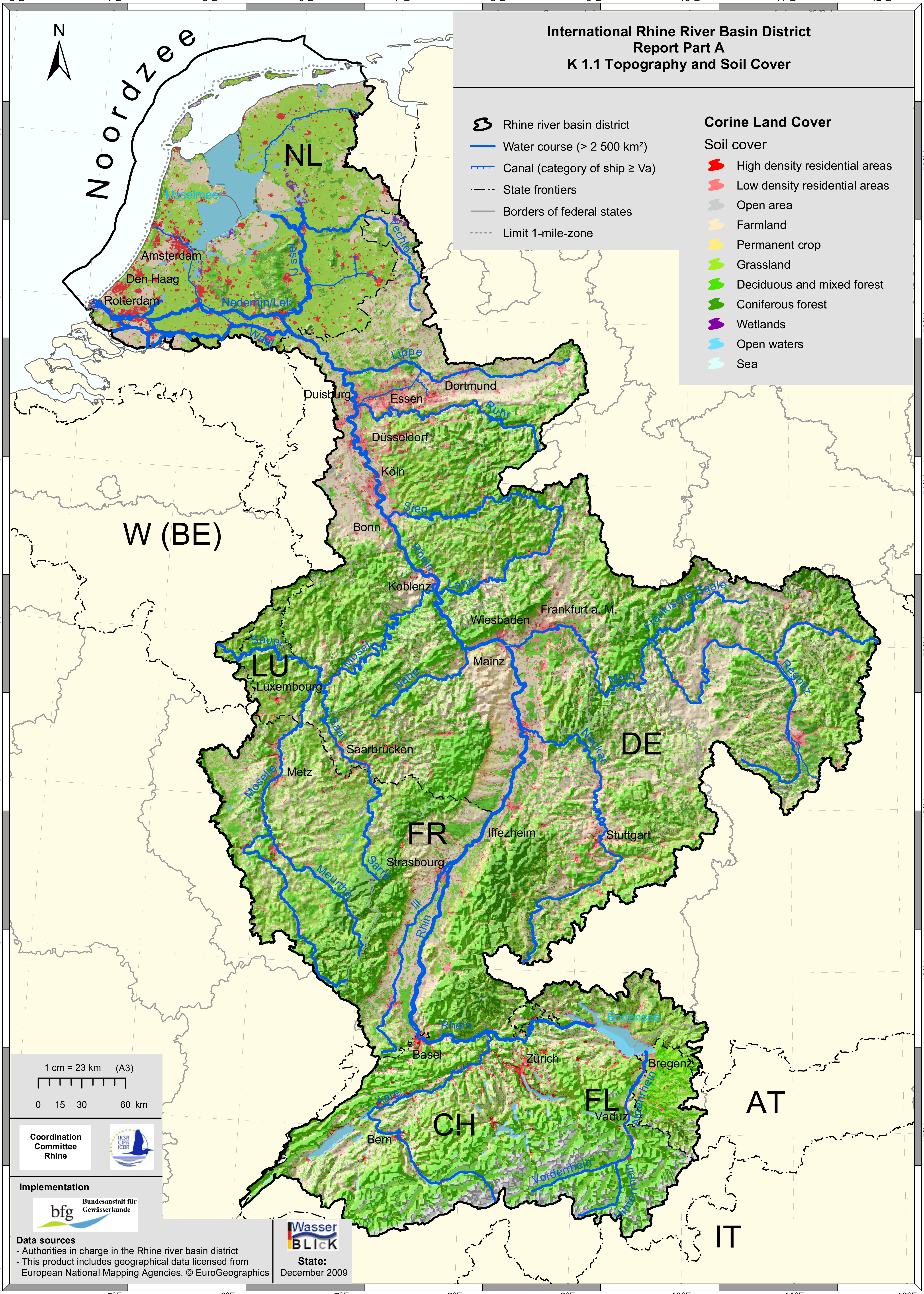
State	Switzerland	Italy	Liechtenstein	Austria	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	France	Luxemburg	Belgium	Netherlands
Federal state		Lombardy region		Vorarlberg	Baden-Württemberg	Bavaria	Hesse	Rhineland-Palatinate	Saarland	Northrhine-Westphalia	Lower Saxony	Thuringia		Luxemburg	Wallonia	
Name of the authority in charge	Switzerland is not obliged to implement the EU WFD (CH)	Lombardy region, for great constructions such as dams the state Ministry of Environment (IT)	Government of the principality of Liechtenstein	Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (AT)	Umweltministerium Baden-Württtemberg (UM)	Bayerisches Staatsministerium für Umwelt und Gesundheit (StMUG)	Hessisches Ministerium für Umwelt, ländlichen Raum und Verbraucherschutz (HMULV)	Ministerium für Umwelt, Forsten und Verbraucherschutz des Landes Rheinland-Pfalz (MUFV)	Ministerium für Umwelt des Saarlandes (MfU)	Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen (MUNLV)	Niedersächsisches Ministerium für Umwelt und Klimaschutz (MU)	Thüringer Ministerium für Landwirtschaft, Forsten, Umwelt und Naturschutz (TMLFUN)	The co-ordinating Prefect for the Rhine-Meuse basin	Ministerium für Inneres und die Großregion (LU)	Ministry for the region Wallonia, Generald Direction for natural Ressources and Environment [1] (W-BE)	The Minister for Traffic, Water Management and Public Works together with collegues in charge of Housing, Land Use and Environment and for Agriculture, Nature Protection and the Quality of Nutrition[2](NL)
Address of the authority in charge		Regione Lombardia Via Pola, 14 I - 20125 Milano	Regierungsgebäude Peter-Kaiser-Platz 1 9490 Vaduz	Stubenring 1 A - 1012 Wien	Kernerplatz 9 D-70182 Stuttgart	Rosenkavalierplatz 2 D-81925 München	Mainzer Str. 80 D-65189 Wiesbaden	Kaiser-Friedrich-Str. 1 D-55116 Mainz	Keplerstr. 18 D-66117 Saarbrücken	Schwannstr. 3 D-40476 Düsseldorf	Archivstr. 2 D-30169 Hannover	Beethovenstraße 3, D-99096 Erfurt	9, Place de la Préfecture, F – 57000 Metz	19, rue Beaumont L-1219 Luxemburg	Avenue Prince de Liège 15 B - 5100 Namur (Jambes)	Postfach 20901 NL-2500 EX DEN HAAG
Legal status of the authority in charge		Supreme water authority of the region		Supreme water authority of the Republic of Austria	Supreme water authority of the federal state	Supreme water authority of the federal state	Supreme water authority of the federal state	Supreme water authority of the federal state	Supreme water authority of the federal state	Supreme water authority of the federal state	Supreme water authority of the federal state	Supreme water authority of the federal state	The co-ordinating Prefect for the catchment co-ordinates and implements the state policy concerning water management and legal compliance (Article L 213-3 of the Environmental Code)			Oberste Behörde des Staates auf dem Gebiet der Wasserwirtschaft
Competence		Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Legal and technical control, co-ordination	Implementation and co-ordination of state policy concerning water management and legal complicance	Legal and technical control		Political planning, implementation, application and co-ordination
Number of lower-level administrations		11 provinces and 1546 towns	1; Environmental Protection Agency	Land minister-president Vorarlberg (Bregenz)	48 (4 Regional Councils, 44 towns / rural districts)	54 (4 governments, 41 subordinate water agencies, Bavarian LfU, 9 water administrations)	30 (3 governments, 26 subordinate water agencies, 1 State Authority for Environment and Geology)	39 (2 Direction for Structure and Authorizations, 36 Lower Water Authorities, State Authority for Environment, Water Management and Trade Control)	9 (8 Lower Water Authorities, 1 State Authority for Environment)	60 (5 Regional Governments, 54 Lower Water Authorities, State Authority für Nature, Environment and Consumer Protection	4 (1 State Office for Water Management, Coastal and Nature Protection, 2 Lower Water Authorities, 1 Technical Authority)	25 (1 State Authority, 1 State Authority for Environment an Geology Thuringia, 23 Lower Water Authorities)		1 Administration de la Gestion de l'EAU		27 (9 Provinces and 18 Water Management Associations)

1) In the future Wallonian law on transposing the WFD, the Government of Wallonia will generally be the authority officially in charge; in a second step the government will delegate its competencies (by means of a decree of the Wallonian government) to a number of authorities and public administrations, among others the authority mentioned (DGRNE)

2) In the Netherlands, the competencies for the regional waters have been delegated to the Provinces and Water Boards

Internationally Coordinated Management Plan for the International River Basin District of the Rhine

Maps


International Rhine River Basin District
Report Part A
K 1.1 Topography and Soil Cover
Rhine river basin district
Water course (> 2 500 km²)
Canal (category of ship ≥ Va)
State frontiers
Borders of federal states
Limit 1-mile-zone
Corine Land Cover
Soil cover
High density residential areas
Low density residential areas
Open area
Farmland
Permanent crop
Grassland
Deciduous and mixed forest
Coniferous forest
Wetlands
Open waters
Sea
N
Noordzee
NL
W (BE)
LU
FR
DE
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
Vechte
Nederrijn/Lek
Waal
Lippe
Duisburg
Essen
Dortmund
Ruhr
Düsseldorf
Köln
Sieg
Bonn
Rhein
Koblenz
Lahn
Wiesbaden
Frankfurt a. M.
Fränkische Saale
Mainz
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Regnitz
Sauer
Luxembourg
Mosel
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Saarbrücken
Metz
Moselle
Neckar
Stuttgart
Iffezheim
Strasbourg
Sarre
Meurthe
Ill
Rhin
Basel
Bodensee
Zürich
Bregenz
Aare
Bern
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
3°E
4°E
5°E
6°E
7°E
8°E
9°E
10°E
11°E
12°E
46°N
47°N
48°N
49°N
50°N
51°N
52°N
53°N
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
IKSR CIPR ICBR
Implementation
bfg Bundesanstalt für Gewässerkunde
Data sources
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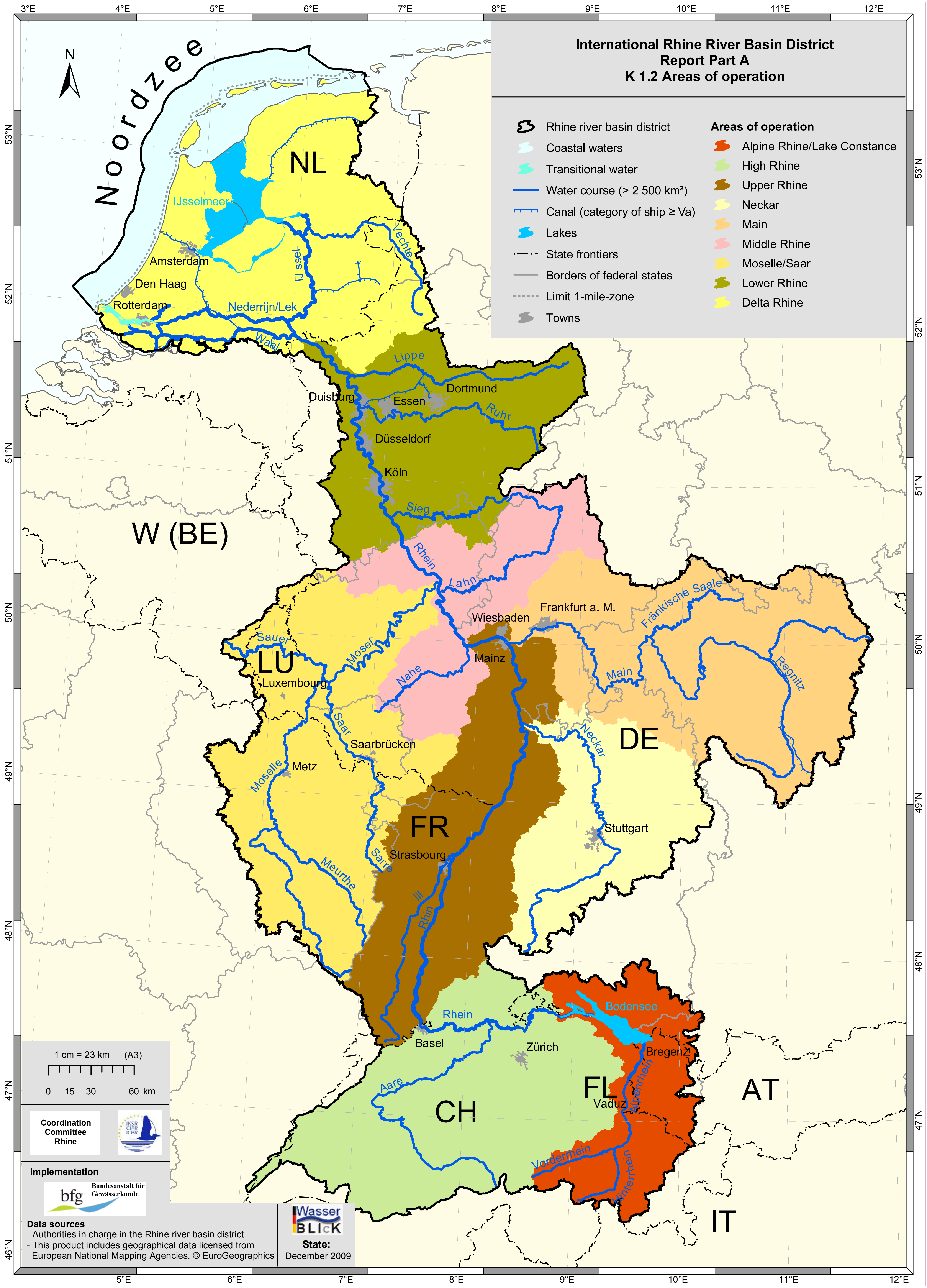
State:
December 2009


International Rhine River Basin District
Report Part A
K 1.2 Areas of operation
Rhine river basin district
Coastal waters
Transitional water
Water course (> 2 500 km²)
Canal (category of ship ≥ Va)
Lakes
State frontiers
Borders of federal states
Limit 1-mile-zone
Towns
Areas of operation
Alpine Rhine/Lake Constance
High Rhine
Upper Rhine
Neckar
Main
Middle Rhine
Moselle/Saar
Lower Rhine
Delta Rhine
Noordzee
NL
W (BE)
LU
FR
DE
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
Waal
IJssel
Vechte
Lippe
Duisburg
Essen
Dortmund
Ruhr
Düsseldorf
Köln
Sieg
Rhein
Lahn
Wiesbaden
Frankfurt a. M.
Fränkische Saale
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Regnitz
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Mosel
Sauer
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Saarbrücken
Moselle
Metz
Neckar
Stuttgart
Strasbourg
Sarre
Meurthe
Ill
Rhein
Basel
Zürich
Aare
Bodensee
Bregenz
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
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Data sources
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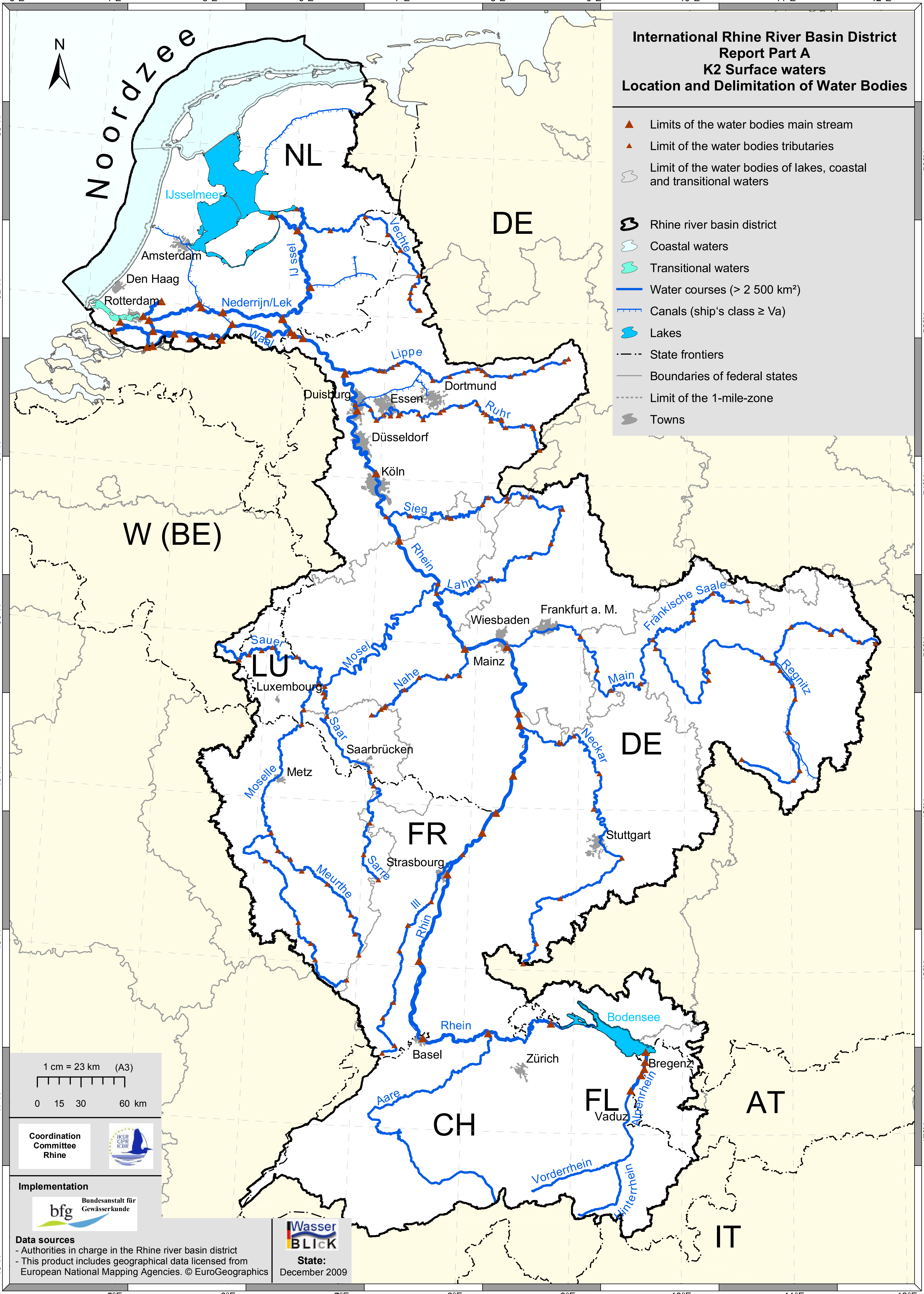
International Rhine River Basin District
Report Part A
K2 Surface waters
Location and Delimitation of Water Bodies
Limits of the water bodies main stream
Limit of the water bodies tributaries
Limit of the water bodies of lakes, coastal and transitional waters
Rhine river basin district
Coastal waters
Transitional waters
Water courses (> 2 500 km²)
Canals (ship's class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
Waal
IJssel
Vechte
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Wiesbaden
Frankfurt a. M.
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Rhin
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Rhein
Bodensee
Bregenz
Zürich
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
Implementation
Bundesanstalt für Gewässerkunde
Data sources
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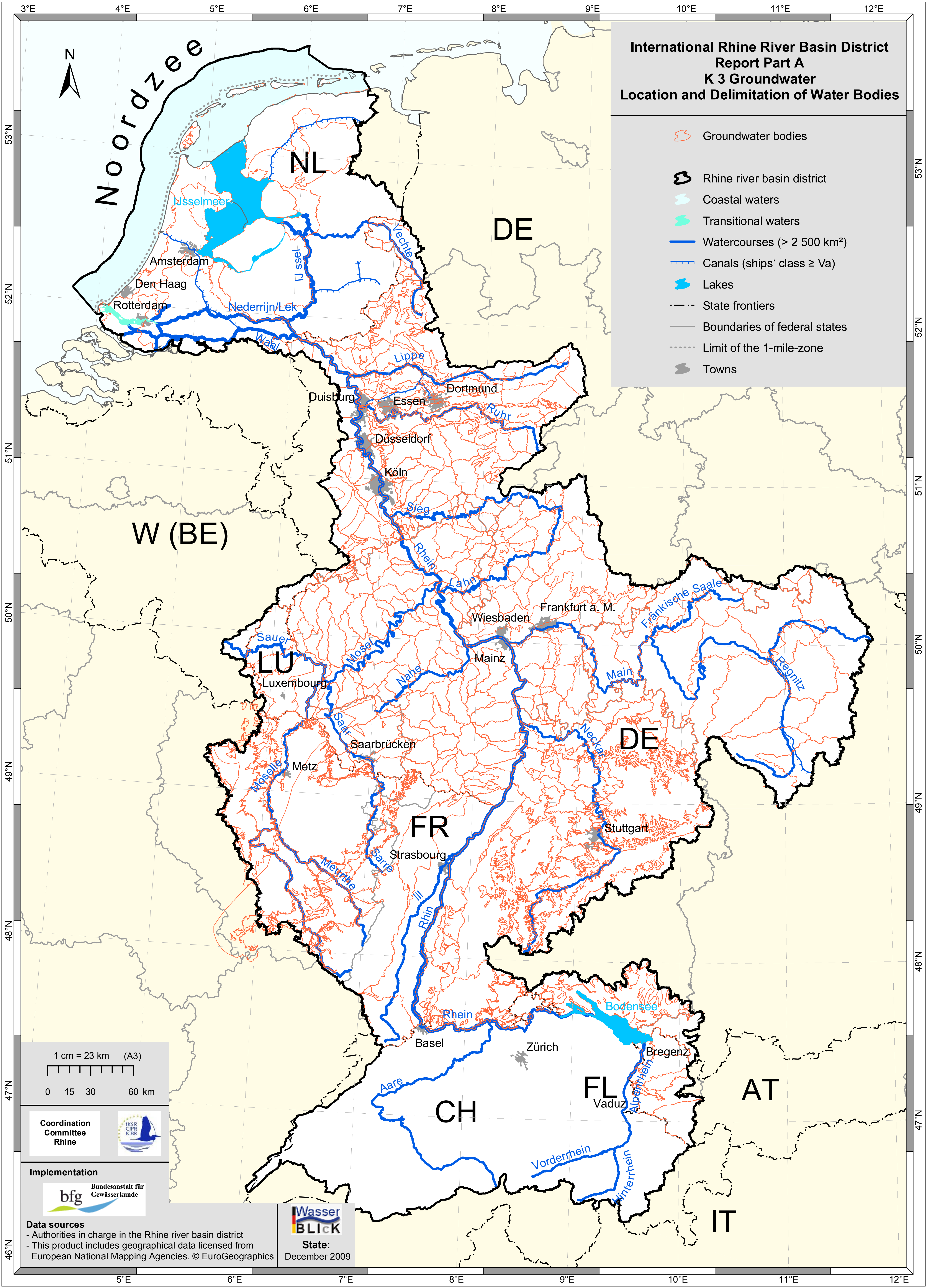
International Rhine River Basin District
Report Part A
K 3 Groundwater
Location and Delimitation of Water Bodies
Groundwater bodies
Rhine river basin district
Coastal waters
Transitional waters
Watercourses (> 2 500 km²)
Canals (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
Noordzee
NL
DE
W (BE)
LU
FR
CH
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AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
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Frankfurt a. M.
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Bodensee
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
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Bundesanstalt für Gewässerkunde
Data sources
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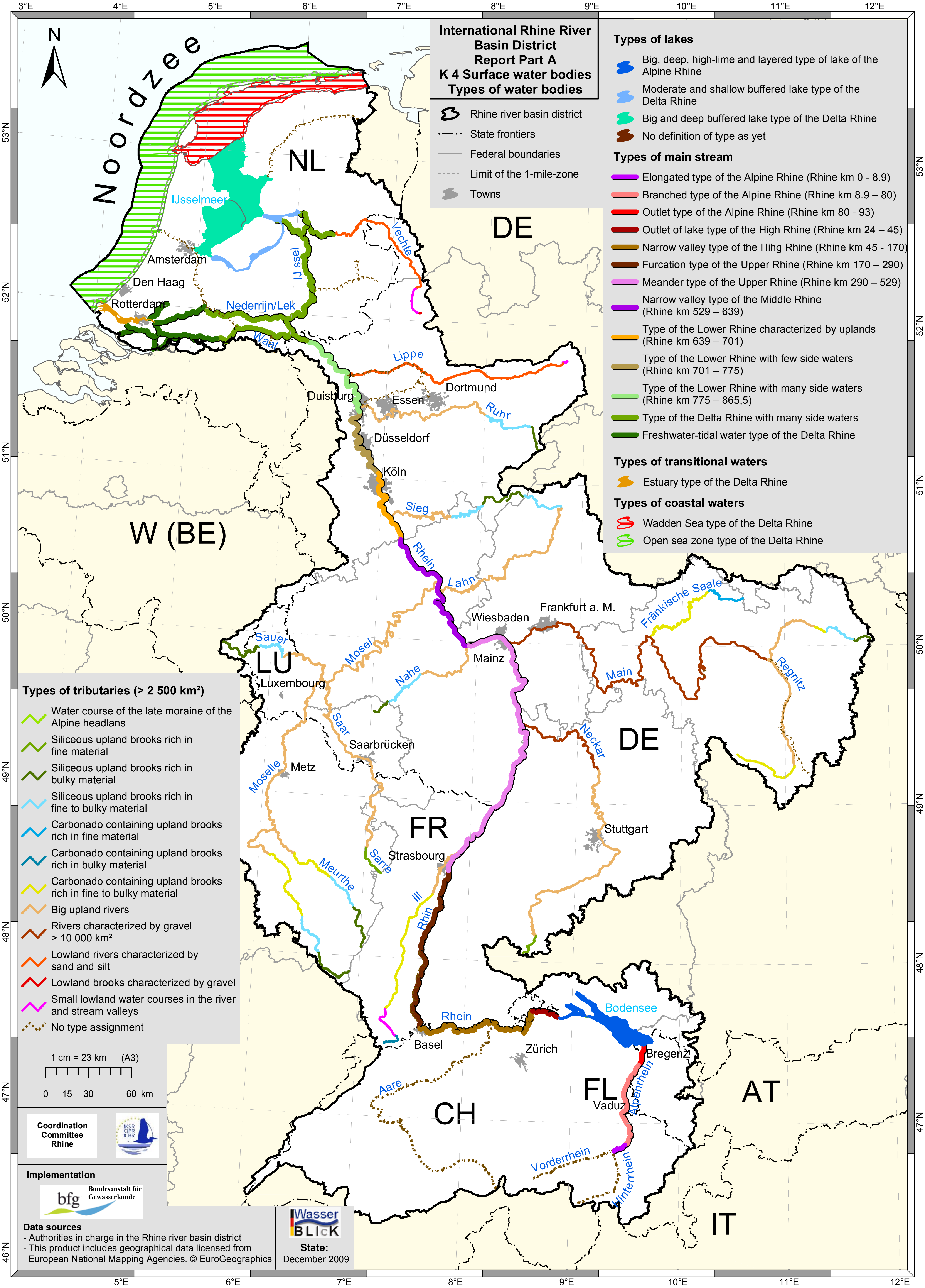
International Rhine River Basin District
Report Part A
K 4 Surface water bodies
Types of water bodies
Rhine river basin district
State frontiers
Federal boundaries
Limit of the 1-mile-zone
Towns
Types of lakes
Big, deep, high-lime and layered type of lake of the Alpine Rhine
Moderate and shallow buffered lake type of the Delta Rhine
Big and deep buffered lake type of the Delta Rhine
No definition of type as yet
Types of main stream
Elongated type of the Alpine Rhine (Rhine km 0 - 8.9)
Branched type of the Alpine Rhine (Rhine km 8.9 – 80)
Outlet type of the Alpine Rhine (Rhine km 80 - 93)
Outlet of lake type of the High Rhine (Rhine km 24 – 45)
Narrow valley type of the Hihg Rhine (Rhine km 45 - 170)
Furcation type of the Upper Rhine (Rhine km 170 – 290)
Meander type of the Upper Rhine (Rhine km 290 – 529)
Narrow valley type of the Middle Rhine (Rhine km 529 – 639)
Type of the Lower Rhine characterized by uplands (Rhine km 639 – 701)
Type of the Lower Rhine with few side waters (Rhine km 701 – 775)
Type of the Lower Rhine with many side waters (Rhine km 775 – 865,5)
Type of the Delta Rhine with many side waters
Freshwater-tidal water type of the Delta Rhine
Types of transitional waters
Estuary type of the Delta Rhine
Types of coastal waters
Wadden Sea type of the Delta Rhine
Open sea zone type of the Delta Rhine
Types of tributaries (> 2 500 km²)
Water course of the late moraine of the Alpine headlans
Siliceous upland brooks rich in fine material
Siliceous upland brooks rich in bulky material
Siliceous upland brooks rich in fine to bulky material
Carbonado containing upland brooks rich in fine material
Carbonado containing upland brooks rich in bulky material
Carbonado containing upland brooks rich in fine to bulky material
Big upland rivers
Rivers characterized by gravel > 10 000 km²
Lowland rivers characterized by sand and silt
Lowland brooks characterized by gravel
Small lowland water courses in the river and stream valleys
No type assignment
1 cm = 23 km (A3)
0 15 30 60 km
N
Noordzee
NL
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W (BE)
LU
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IT
IJsselmeer
Amsterdam
Den Haag
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Alpenrhein
Vorderrhein
Hinterrhein
3°E 4°E 5°E 6°E 7°E 8°E 9°E 10°E 11°E 12°E
46°N 47°N 48°N 49°N 50°N 51°N 52°N 53°N
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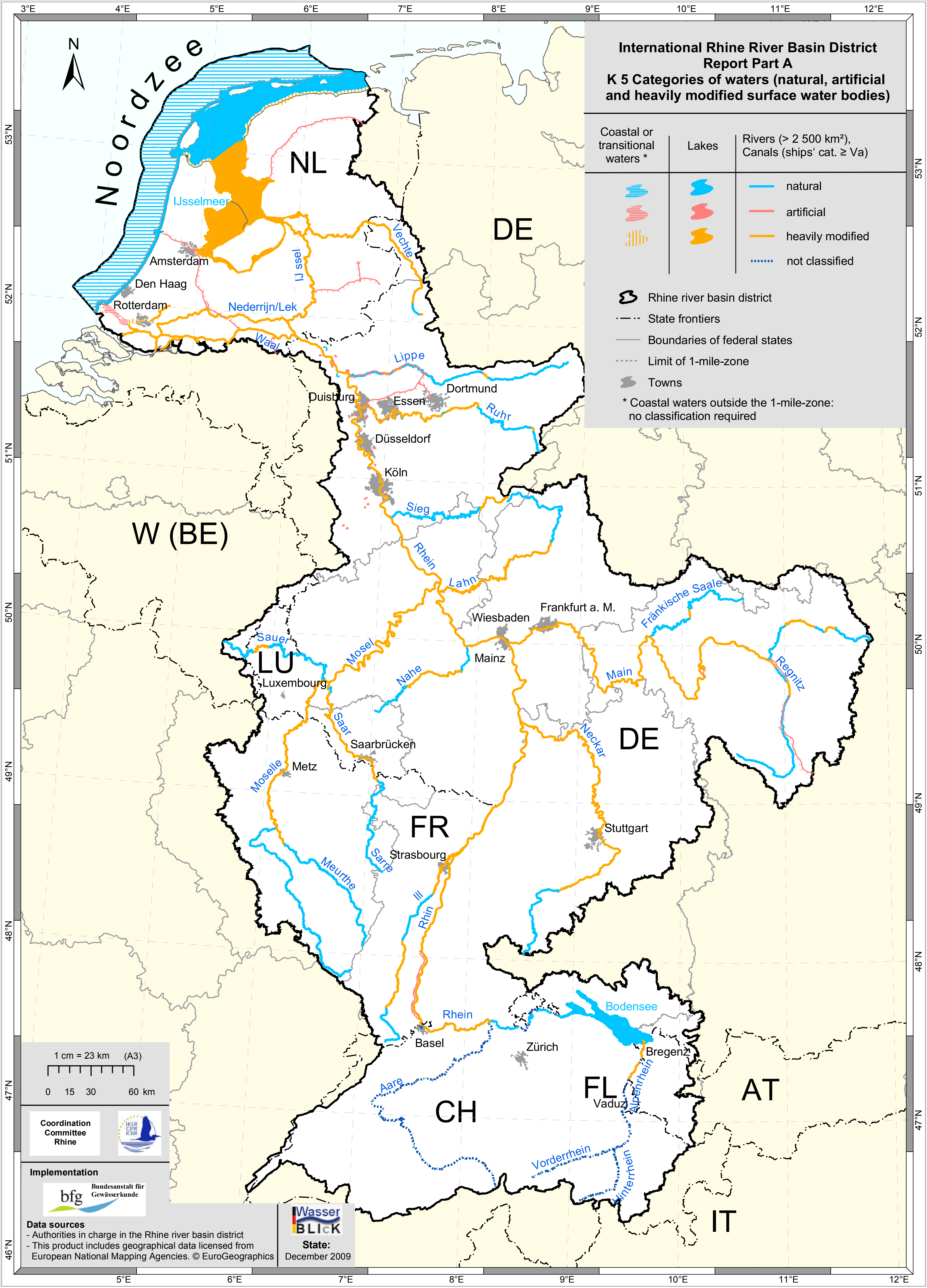

International Rhine River Basin District
Report Part A
K 5 Categories of waters (natural, artificial and heavily modified surface water bodies)
Coastal or transitional waters *
Lakes
Rivers (> 2 500 km²), Canals (ships‘ cat. ≥ Va)
natural
artificial
heavily modified
not classified
Rhine river basin district
State frontiers
Boundaries of federal states
Limit of 1-mile-zone
Towns
* Coastal waters outside the 1-mile-zone: no classification required
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
IJssel
Vechte
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Duisburg
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Rhin
Rhein
Bodensee
Basel
Zürich
Bregenz
Aare
Alpenrhein
Vaduz
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
Implementation
Bundesanstalt für Gewässerkunde
Data sources
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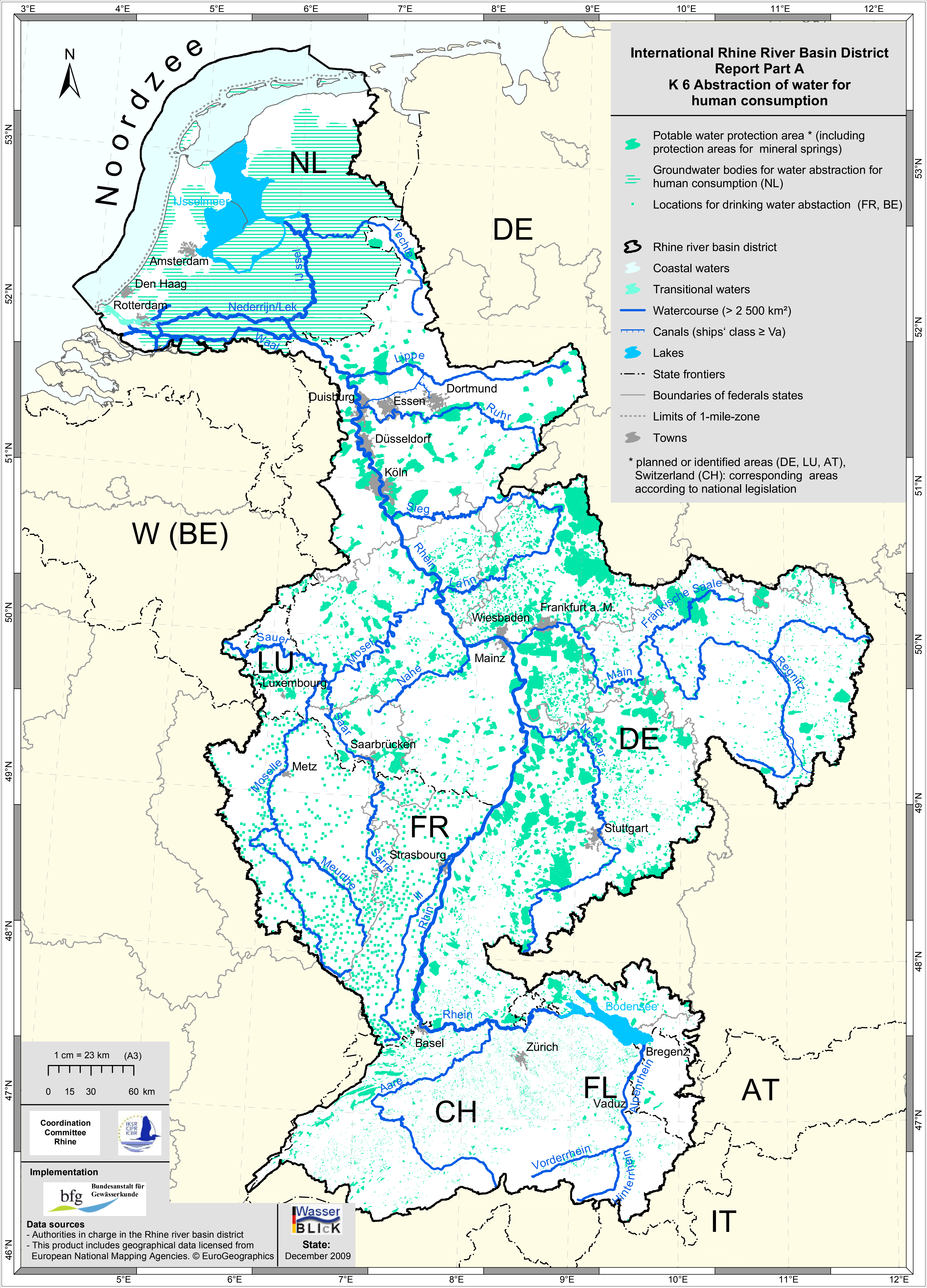
International Rhine River Basin District
Report Part A
K 6 Abstraction of water for
human consumption
Potable water protection area * (including protection areas for mineral springs)
Groundwater bodies for water abstraction for human consumption (NL)
Locations for drinking water abstaction (FR, BE)
Rhine river basin district
Coastal waters
Transitional waters
Watercourse (> 2 500 km²)
Canals (ships‘ class ≥ Va)
Lakes
State frontiers
Boundaries of federals states
Limits of 1-mile-zone
Towns
* planned or identified areas (DE, LU, AT), Switzerland (CH): corresponding areas according to national legislation
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
Vechte
Nederrijn/Lek
Waal
Lippe
Dortmund
Duisburg
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Ruhr
Düsseldorf
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Lahn
Frankfurt a. M.
Wiesbaden
Fränkische Saale
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Mosel
Mainz
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Regnitz
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Saarbrücken
Neckar
Moselle
Metz
Stuttgart
Strasbourg
Sarre
Meurthe
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Rhin
Rhein
Bodensee
Basel
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
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Data sources
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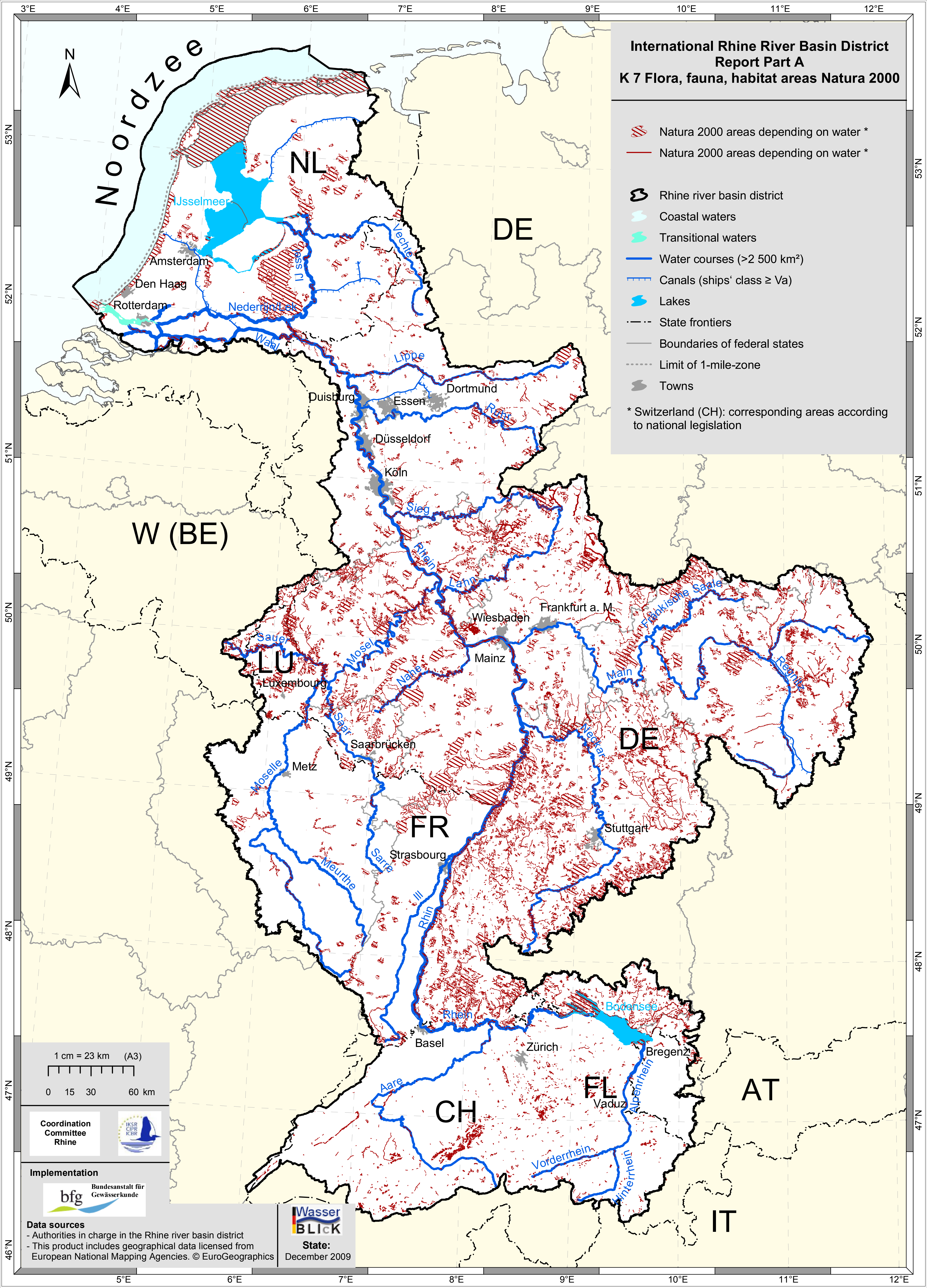
International Rhine River Basin District
Report Part A
K 7 Flora, fauna, habitat areas Natura 2000
Natura 2000 areas depending on water *
Natura 2000 areas depending on water *
Rhine river basin district
Coastal waters
Transitional waters
Water courses (>2 500 km²)
Canals (ships‘ class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of 1-mile-zone
Towns
* Switzerland (CH): corresponding areas according to national legislation
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
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Dortmund
Düsseldorf
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Wiesbaden
Frankfurt a. M.
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Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
IKSR CIPR ICBR
Implementation
bfg Bundesanstalt für Gewässerkunde
Data sources
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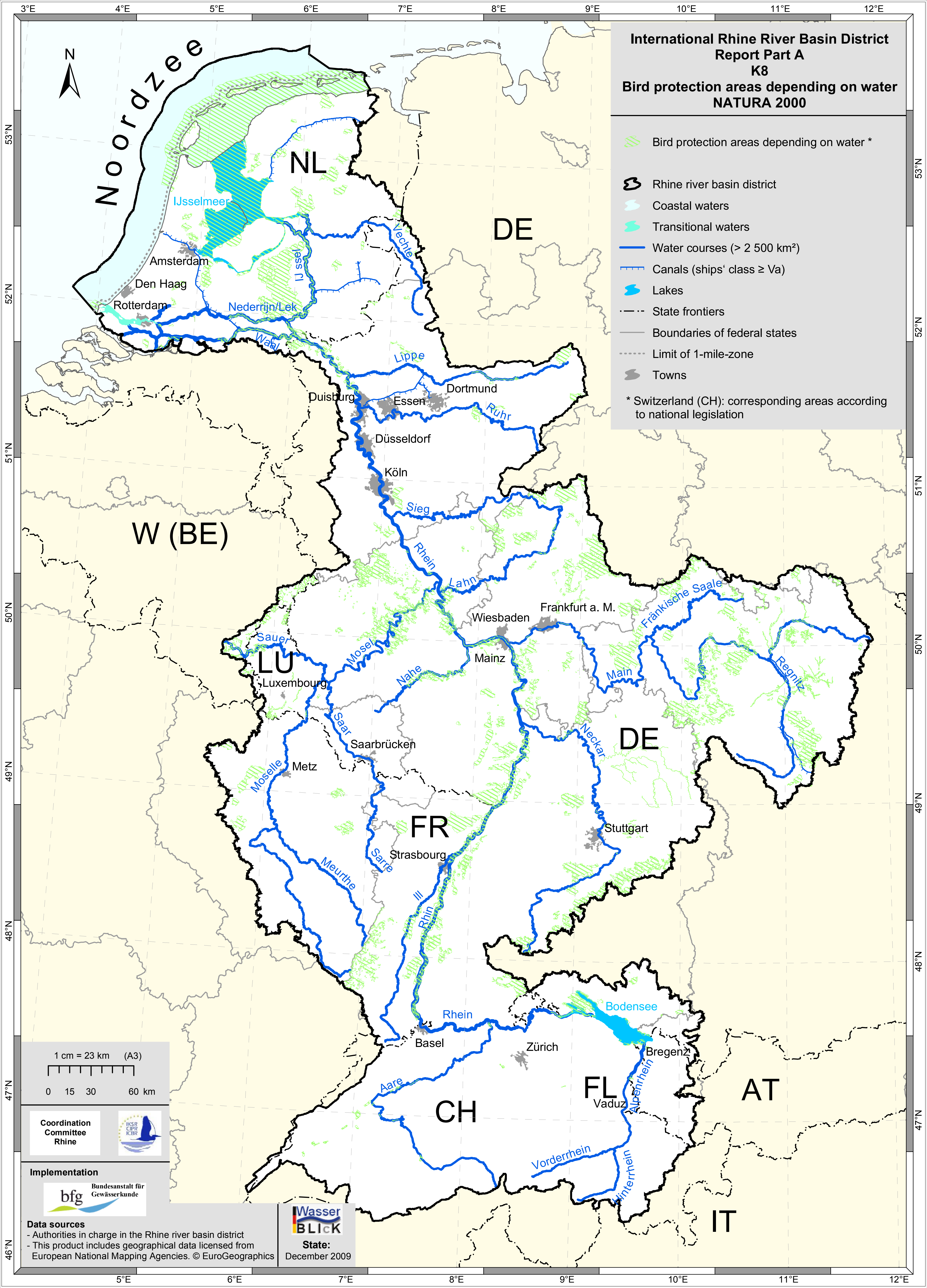

International Rhine River Basin District
Report Part A
K8
Bird protection areas depending on water
NATURA 2000
Bird protection areas depending on water *
Rhine river basin district
Coastal waters
Transitional waters
Water courses (> 2 500 km²)
Canals (ships‘ class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of 1-mile-zone
Towns
* Switzerland (CH): corresponding areas according to national legislation
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
Waal
IJ ssel
Vechte
Lippe
Ruhr
Duisburg
Essen
Dortmund
Düsseldorf
Köln
Sieg
Rhein
Lahn
Wiesbaden
Frankfurt a. M.
Fränkische Saale
Mainz
Main
Regnitz
Sauer
Mosel
Luxembourg
Nahe
Saar
Saarbrücken
Neckar
Moselle
Metz
Stuttgart
Strasbourg
Sarre
Meurthe
Ill
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Rhein
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Bodensee
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
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Implementation
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Data sources
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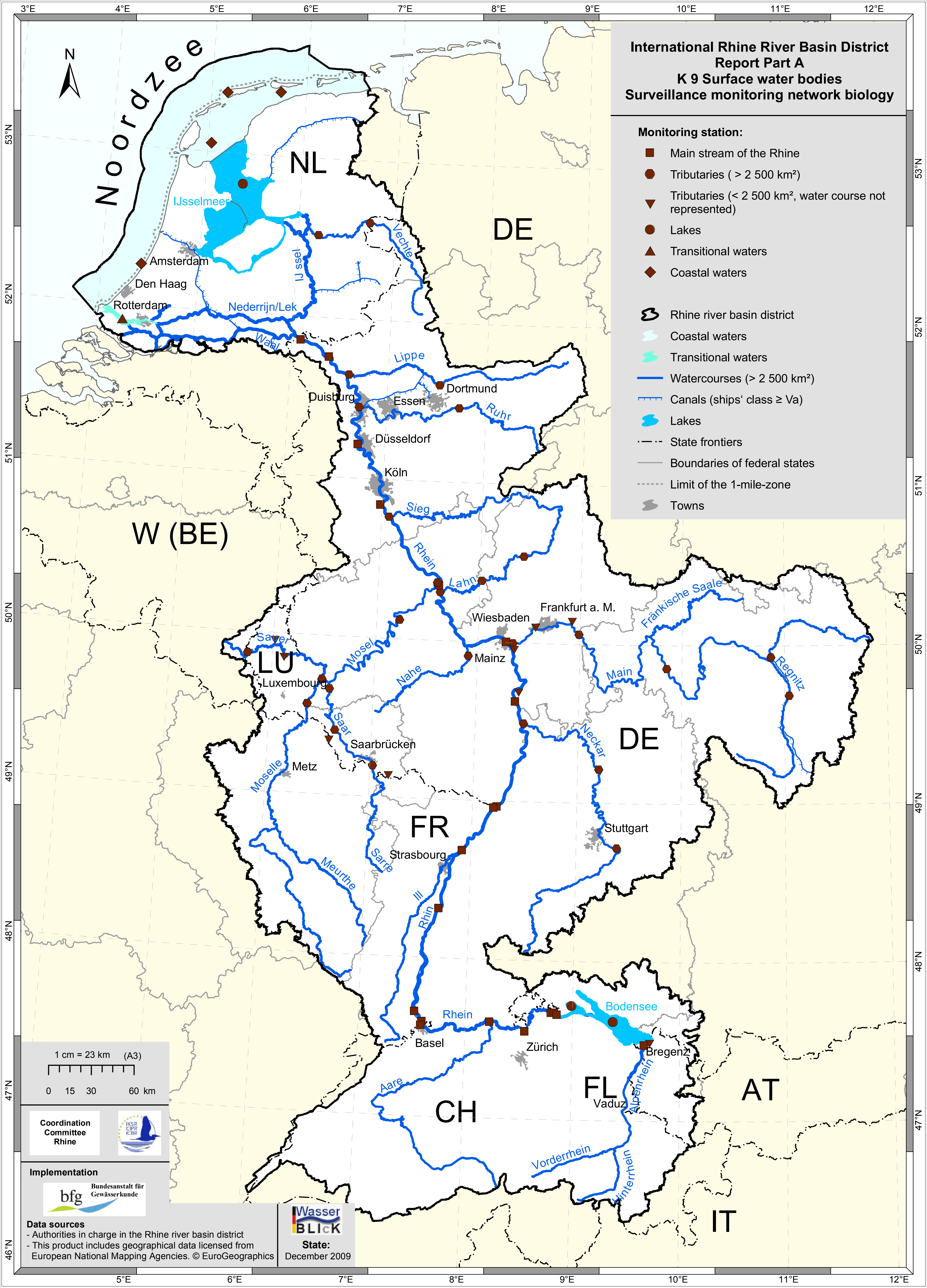

International Rhine River Basin District
Report Part A
K 9 Surface water bodies
Surveillance monitoring network biology
Monitoring station:
Main stream of the Rhine
Tributaries (> 2 500 km²)
Tributaries (< 2 500 km², water course not represented)
Lakes
Transitional waters
Coastal waters
Rhine river basin district
Coastal waters
Transitional waters
Watercourses (> 2 500 km²)
Canals (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
Vechte
Nederrijn/Lek
Waal
Lippe
Duisburg
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Ruhr
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Frankfurt a. M.
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Rhein
Basel
Zürich
Bodensee
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
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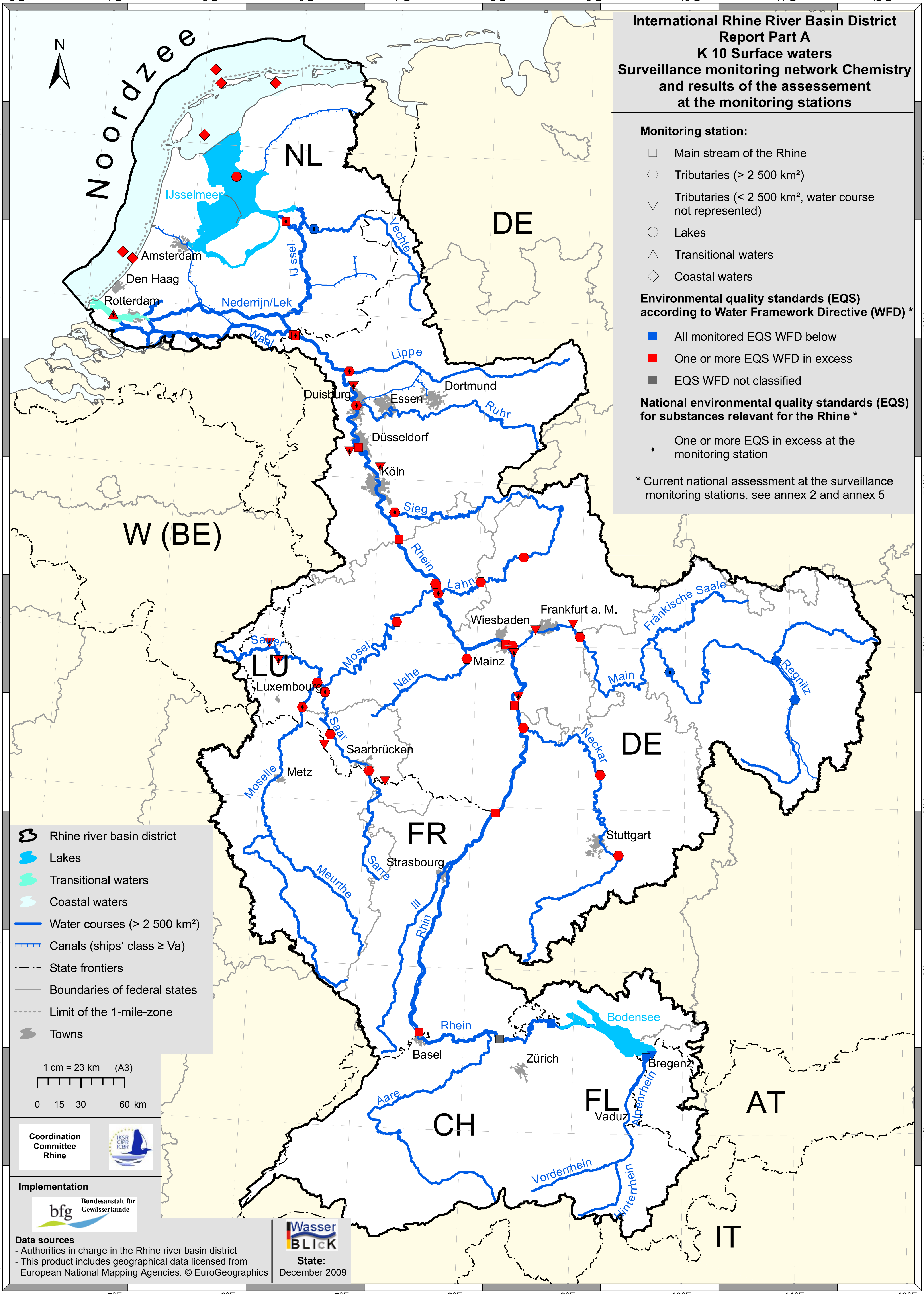
International Rhine River Basin District
Report Part A
K 10 Surface waters
Surveillance monitoring network Chemistry
and results of the assessement
at the monitoring stations
Monitoring station:
Main stream of the Rhine
Tributaries (> 2 500 km²)
Tributaries (< 2 500 km², water course not represented)
Lakes
Transitional waters
Coastal waters
Environmental quality standards (EQS) according to Water Framework Directive (WFD) *
All monitored EQS WFD below
One or more EQS WFD in excess
EQS WFD not classified
National environmental quality standards (EQS) for substances relevant for the Rhine *
One or more EQS in excess at the monitoring station
* Current national assessment at the surveillance monitoring stations, see annex 2 and annex 5
Rhine river basin district
Lakes
Transitional waters
Coastal waters
Water courses (> 2 500 km²)
Canals (ships' class ≥ Va)
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
1 cm = 23 km (A3)
0 15 30 60 km
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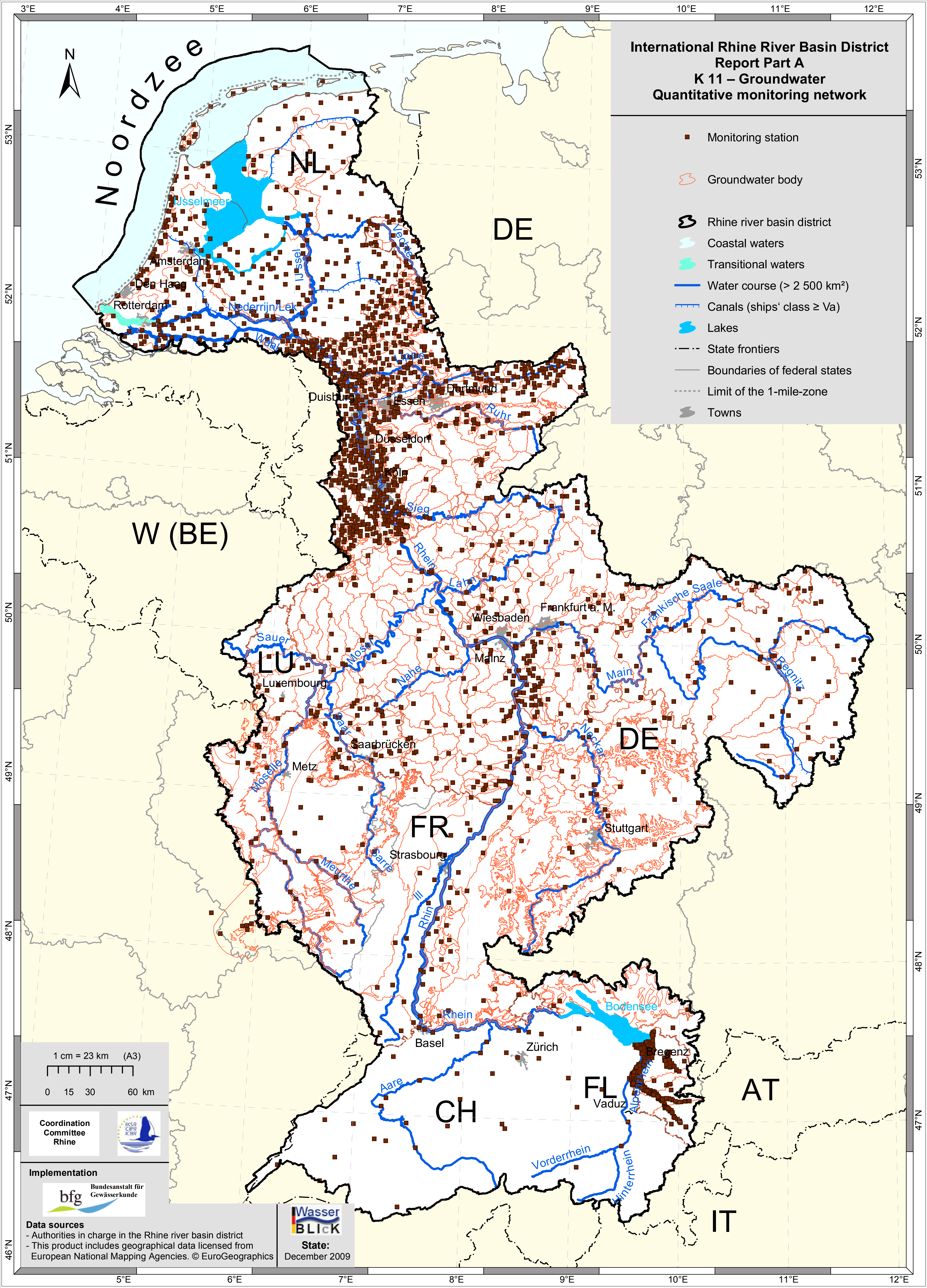
Alpenrhein
Vaduz
Vorderrhein
Hinterrhein
3°E 4°E 5°E 6°E 7°E 8°E 9°E 10°E 11°E 12°E
46°N 47°N 48°N 49°N 50°N 51°N 52°N 53°N



International Rhine River Basin District
Report Part A
K 11 – Groundwater
Quantitative monitoring network
Monitoring station
Groundwater body
Rhine river basin district
Coastal waters
Transitional waters
Water course (> 2 500 km²)
Canals (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
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Rhin
Bodensee
Basel
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
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Data sources
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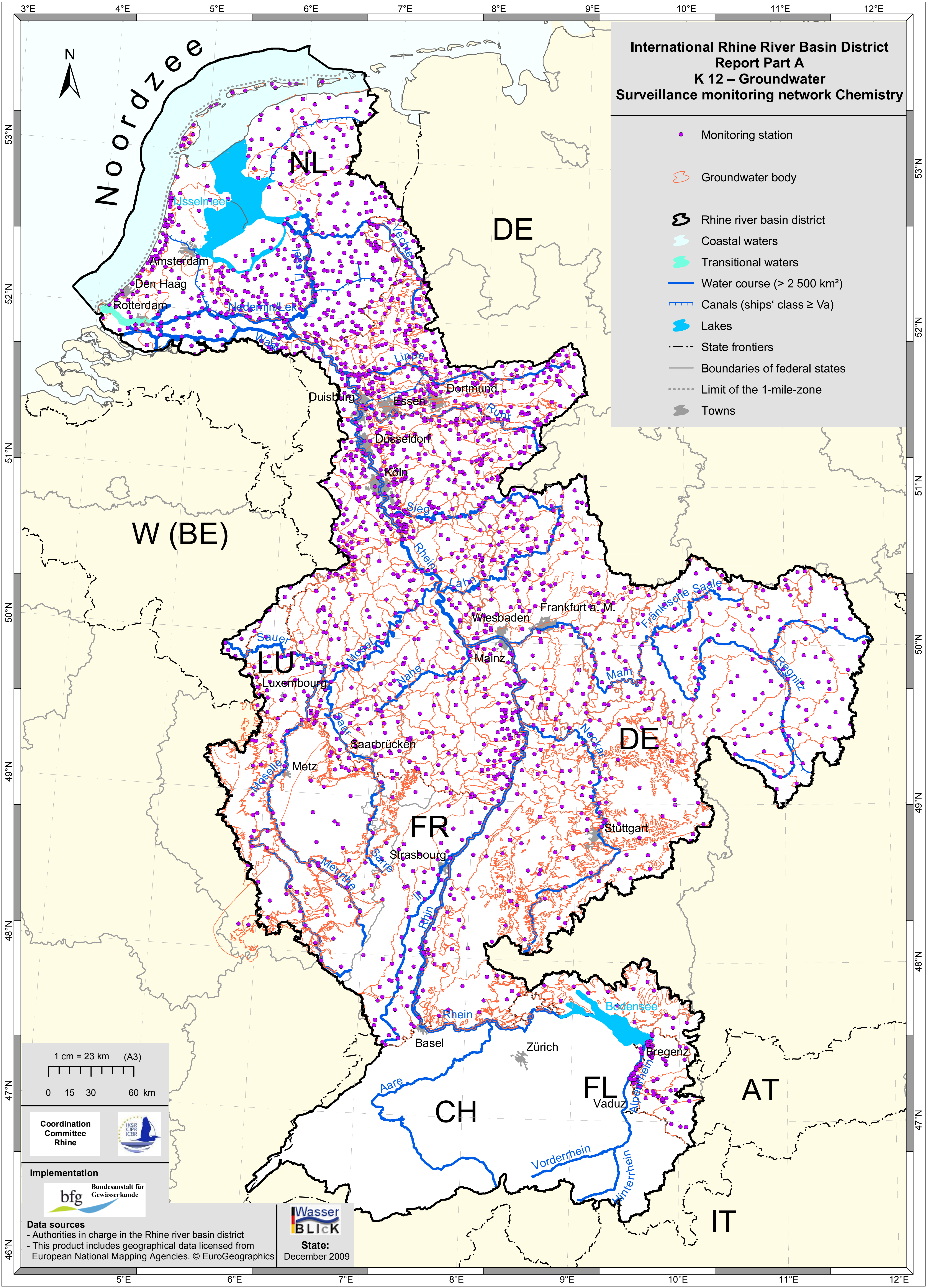
International Rhine River Basin District
Report Part A
K 12 – Groundwater
Surveillance monitoring network Chemistry
Monitoring station
Groundwater body
Rhine river basin district
Coastal waters
Transitional waters
Water course (> 2 500 km²)
Canals (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
Noordzee
NL
DE
W (BE)
LU
FR
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IJsselmeer
Amsterdam
Den Haag
Rotterdam
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IJssel
Sauer
Meurthe
Ill
Regnitz
Fränkische Saale
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
Implementation
Bundesanstalt für Gewässerkunde
Data sources
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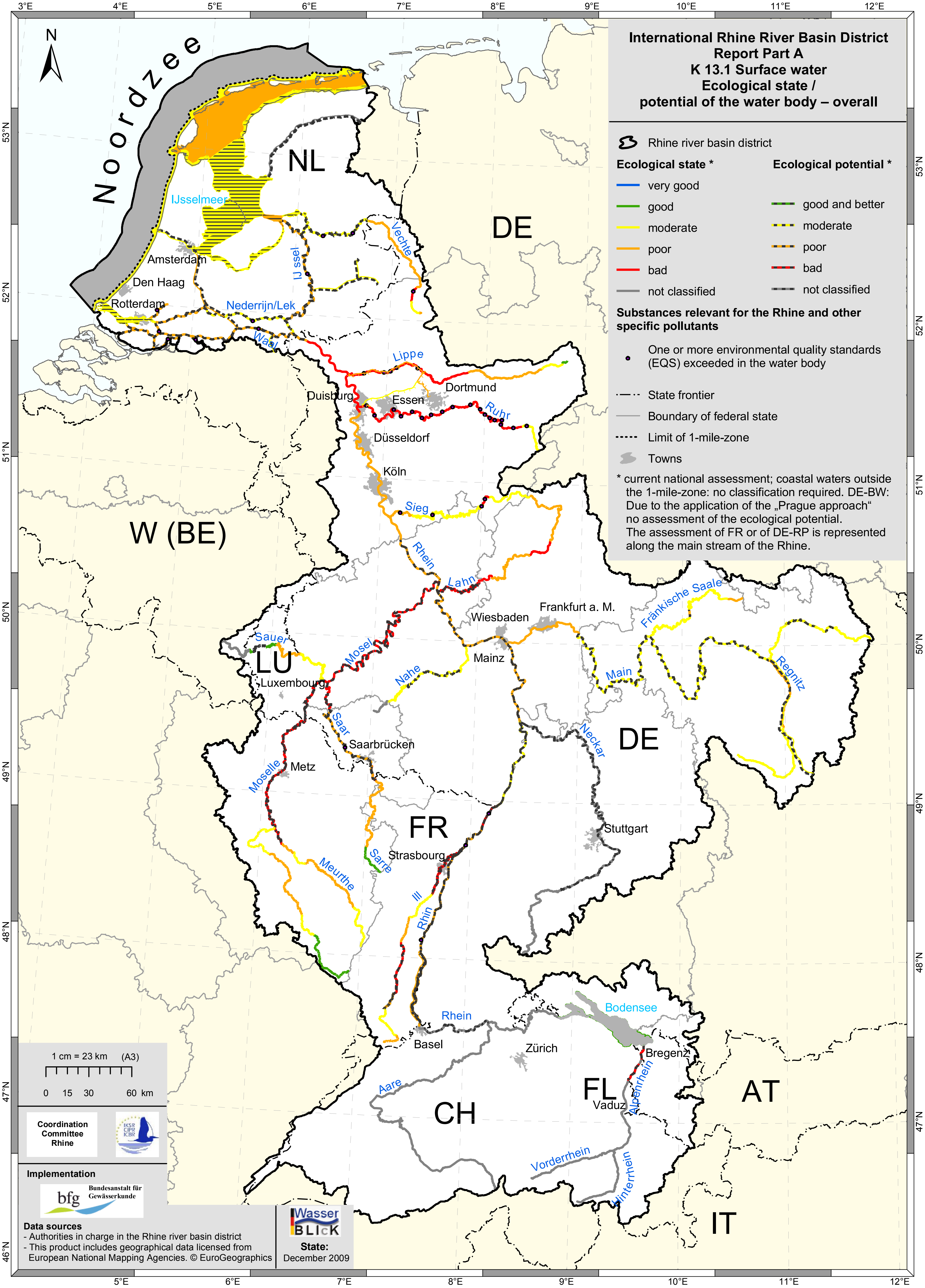
International Rhine River Basin District
Report Part A
K 13.1 Surface water
Ecological state /
potential of the water body – overall
Rhine river basin district
Ecological state *
very good
good
moderate
poor
bad
not classified
Ecological potential *
good and better
moderate
poor
bad
not classified
Substances relevant for the Rhine and other specific pollutants
One or more environmental quality standards (EQS) exceeded in the water body
State frontier
Boundary of federal state
Limit of 1-mile-zone
Towns
* current national assessment; coastal waters outside the 1-mile-zone: no classification required. DE-BW: Due to the application of the „Prague approach“ no assessment of the ecological potential. The assessment of FR or of DE-RP is represented along the main stream of the Rhine.
Noordzee
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Basel
Bodensee
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Zürich
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
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Data sources
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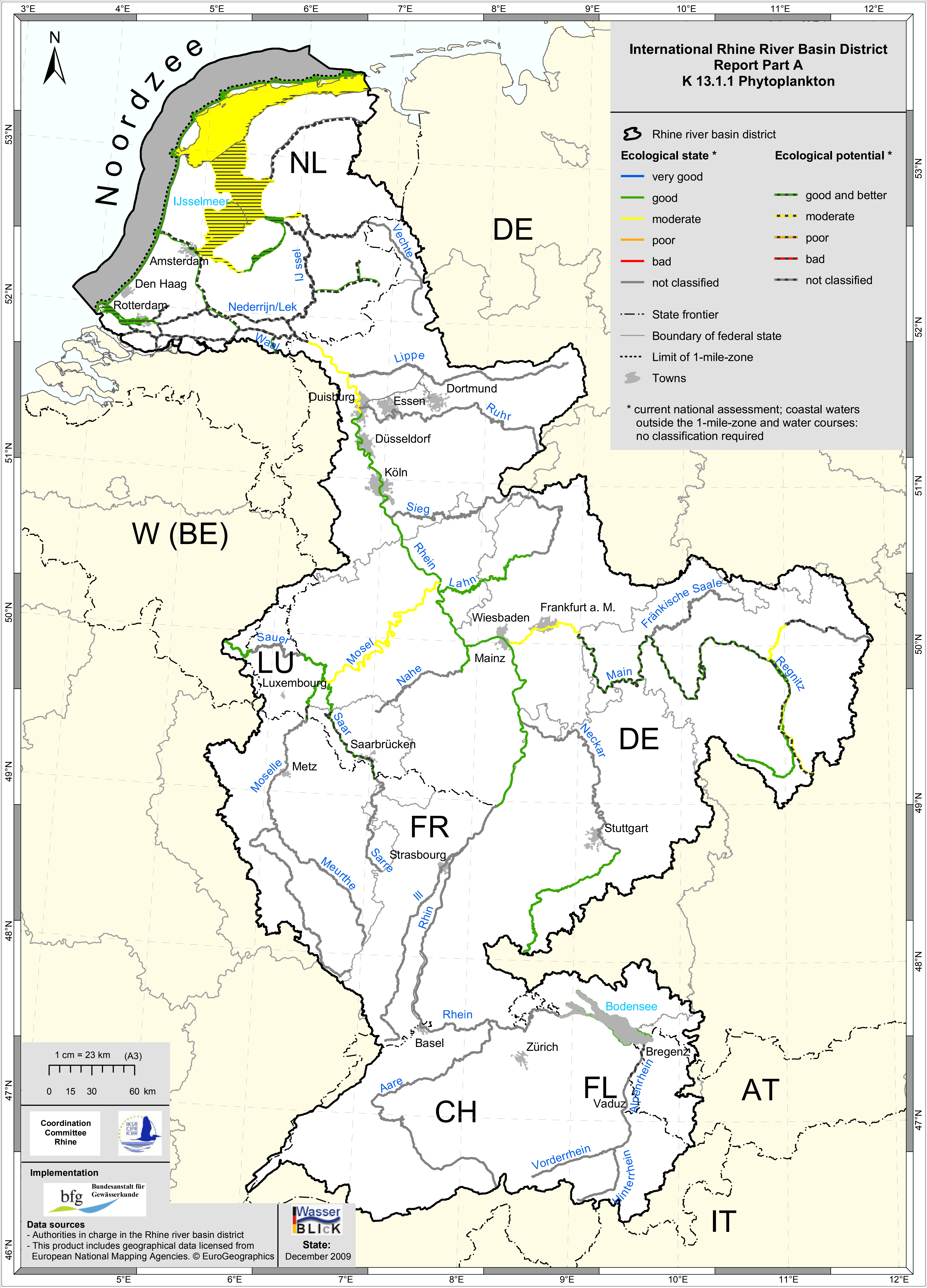
International Rhine River Basin District
Report Part A
K 13.1.1 Phytoplankton
Rhine river basin district
Ecological state *
very good
good
moderate
poor
bad
not classified
Ecological potential *
good and better
moderate
poor
bad
not classified
State frontier
Boundary of federal state
Limit of 1-mile-zone
Towns
* current national assessment; coastal waters outside the 1-mile-zone and water courses: no classification required
Noordzee
NL
DE
W (BE)
LU
FR
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IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
Vechte
Nederrijn/Lek
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Bodensee
Basel
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
Implementation
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Data sources
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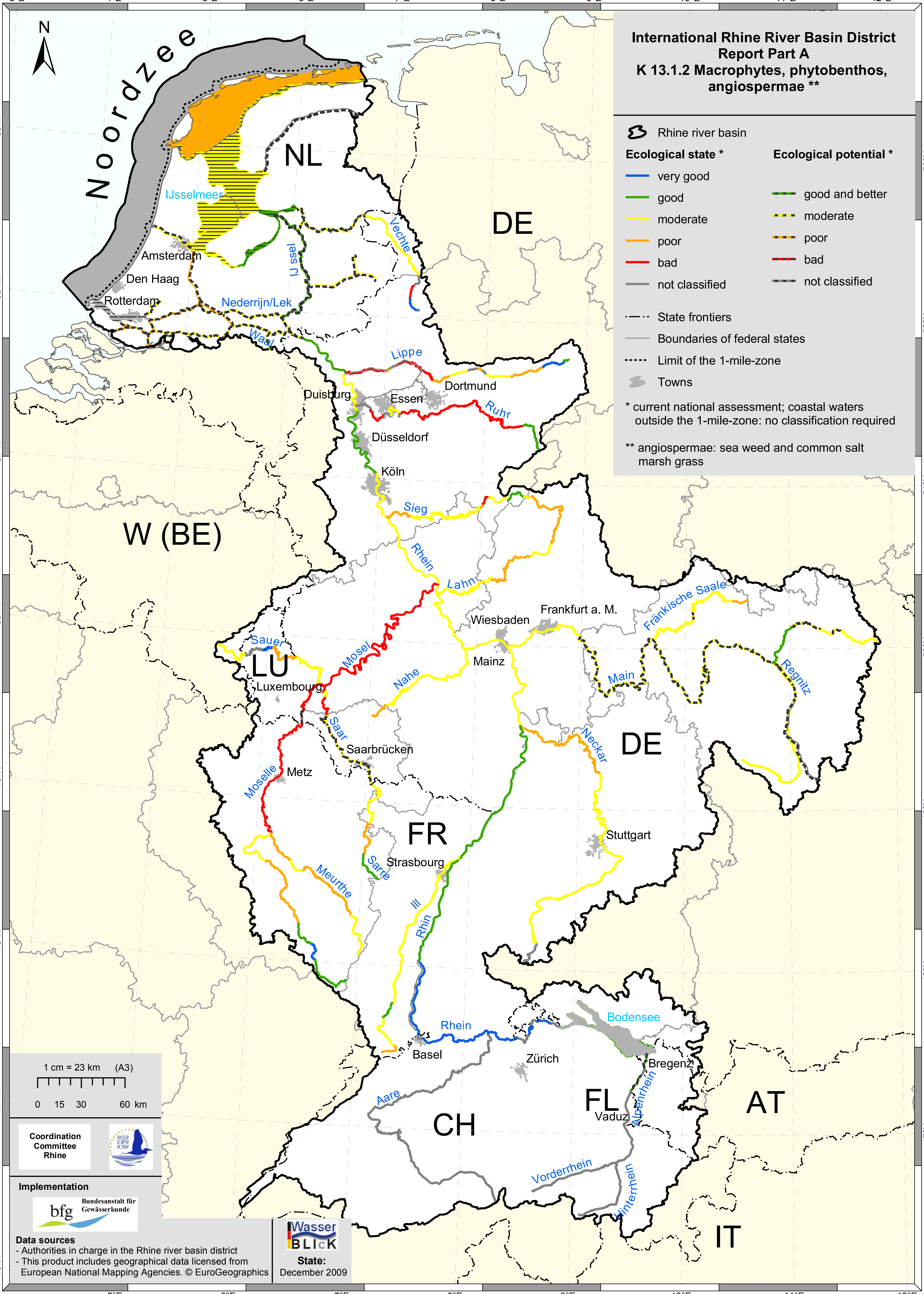
International Rhine River Basin District
Report Part A
K 13.1.2 Macrophytes, phytobenthos, angiospermae **
Rhine river basin
Ecological state *
very good
good
moderate
poor
bad
not classified
Ecological potential *
good and better
moderate
poor
bad
not classified
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment; coastal waters outside the 1-mile-zone: no classification required
** angiospermae: sea weed and common salt marsh grass
Noordzee
NL
DE
W (BE)
LU
FR
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IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
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Frankfurt a. M.
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Bodensee
Basel
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
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Data sources
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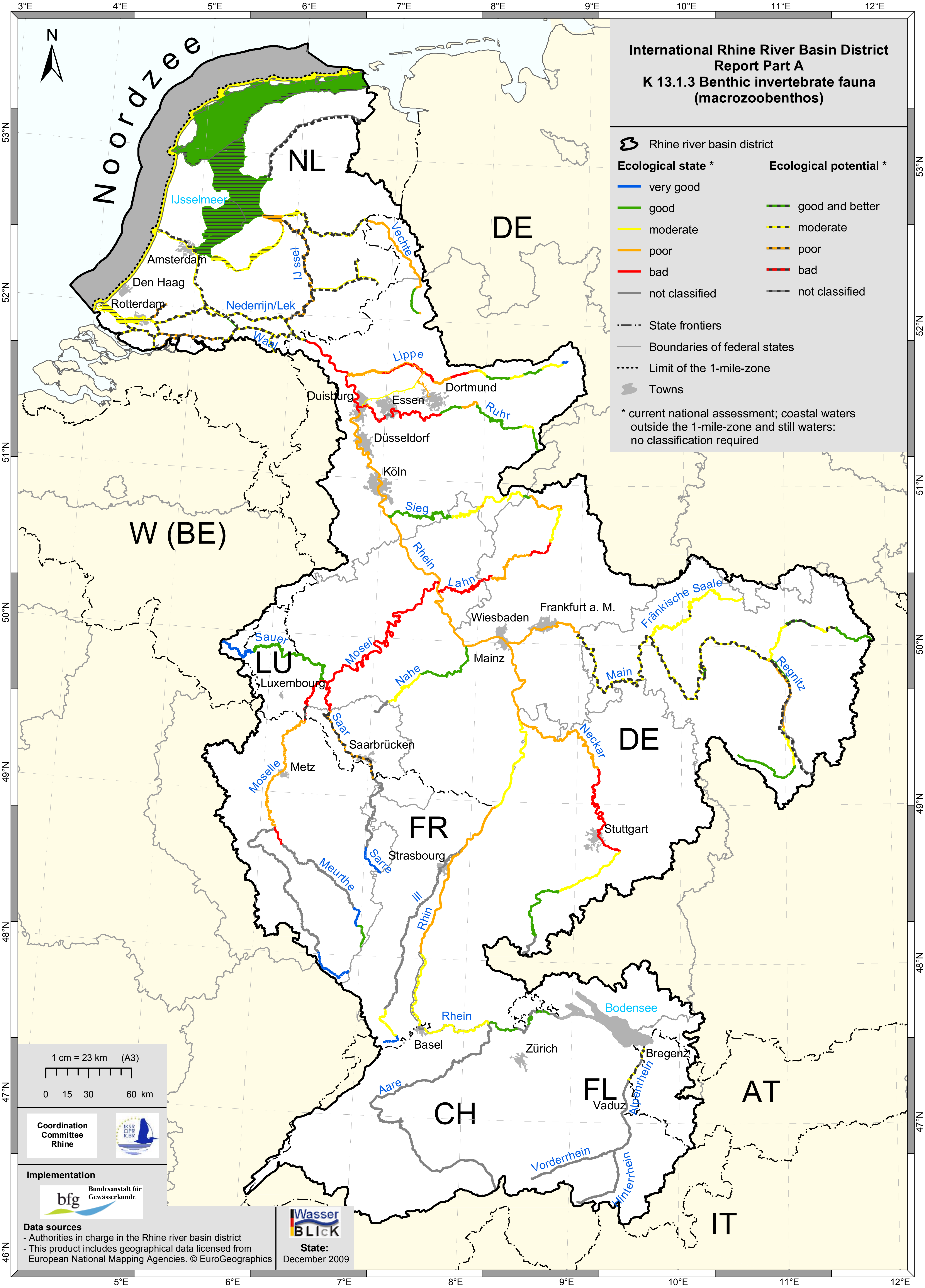
International Rhine River Basin District
Report Part A
K 13.1.3 Benthic invertebrate fauna
(macrozoobenthos)
Rhine river basin district
Ecological state *
very good
good
moderate
poor
bad
not classified
Ecological potential *
good and better
moderate
poor
bad
not classified
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment; coastal waters outside the 1-mile-zone and still waters: no classification required
Noordzee
NL
DE
W (BE)
LU
FR
CH
FL
AT
IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
Nederrijn/Lek
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Dortmund
Duisburg
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Düsseldorf
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Wiesbaden
Frankfurt a. M.
Fränkische Saale
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Stuttgart
Sarre
Strasbourg
Meurthe
Ill
Rhin
Rhein
Bodensee
Basel
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
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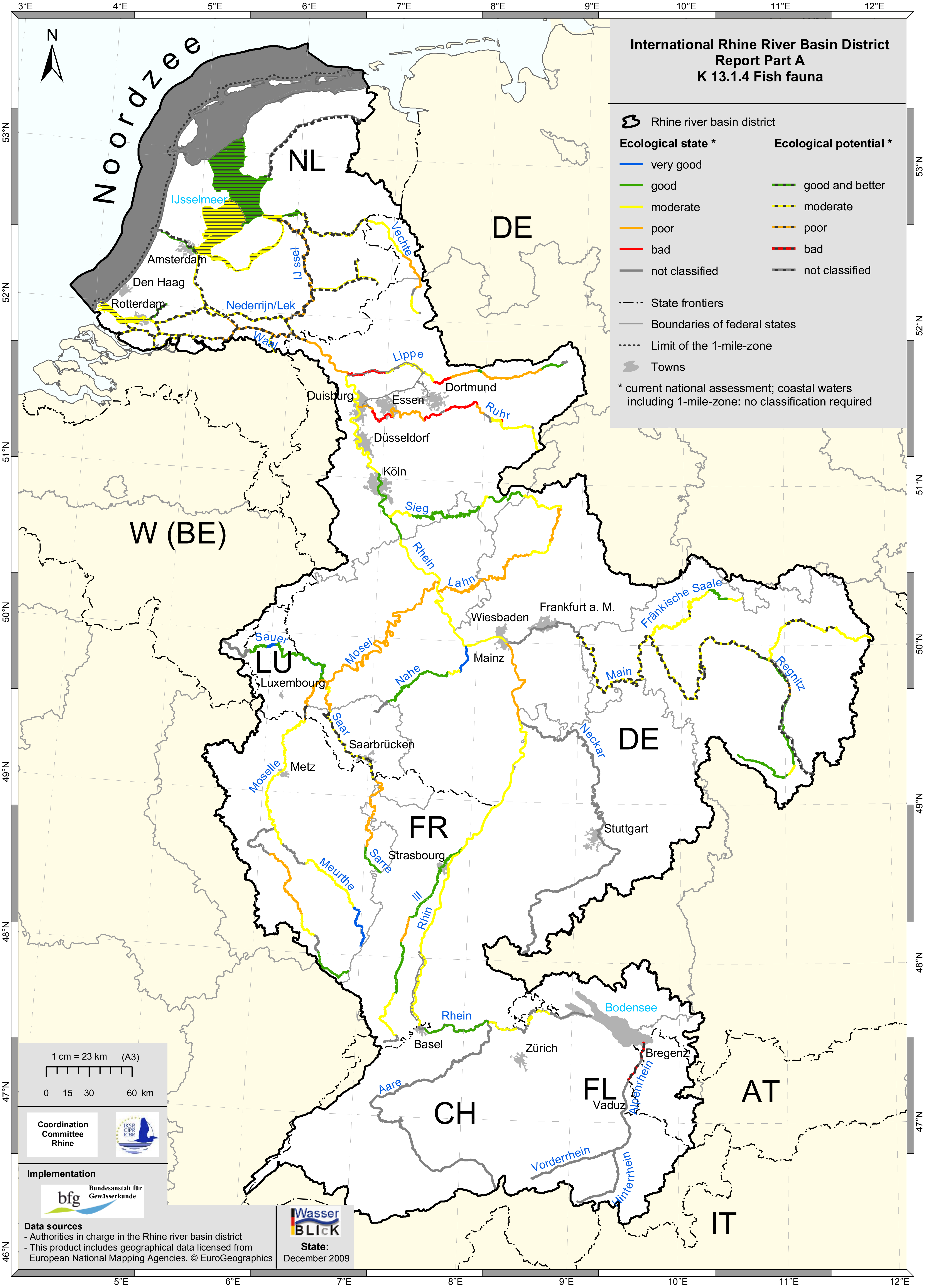
International Rhine River Basin District
Report Part A
K 13.1.4 Fish fauna
Rhine river basin district
Ecological state *
very good
good
moderate
poor
bad
not classified
Ecological potential *
good and better
moderate
poor
bad
not classified
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment; coastal waters including 1-mile-zone: no classification required
N
Noordzee
NL
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IJsselmeer
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Aare
Alpenrhein
Vaduz
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
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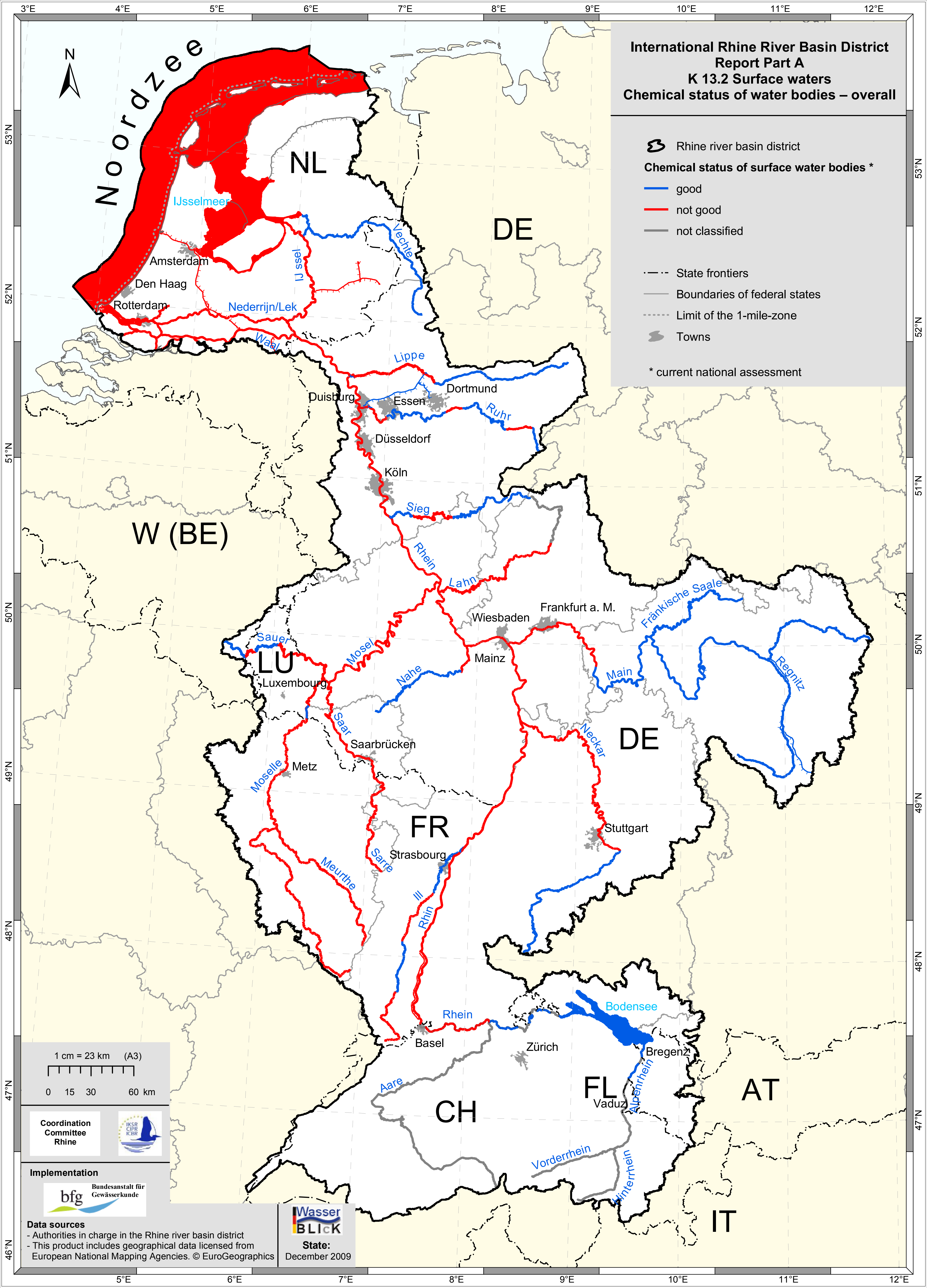

International Rhine River Basin District
Report Part A
K 13.2 Surface waters
Chemical status of water bodies – overall
Rhine river basin district
Chemical status of surface water bodies *
good
not good
not classified
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment
Noordzee
NL
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W (BE)
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IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
Vechte
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Zürich
Bodensee
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
N
1 cm = 23 km (A3)
0 15 30 60 km
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Data sources
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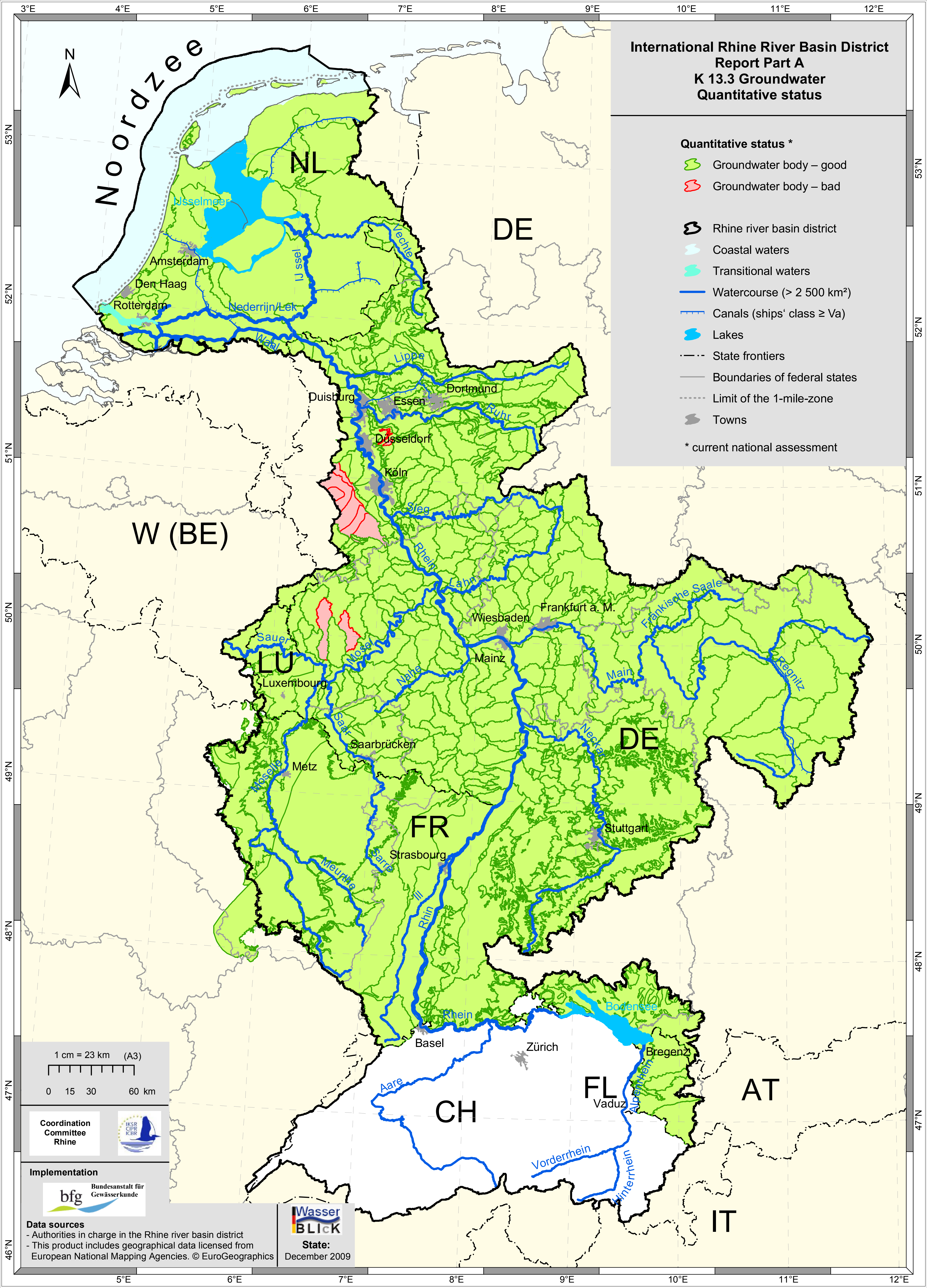
International Rhine River Basin District
Report Part A
K 13.3 Groundwater
Quantitative status
Quantitative status *
Groundwater body – good
Groundwater body – bad
Rhine river basin district
Coastal waters
Transitional waters
Watercourse (> 2 500 km²)
Canals (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment
Noordzee
NL
DE
W (BE)
LU
FR
CH
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IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
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Bodensee
Bregenz
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Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
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Implementation
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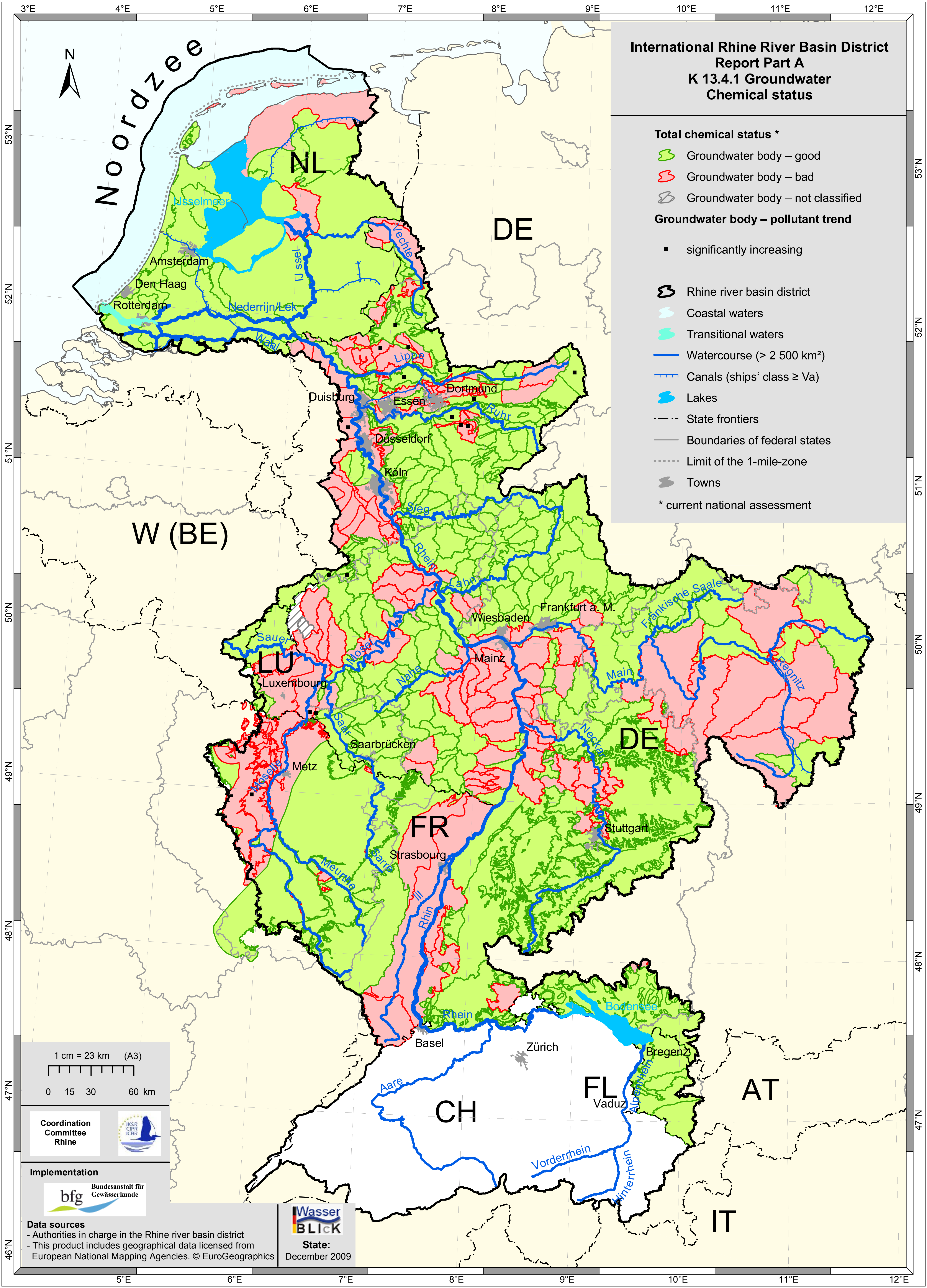
International Rhine River Basin District
Report Part A
K 13.4.1 Groundwater
Chemical status
Total chemical status *
Groundwater body – good
Groundwater body – bad
Groundwater body – not classified
Groundwater body – pollutant trend
significantly increasing
Rhine river basin district
Coastal waters
Transitional waters
Watercourse (> 2 500 km²)
Canals (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment
Noordzee
NL
DE
W (BE)
LU
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IJsselmeer
Amsterdam
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Rotterdam
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Bregenz
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Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
Implementation
Bundesanstalt für Gewässerkunde
Data sources
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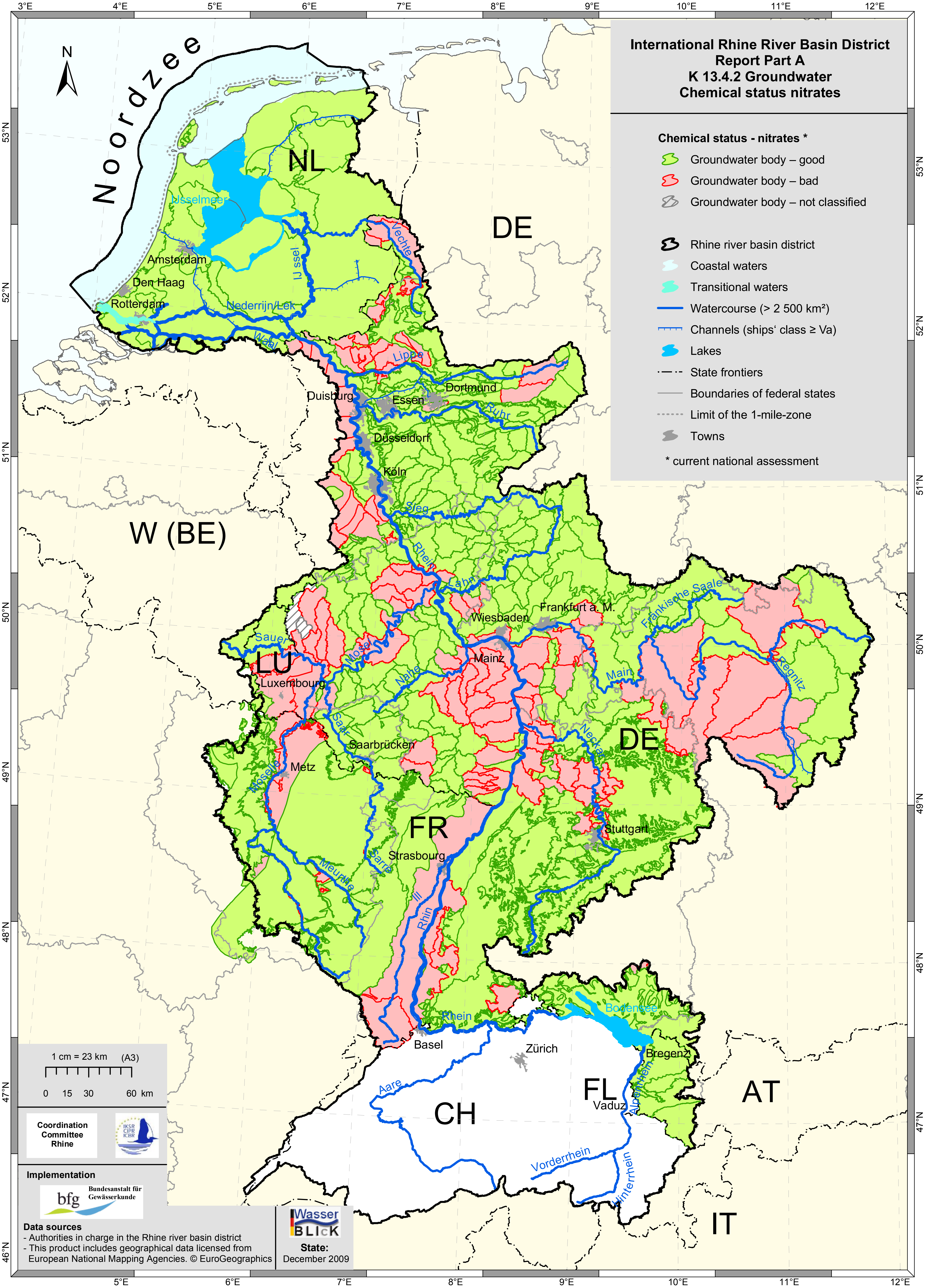
International Rhine River Basin District
Report Part A
K 13.4.2 Groundwater
Chemical status nitrates
Chemical status - nitrates *
Groundwater body – good
Groundwater body – bad
Groundwater body – not classified
Rhine river basin district
Coastal waters
Transitional waters
Watercourse (> 2 500 km²)
Channels (ships' class ≥ Va)
Lakes
State frontiers
Boundaries of federal states
Limit of the 1-mile-zone
Towns
* current national assessment
N
Noordzee
NL
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W (BE)
LU
FR
CH
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IT
IJsselmeer
Amsterdam
Den Haag
Rotterdam
IJssel
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Mainz
Main
Regnitz
Sauer
Mosel
Luxembourg
Nahe
Saar
Saarbrücken
Neckar
Metz
Moselle
Stuttgart
Strasbourg
Sarre
Meurthe
Ill
Rhin
Rhein
Bodensee
Basel
Zürich
Bregenz
Aare
Vaduz
Alpenrhein
Vorderrhein
Hinterrhein
1 cm = 23 km (A3)
0 15 30 60 km
Coordination Committee Rhine
IKSR CIPR ICBR
Implementation
bfg Bundesanstalt für Gewässerkunde
Data sources
- Authorities in charge in the Rhine river basin district
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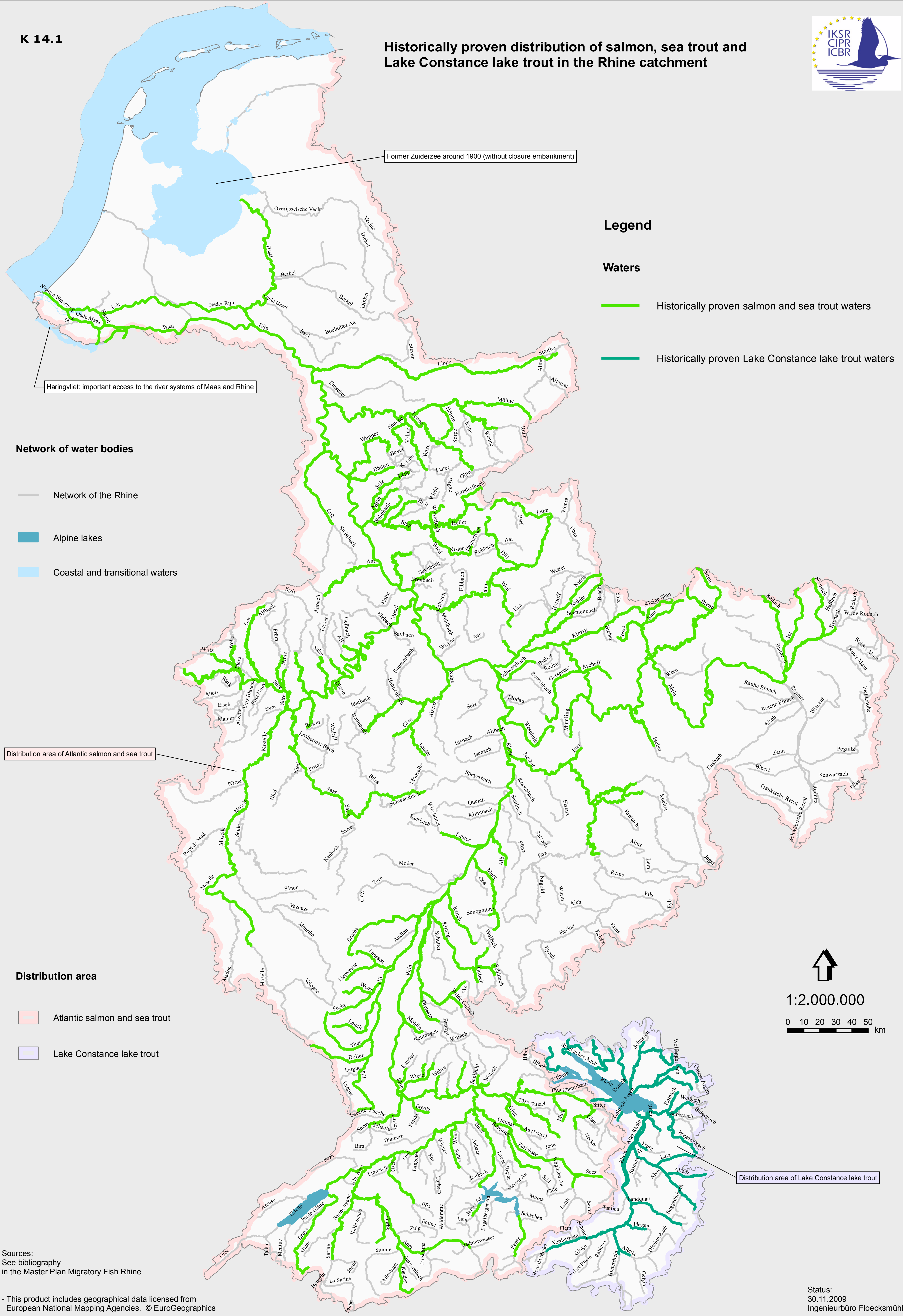
Wasser BLIcK
State: December 2009

K 14.1

Historically proven distribution of salmon, sea trout and Lake Constance lake trout in the Rhine catchment



Legend

Waters

- Historically proven salmon and sea trout waters
- Historically proven Lake Constance lake trout waters

Network of water bodies

- Network of the Rhine
- Alpine lakes
- Coastal and transitional waters

Distribution area

- Atlantic salmon and sea trout
- Lake Constance lake trout

Sources:
See bibliography
in the Master Plan Migratory Fish Rhine

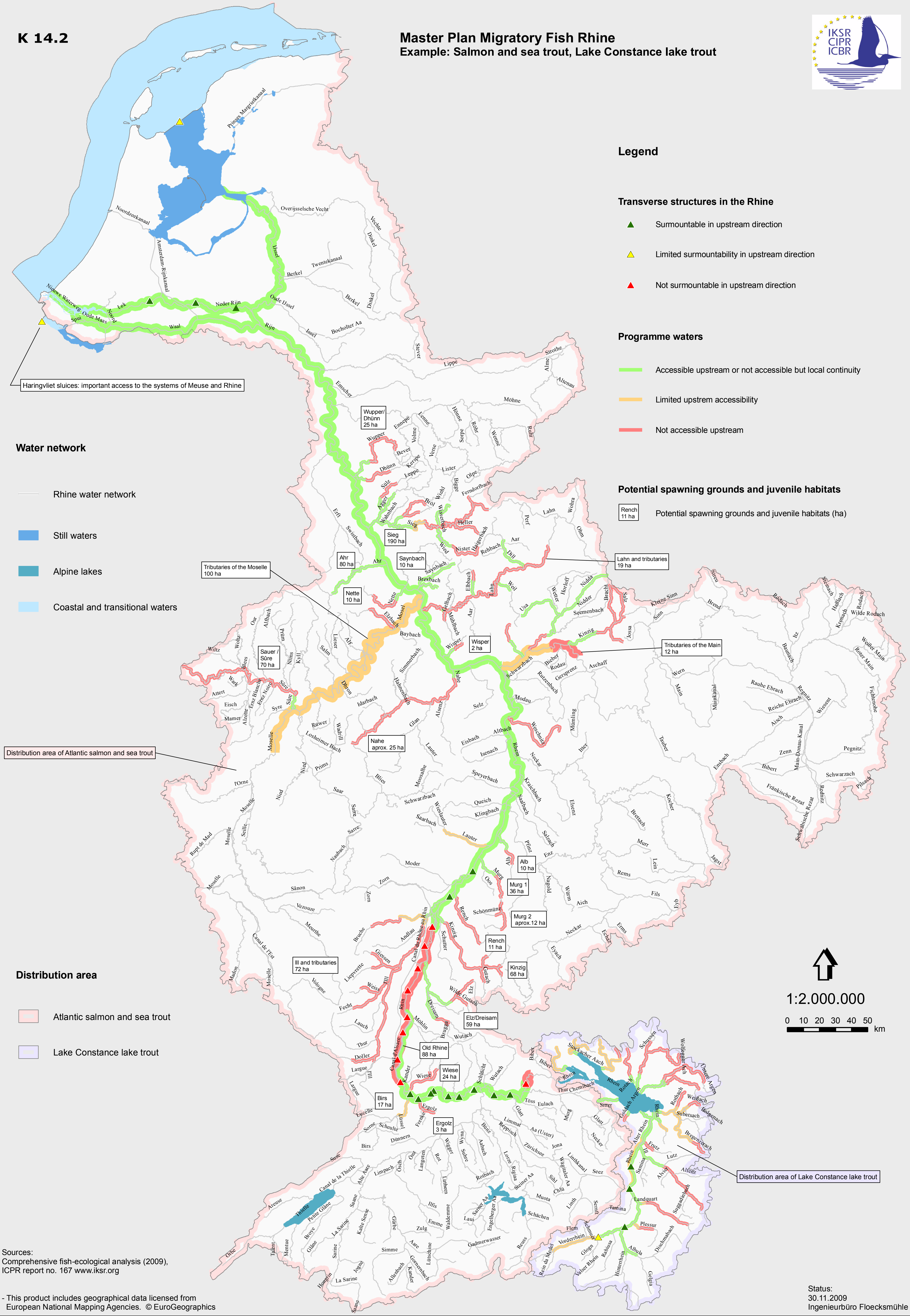
Status:
30.11.2009
Ingenieurbüro Floecksmühle

K 14.2

Master Plan Migratory Fish Rhine

Example: Salmon and sea trout, Lake Constance lake trout

IKSR CIPR ICBR



Sources:
Comprehensive fish-ecological analysis (2009),
ICPR report no. 167 www.iksr.org

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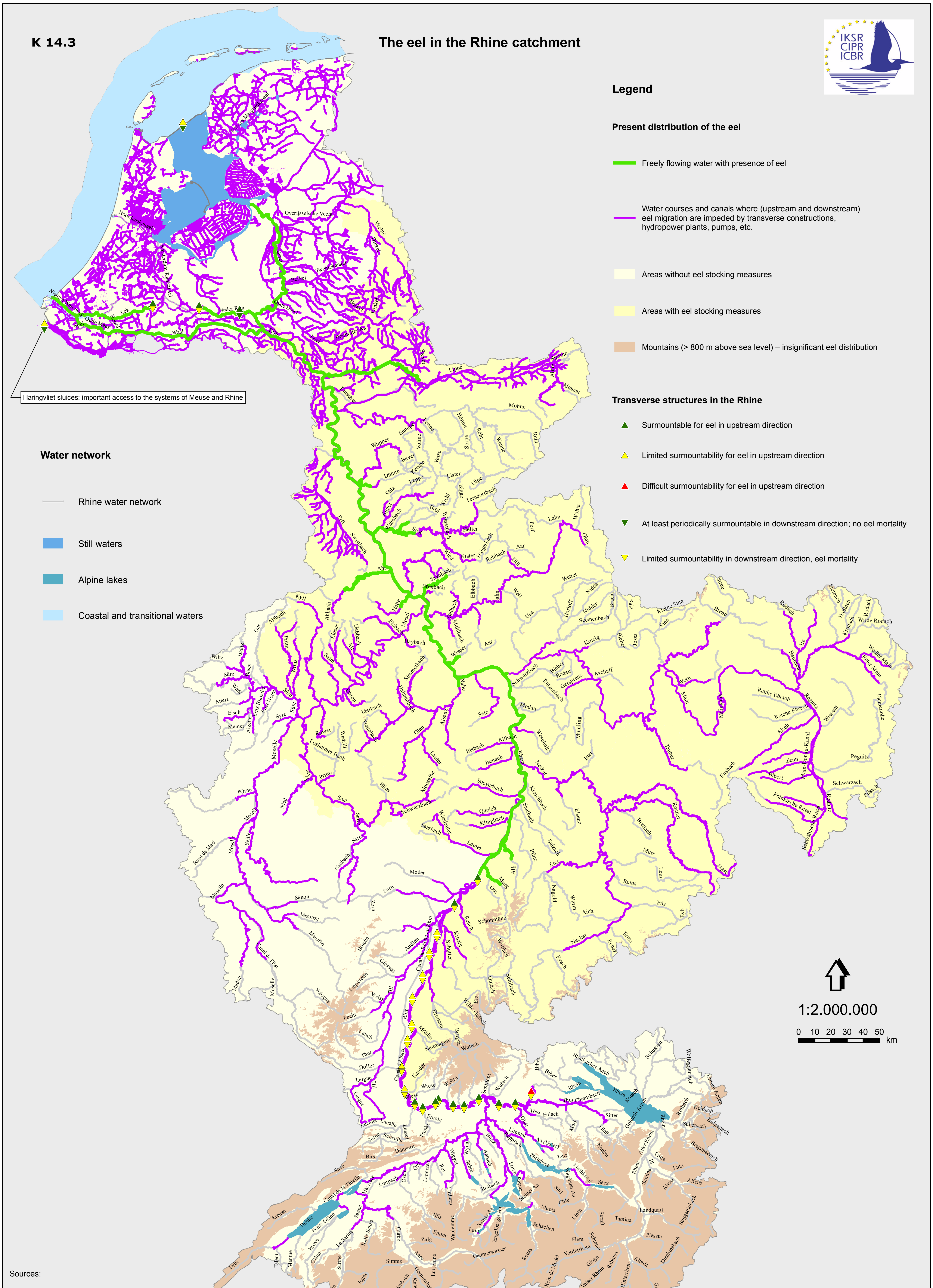

Sources:

- SRTM - Digitales Höhenmodell, DLR, 2009

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