Länderarbeitsgemeinschaft Wasser (LAWA)

German Guidance Document for the implementation of the EC Water Framework Directive

Contents

<u>Updated version of 30.04.2003</u>

This Guidance Document is a compendium of the results and findings of the LAWA committees. It will be updated as the work progresses.

German Guidance Document for the implementation of the EC Water Framework Directive

Part 1 Introduction

1. Purpose of the Guidance Document
2. Layout of the Guidance Document
3. Important timeframes

1. Purpose of the Guidance Document

This Guidance Document is intended to make the complex structure of the Directive easier to understand for enforcement purposes across Germany, to ensure a uniform approach to implementing the Directive and to avoid any duplication of effort. We also want the Guidance Document to serve as an example for other countries in Europe, especially since by providing advance information on the approaches being taken and the content of activities being pursued, it can help to stimulate discussion Europe-wide on the implementation of the Water Framework Directive.

Under the direction of the LAWA-EU Liaison Committee, two sub-committees were set up to perform the legal and technical functions associated with preparations for the implementation of the EC Water Framework Directive in Germany. These sub-committees collaborate closely with the relevant LAWA technical committees and draw directly on their findings.

At the outset of our work, the task of legal implementation posed the question of what amendments would be needed to the Federal Water Act (*Wasserhaushaltsgesetz*) and to water legislation in the *Länder* along with the necessary secondary regulations. As for the field of technical implementation, the first problem to be tackled here was how to determine the existing status of surface waters, groundwaters and protected areas.

We decided to document the results of this work, integrating in a unified and systematic manner all the relevant working papers and thus building up, step by step as the work progresses, a comprehensive Guidance Document for the Implementation of the EC Water Framework Directive. The following is a draft for this loose-leaf compilation. It contains sections which are inevitably still incomplete and does not include a number of papers that have yet to be submitted. The Guidance Document does not present the final arrangements for the implementation of the WFD. In drawing up this document, the Standing Committees of LAWA have always emphasised that scope for management initiative must remain at the sub-basin level in particular, where actions can be taken in consultation with the Higher Water Authorities and the representatives on the Standing LAWA Committees. This also applies to water bodies that cross *Länder* boundaries. A solution should be sought here directly at the sub-basin level.

It lies in the nature of our tasks that a lot of time is needed to deal with the many complex and demanding questions raised, so we have started by considering those measures demanded by the Water Framework Directive that should be completed within the first four to six years.

The Water Framework Directive sets out binding deadlines for these measures, which are enclosed below. It is clear from the Directive that the work of legal implementation and of designation of competent authorities leads to the submission of a report to the Commission within the first three to three-and-a-half years. In respect of the status review and analysis of river basin districts, a report must be submitted to the Commission after four years. The programmes of water status monitoring must be submitted after six years.

This document seeks to make an important contribution to the unified and full implementation of the Water Framework Directive. The work focuses on the substantive matters that flow directly from the task of fulfilling the provisions and requirements of the Water Framework Directive.

The authors hope that these initial incomplete chapters will be favourably received by experts in the field. The work of further elaboration and of completing the missing chapters is well in hand and proceeding according to schedule.

2. Layout of the Guidance Document

This Guidance Document is directed at experts at Federal and *Länder* levels, in particular those responsible on the ground for drawing up the programme of measures and the management plan. It is divided into the following parts:

Part 1 Introduction

Part 2 Legal foundations

Part 3 Preparations and guidelines for producing an EC management plan

Part 4 Thematic working papers

The implementation of the Water Framework Directive demands compliance with relatively tight deadlines. This was taken into consideration when designing the individual parts of the Guidance Document. That is why the Guidance Document deals first of all with the work to be completed in the first four years. These tasks represent the minimum required to meet EC obligations.

Since the wording of the Directive is in many places open to interpretation and imprecise, these points need expert clarification and definition. We have therefore produced, and are still producing, thematic working papers for inclusion in the Guidance Document.

The table incorporated in Part 3 as Annex 3.2 refers to the usable map material required to fulfil our obligation to report. The basic map used here is the DLM 1000 (Digitales Landschaftsmodell 1000) on a scale of 1:500,000, which serves as the foundation for all other report maps to be drawn up for obligatory reporting to the Commission. The intention is to facilitate management planning that transcends national boundaries.

The table enclosed below as Annex 3.2 refers to the maps required for the reports and for the special and background layers needed to produce them. The reports are intended to facilitate cross-*Länder* management planning.

The Guidance Document has the character of a loose-leaf compilation which will be continuously supplemented and updated as our work progresses. Preparation and updating of the individual chapters, along with a reference to the relevant working parties, is recorded in the annex “Preparation status of the LAWA WFD Guidance Document”.

3. Important timeframes in the Water Framework Directive

pursuant to the version of 23.10.2000

	Article in Water Framework Directive	**Deadlines**[1]
Entry into force	25	around 4th quarter 2000
Legal implementation		
- Adopting statutory provisions	24	Dec. 2003
- Identification of the competent authority	3 (7)	Dec. 2003
- Notifying the EC of competent authorities	3 (8)	June 2004
Status review		
- Analysis of characteristics of a river basin district	5 (1)	Dec. 2004
- Register of areas requiring protection	6 (1)	Dec. 2004
- Reviewing and assessing significant impacts	5 (1)	Dec. 2004
- Economic analysis of water use	5 (1)	Dec. 2004
- Updating of reviews and analyses	5 (2)	Dec.2013/ Dec. 2019
EC regulation of groundwater		
- Adoption of measures to protect groundwater by EC	17 (1)	Dec. 2002
- Criteria for chemical status and trend reversal by EC	17 (2)	Dec. 2002
- Criteria on a national basis (if necessary)	17 (4)	Dec. 2005
Monitoring programmes		
- Setting up networks and putting them into operation	8	Dec. 2006
Public information and consultation		
- Active involvement of all interested parties in implementation		ongoing
- Publication of a timetable and work programme[2]	14 (1a)	Dec. 2006
- Publication of the most important water management issue[2]	14 (1b)	Dec. 2007
- Publication of drafts of the management plan[2]	14 (1c)	Dec. 2008
Management plan and programme of measures		
- Drawing up and publishing the management plan	13 (6)	Dec. 2009
- Drawing up a programme of measures	11 (7)	Dec. 2009
- Implementing the measures	11 (7)	Dec. 2012
- Updating the management plan	13 (7)	Dec. 2015
- Updating the programme of measures	11 (8)	Dec. 2015
Achieving objectives		
- Good surface water status	4 (1a)	Dec. 2015
- Good groundwater status	4 (1b)	Dec. 2015
- Compliance with objectives for protected areas	4 (1c)	Dec. 2015
- Extension of deadlines to meet objectives	4 (4)	Dec. 2021/ 2027

[1] The deadlines refer to the obligation to report to the EC; in some cases much shorter deadlines are to be set for finalising plans in the sub-basin survey areas.
[2] every six years

Lists of priority substances	Annex X	
- Proposal of limit values for substance exports and imports	16 (8)	Dec. 2003
- Review of the priority substances list	16 (4)	Dec. 2004
- Phasing out discharges of priority hazardous substances	16 (6)	20 years[3]
Recovering the costs of water services		2010
- Introduced by	9 (1)	

[3] after proposals on the implementation of the requirements for priority hazardous substances have been adopted

Guidance Document to the implementation of the EC Water Framework Directive

Part 2 Legal foundations

1. Adapting the Federal Water Resources Act (*Wasserhaushaltsgesetz*) and water laws of the *Länder*

2. Model ordinance for the implementation of Annexes II and V of the EC Water Framework Directive

3. Other secondary legislation

4. Administrative agreements, conventions (e.g. establishment of co-ordination bodies)

The legal implementation of the Water Framework Directive will be carried out in Germany by amending the Federal Water Act (*Wasserhaushaltsgesetz*) and the water laws of the *Länder* and by adopting ordinances. Implementation must be completed by the end of 2003, i.e., three years after the Directive has entered into force.

Since, under the German constitution (Art. 75 GG, Basic Law), the Federation is only able to enact skeleton provisions in this field, it was only possible to amend the *Wasserhaushaltsgesetz* (WHG) to incorporate the general intent of the Water Framework Directive while the regulatory tasks in particular were assigned to the *Länder* for implementation.

The provisions of the water legislation of the *Länder* are to be brought into line with the skeleton provisions contained in the WHG. The *Länder* also have to adopt all those provisions required to implement the Water Framework Directive which cannot, for constitutional reasons, be incorporated in the WHG. In particular, this concerns not only the procedural requirements, e.g. arrangements to set up the programmes of measures and the management plans, and especially the conducting of comprehensive public consultation as called for under the Directive, but also the standards for monitoring the status of waters. Moreover, there will be *Länder*-specific tasks, e.g. concerning transitional or coastal waters, which the respective *Länder* will have to regulate.

Amendment of the Federal Water Act (*Wasserhaushaltsgesetz*)

Essentially, the following elements of the Water Framework Directive have – to the extent permissible under the constitution – been included in the *Wasserhaushaltsgesetz*:

- new definitions of terms (e.g. “river basin district”),
- the principle of water management by river basin area and the obligation to co-ordinate transboundary management of waters between different *Länder*,
- the objectives set by the Directive (good water status) for surface waters and groundwater,
- the scope for extensions and exemptions, and
- the instruments of the Water Framework Directive (programme of measures and management plan).

Since wide-ranging planning instruments are available in the form of the programme of measures and the management plan provided for in Art. 11 and 13 of the Directive, the government has revoked the planning instruments such as those set out in Section 18a par. 3 WHG (water resource development framework plans) and Section 36b WHG (management plans). In any case, these instruments have, in the past, only been used by the Länder to a very limited extent.

The discussions at national level have made it clear that the instrument provided for under the Water Framework Directive for implementing the programme of measures already exists in German water legislation and will not require the creation of any

new licensing regulations in addition to the existing rafts of permits, allowances and authorisations.

The adoption of the provisions of the Directive in the Wasserhaushaltsgesetz (WHG) is to be completed by the end of the legislative period in autumn 2002. This timeframe is particularly important because the WHG must be implemented by the Länder as skeleton provisions.

The draft of a seventh Act for the amendment of the Federal Water Act (WHG – cf. Federal Law Gazette I p.1914) entered into force on 25 June 2002. The whole WHG was promulgated anew (Federal Law Gazette I p.3245). The text of the WHG can be downloaded from the German Federal Environment Ministry's website at http://www.bmu.de (keywords "Gewässerschutz" or "Downloads").

The Opinion of the *Bundesrat* and the counter-statement by the Federal Government can be found in the *Bundestag* printed paper 14/7755 at www.bundestag.de

Amendment to the *Länder* water laws

To regulate the implementation of WFD provisions in the *Länder* water laws, model elements have been developed, which are arranged in the following three groups:

1. **Implementing the regulatory tasks from the Amendment to the Federal Water Act. This includes:**
   - § 1 b para. 2 FWA on the coordination of river basin district management
   - § 1 b para. 3 FWA on the classification of river basins within the *Land* borders as national or international river basin districts
   - §§ 25 c, 32 c, 33 a FWA on determining deadlines for setting up and implementing programmes of measures and/or for the setting up, review and updating of the management plan.

2. **New procedural provisions governed by water law**
   - Regular review of permits and consents issued under water law (Art. 11 para. 3 e) to l), WFD)
   - Re. § 37 a) FWA structuring of access to and collection of data, and the obligation to make available on demand available water management data and records through municipalities, municipal associations, water associations and other parties responsible for water management measures.
   - Public information and consultation in the drawing up of the management plan (§ 36b para. 5 WHG)

3. **Creation or restructuring of principles for enforcing the programme of measures under water law**
   - Adapting the stipulations for water body maintenance
   - Adapting permits for operating facilities
   - as an optional possibility, river bank strips to prevent or limit emissions of pollutants from diffuse sources.

Model ordinance to implement Annexes II and V of the Water Framework Directive

The detailed substantive provisions of the Water Framework Directive, especially those on inventories and on the assessment, monitoring and presentation of the status of waters (Annexes II and V of the Directive), are to be legally implemented in the form of ordinances. Since the Federation only has powers to enact skeleton provisions, common technical standards for the whole country cannot be enforced via a federal ordinance. This means that 16 *Länder* ordinances will have to be

enacted. To ensure uniform implementation, a model ordinance has been drawn up that is compliant with the Water Framework Directive.

This ordinance consists of a small section of clauses setting out the general standards for categorising and developing a typologies of surface waters, for establishing type-specific reference conditions, for identifying pressures on waters and assessing their impacts, for classifying the ecological and chemical status of surface waters and monitoring them, and for presenting monitoring results and ensuring their comparability. In respect of groundwater bodies, there will be normative provisions governing their description and assessment, the classification and monitoring of their quantitative and chemical status, and the presentation of these findings. The core of the model ordinance is formed by thirteen annexes which reflect in detail the requirements of the Directive, as specified in Annexes II and V.

For the draft of the model ordinance, a nation-wide, informal consultation with associations was conducted by LAWA on 26.11.2002 to facilitate the legislative procedures required for regulations in the *Länder*.

German Guidance Document
for the implementation
of the EC Water Framework Directive

Part 3
Preparations and guidelines for reporting to the Commission and for drawing up a management plan

Contents

I. Introduction

1 Overview of the tasks arising from the Water Framework Directive

A co-ordinated approach within a river basin district forms the central element of the Water Framework Directive. This demands far-reaching co-ordination between all the parties involved. The success of the Water Framework Directive therefore depends crucially on a willingness to co-operate beyond regional and national boundaries. This commitment to co-operation is all the greater if the tasks to be performed are made as transparent as possible and the respective responsibilities and competencies are specified clearly and precisely. The appropriate instrument for this is the management plan as defined in Article 13 of the Water Framework Directive.

In view of the scope of the work to be completed in order to achieve the most unified implementation of the Directive possible, at least in Germany and the river basins with German involvement, we must establish in a concerted manner all the technical requirements, standards and general instructions that underlie the production of a River Basin Management Plan. This concerted approach also applies to all the measures to be performed in the first years following the entry into force of the Directive and to the preparations for the management plan and programme of measures, which have to be submitted within nine years. This Guidance Document is directed not only at the governmental decision-makers at Federal and *Länder* levels but also at those responsible for developing the management plan on the ground. The Guidance Document is a complementary aid to the necessary legal instruments of the Federation and *Länder*.

The tasks that flow from the adoption of the Water Framework Directive can be divided into three core areas to be dealt with step by step over within the first nine years:

- reviewing the situation of waters within the river basin district from a water management, ecological and economic perspective,
- monitoring the status of waters,
- elaborating and operationalising the objectives to be achieved in the river basin district with regard to the status of the waters,
- establishing the measures or programmes of measures needed to achieve these objectives.

The objectives agreed and the measures envisaged must be co-ordinated beyond the level of individual survey areas and consolidated for the river basin district as a whole. This requires co-ordination among all the competent authorities and institutions at national and international level.

2 The management plan

2.1 The significance of the management plan

Under Article 13 of the Water Framework Directive, management plans have to be drawn up for river basin districts. They are to be published no later than nine years after the Directive has entered into force. Pursuant to Annex VII of the Water Framework Directive the management plan should contain *inter alia* the following elements:

- a general description of the river basin district, i.e. of surface waters and groundwater
- a summary of all significant pressures and anthropogenic impacts
- mapping of the protected areas, maps of the monitoring networks for the bodies of surface water, bodies of groundwater and protected areas
- a list of environmental objectives for the waters
- a summary of the economic analysis of water use
- a summary of all measures and programmes of measures adopted under Art. 11
- a list of the competent authorities, and
- a summary of public information and consultation measures.

The management plan must be regularly (at least every six years) adjusted and updated every six years at the latest.

The management plan must also identify and regularly document the desired outcome of measures along with the use of any exemptions that are made. The management plan becomes the instrument of control for the river basin district management participants themselves and for the European Commission. Particular attention should therefore be given to the work of drawing up, regularly reviewing and updating the plan.

2.2 The scope of the management plan

The management plan must cover an entire river basin district. The management plan itself contains an superordinate summary presentation of the whole river basin area and all major factors influencing the overall management of the river basin district. Where river basin districts are large, it may be useful to divide the district into operational areas / sub-basin survey areas (*Bearbeitungsgebiete/Teileinzugsgebiete*). The division into sub-basin survey areas is a matter for the *Länder* authorities or national authorities that share control over a river basin. These sub-basin areas must be defined by hydrographic criteria or, only in demonstrably exceptional cases, by administrative or other criteria.

The level of detail required in this work on the management plan is determined by provisions contained in Annexes II and V of the Water Framework Directive. It is necessary for agreement to be reached as far as possible on **common criteria** for application in the river basin district as a whole. This will keep the scope of the management plan to what is actually required under the terms of the Water

Framework Directive and ensure a generally consistent presentation within the river basin district as a whole. Information and special aspects which go beyond the scope of the plan should be considered independently, since they are not obligatory elements in the production of management plans and implementation of the Water Framework Directive.

When elaborating and operationalising the objectives, we must accord special importance to coordination within the river basin district as a whole. First of all, the overriding objectives for the entire river basin district must be agreed between the States/*Länder* involved and transferred to the sub-basin areas being treated. The detailed objectives in the sub-basin survey areas must be geared to the overriding objectives. No objectives may be pursued in these sub-basin areas which might call into question the overriding objectives for the whole river basin district or even make their achievement impossible.

Otherwise, separate objectives for sub-basin areas may be pursued independently of the overriding objectives for the river basin district. However, these objectives must be integrated in the management plan and worked on as part of the measures envisaged in the WFD to the extent that they serve the achievement of the overriding objectives.

3 Review (inventory)

To characterise and determine the status of waters, Article 5 of the Water Framework Directive requires Member States to carry out

- an analysis of the characteristics of the river basin district
- a review of the impact of human activity on the status of bodies of surface water and bodies of groundwater, and
- an economic analysis of water use in the river basin district as required in Annexes II and III of the Water Framework Directive.

First of all the **surface waters** must be mapped within the river basin, their location identified and the catchment area delineated. Here, we must also distinguish between surface water categories, namely rivers, lakes, transitional waters or coastal waters.

In each of these categories we must determine the relevant type of surface water body. As far Germany is concerned, these types are already identified in accordance with Annex II on the Federal Republic of Germany's map of water body types. Thus, further work in the survey areas to identify water body types is not required. In the case of transboundary waters, however, we must engage in international co-ordination to agree on the water body types in areas close to national borders.

Type-specific reference conditions are to be established for all surface water types that meet the criterion of high ecological status.

In addition, **artificial bodies of surface water** are to be identified and designated. The question as to whether **heavily modified bodies of surface water** should also be designated can only be answered after thorough analysis and an estimation of achievable water status.

Building on these initial hydrological surveys and characterisations, we must identify all the significant anthropogenic pressures to which the bodies of surface water are subject. The degree and extent of the survey is mainly determined by the information required under the existing EC Directives that already apply here. To determine the significant anthropogenic pressures identified in this way, we also need to make an assessment of these pressures with regard to their potential threat to good status. The form of the presentation (e.g. in tables, maps or in GIS-based internet-capable formats) has yet to be agreed at European level and in the river basin districts.

As for **groundwater**, here, too, it is necessary to provide a presentation and description of the water bodies and to undertake a survey and study of the qualitative and quantitative effects on groundwater of any significant pressures.

We must also identify all the groundwater bodies within the river basin district. In so doing, we must assess the extent to which they are being used and the likelihood that the environmental objectives for each individual groundwater body will not be achieved. Groundwater may be dealt with in groups of groundwater bodies. Existing data should be used, especially to determine pressures on groundwater. In the case of groundwater bodies which are likely to fail to achieve the environmental objective, greater description is necessary. In addition to geological, hydrogeological, hydrological and chemical data, the impact of human activity shall also be examined. We must identify those groundwater bodies that, under Article 4, take less stringent environmental objectives in both quantitative (groundwater level) or qualitative terms.

The review of water status is complemented by an economic analysis for the river basin district in order to comply with the principle of recovering the costs of water services as set out in Article 9.

A further task is to register and present in the management plan all the existing water-relevant protected areas established under EC Directives (conservation of natural habitats; freshwater fish and shellfish Directives; bathing waters; nutrition-sensitive/ endangered/ vulnerable areas), areas protected for the abstraction of water for human consumption, and areas designated for the protection of economically significant aquatic species.

The EC Water Framework Directive requires from the Member States a range of information in the form of maps.

Only Annexes I and II refer explicitly to a submission of maps in GIS format; however, most of the data compiled for characterisation and management purposes is spatially referenced and will be presented in the form of GIS layers.

Reports presented in the form of digital layers are in fact far more flexible and improve the quality of the reporting.

The maps and layers listed in Annex 3.2 can be used to present all the necessary reports to the Commission. This Guidance Document therefore suggests that only the two overview maps (river basin districts and competent authorities – maps 1 and 2 in Annex 3.2) be supplied as layers and paper maps. This approach is in line with the proposals in the EU's GIS guidance document ("Development of a Geographical Information System"), which has been drawn up by the Commission and the Member States to advise on GIS applications. It can be downloaded from the WasserBLIcK site. A detailed description of the functions of WasserBLIcK is contained in Thematic Working Paper 7.

The WasserBLIcK concept envisages a portal to be used for the compilation of national reports for the WFD. This also has important consequences for reporting on the international river basin districts. “WasserBLIcK” operates as a national datapool supporting the reporting system from various perspectives and ensuring the necessary technical correspondence between reports with different aggregation levels so they remain compatible for the phenomena being reported.

The strategies recommended in the CIS guidance on GIS – concerning for example a standard reference system for coordinates, standard models, standard attributions, Europe-wide coding of waters, monitoring sites and point sources, and standardised metadata – can hardly be tackled without central cross-border coordination of the information reported to acquire data at the required level of uniformity. “WasserBLIcK” is a key instrument for performing these tasks.

Part 4 / 8 of the agreements on electronic data exchange in reporting (“Vereinbarungen zum elektronischen Datentausch bei der Berichterstattung”) describes the prerequisites to be met in terms of the integrated data network and says what the interfaces and data content should look like. The necessary adjustments to the information structures used in Germany are currently being examined by a R&D project. The results are expected in July 2003.

The agreement to optimise standardisation, for the entire scope of the WFD, of the data and data formats for the reports to the Commission and for the management plan (inter alia for maps and layers, data exchange, metadata, use of keys) will make implementation easier in the long run. Within the international river basin districts such standardisation is absolutely essential.

The WFD says little about the requirements for the report maps, so it is all the more important to reach agreement through international consultation.

Depending on the requirement (level of detail and positional accuracy, on the one hand, and comprehensibility and clarity, on the other), different scales must be chosen for the presentation. For the general maps (report maps), all the information required for reports under the WFD can be presented on maps as polygons, lines and points on a scale of 1:500,000. For the presentation of larger areas (e.g. the competent authorities) smaller scales are appropriate, down to 1 : 4 million.

The data of the digital landscape model (digitales Landschaftsmodell, DLM 1000), produced by the Federal Office of Cartography and Geodesy, are available as the basic source of information. These maps are derived from the German topographic general maps of 1:500,000. Moreover, a great deal of technical data supplied by Federal and *Land*-level agencies is adapted to the geometrics of DLM 1000 and should therefore be used for reporting obligations under the Directive.

The DLM 1000 contains all waters with catchments > 10 km^2 and lakes > 0.5 km^2.

To comply with the reporting obligations, maps must be produced with special layers. The list of layers and maps is given in Annex 3.2. This overview also details the references to the Directive, the required designations and details of the attributes and the data needed for completion (a) for submission to the Commission, (b) for inclusion in the reporting system for Germany (WasserBLIcK) and (c) the compiler of the data.

All special layers to be filled in by the compilers and the background layer can be accessed interactively in WasserBLIcK.

Since the maps are made by superimposing several layers , it is recommended that these layers be as accurate as possible. They should at least match the geometrics of DLM 100. Attributes that demand a high degree of accuracy (e.g. water levels) should be linked with their related attribute (e.g. stationing of the water axis).

4 Objectives

When elaborating and operationalising the objectives, we must accord particular importance to co-ordination within the river basin district as a whole. First of all, the overriding objectives for the entire river basin district must be agreed between the States/Länder involved and transferred to the sub-basin areas being treated. The detailed objectives in the operational areas must be geared to the overriding objectives. No objectives may be pursued in the operational areas which could call into question the overriding objectives for the whole river basin district or even make their achievement impossible.

Separate objectives in the sub-basin operational areas can otherwise be pursued independently of the overriding objectives for the river basin district. However, they must be incorporated in the management plan, and worked on as part of the measure provided for in the WFD, to the extent that they serve the achievement of the overriding objectives.

5. Public information and consultation

The Water Framework Directive provides, in Article 14, for active involvement of the public and all interested parties in the implementation of the Directive. More detailed provisions apply to formalised public consultation when developing the management plan for a river basin district. The information on the management plan should take place in several stages, so that the public can be informed about and give an opinion on the timetable, the work programme for the production of the management plan, of an interim overview of the significant water management issues and finally of the drafts for the management plans for the river basin. For the programme of measures summarised in the management plan no separate public participation is required by the WFD. However, this is in fact called for under the SEA Directive (Directive 2001/43/EC of the European Parliament and the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes). Besides multi-phased involvement of the public in the production of the management plan, the WFD requires from the outset an active involvement of all interested parties in the implementation of the WFD.

II. Preparations and guidelines for producing EC management plans

This section provides advice and guidelines for the work of reviewing the status of waters, specifying the objectives and developing measures for achieving those objectives. In addition to the requirements set out in Annexes II and V of the Water Framework Directive, these guidelines are also geared to the elements for the management plan listed in Annex VII of the Water Framework Directive. For each individual task dealt with below, we shall present information and guidance in accordance with the following pattern:

1) Reference to the Directive

This section cites the references to the Articles and Annexes of the Water Framework Directive which contain provisions addressed and elaborated in the respective chapter of this Guidance Document.

2) Technical background

To help clarify the issues at hand, we give here a brief account of the technical background indicated by the Water Framework Directive and specified in depth by LAWA.

3) National provisions

This section refers, at least in the German version of the Guidance Document, to the relevant nationally applicable regulations, aids, tools and parameters. The English version does not contain all this information but only presents certain points to illustrate our approach. If this Guidance Document is used as a model for similar manuals in other countries, this section will obviously have to contain the applicable national provisions for that country.

4) Source material

We refer here to the material in Germany that is directly available for these implementation tasks and should be used to ensure standardisation. This material includes above all the mapping documentation used for reports. The following layers are particularly important:

- delineation of river basin districts
- location and boundaries of surface water bodies (reduced water network) and groundwater bodies
- mapping of protected areas, and
- mapping of the background

If the source material is still in preparation, this will be referred to in the section headed “Points to note”.

This section also contains references to ongoing R&D projects, which are being listed and updated by the Federal Environmental Agency (UBA); the respective updated list is presented in the annex as Working Paper 1.

Where specialised strategy papers from the European Commission dealing with the implementation of the WFD are prepared, we shall refer to this under the relevant technical aspect. The list of the current eleven projects is included here in the annex as Working Paper 2 and names the chairperson and responsible LAWA committee.

5) Necessary activities

This section specifies the activities to be performed by the competent authorities for the development of the management plan.

Points to note

Not all the material is yet available for some parts of this Guidance Document. For each task, additional references (Points to note) shall be made to any preparatory work still needed from the EC, from the German Federal Government/LAWA or from international and supranational bodies. Moreover, on certain subjects R&D projects are still in progress. When the work is completed and the material available, the "Points to note" section will be deleted.

1 Necessary activities to be implemented by 12/2004

The following chapter describes — separately for surface water and groundwater due to the major methodological differences in each case — the essential tasks of analysing the characteristics (inventory) and examining the impacts of human activities on the status of surface waters and the groundwater (risk assessment) as required under Art. 5 and Annexes II and III of the Water Framework Directive (WFD), the results of which are, in accordance with Art. 15 of the WFD, to be submitted in March 2005 by the Member States to the European Commission as a summary report concerning the management plans for the individual river basin districts.

The report shall give an overview of the river basin districts, presenting a summary of the characteristics and anthropogenic pressures and their impacts on bodies of surface water and bodies of groundwater. In addition to giving separate treatment to protected areas designated under the relevant EC legislation (cf. Chap. 1.3, the inventory shall contain an economic analysis of water uses in accordance with Art. 5 and Annex III of the WFD (cf. Chap. 1.4 below).

A key objective of the inventory is to identify those bodies of surface water and bodies of groundwater which are likely to fall short of the environmental objectives set for this water body under Art. 4. The Water Framework Directive does not in principle require new examinations designed specifically for the inventory. It is understood that the data and information already gathered through the implementation of current EC Directives that apply and of existing water management policies are adequate for risk assessment..

The procedure and the report on the inventory are means to an end and should therefore be designed as far as possible with the requirements and structure of the later management plans in mind so as to avoid a duplication of effort here and to refine the arrangements for distinguishing and combining the technical (working) level and reporting level.

Previous experience has shown that it is sensible to adopt a coordinated approach to the tasks of determining pressures on and assessing impacts on bodies of surface water and groundwater for the inventory and initial characterisation. The necessary work of bringing together the existing data on emissions and discharges, land uses, water abstraction or flow regulation, and collecting data on morphological changes and the data needed for the risk assessment of groundwater bodies as part of for the initial characterisation is to be carefully coordinated to avoid duplication of effort. All the results are to be presented in a coherent manner.

The timely submission of meaningful reports to the Commission ("Report 2004) shall be ensured by the following approach:

- In practice the inventory shall make use of data that is already available. The data are to be collected and stored by river basin district or sub-basin area or, where appropriate, by water body or group of water bodies. This data will be passed on to the Commission if it so requests.

When compiling the data for the surface waters, we shall apply cut-off and aggregation criteria appropriate to the task or derived from the EU Directives under Annex II; they are defined for the pressure data in Part 4 (Thematic Working Papers) in point 3.

The data for the groundwater bodies are compiled in accordance with Annex II 2.1 and no cut-off criteria are applied.

- Existing immissions data gathered from environmental monitoring can be examined for the relevant observation period. Since, for groundwater, immissions data are insufficient for a risk assessment, they may be used but do not have to be.
- To assess the impacts on surface waters, the immissions data are to be used as a primary source. The impacts data are – as is necessary – combined with pressures data to arrive at a preliminary integral assessment. For assessing the impact of pollution pressures on the coastal waters, separate load observations must be made for substances that contribute to eutrophication. In the case of groundwater, the long time periods between a contamination and its registration in immissions data always make it necessary to integrate the potential pressures in the analysis.
- Local knowledge of a site is to be taken into account in the assessment.
- When handling the information internally, it is useful to collate and present the selected data in GIS maps.
- For those groundwater bodies that indicate a risk in the initial characterisation or lie across the territories of two or more Member States, a further characterisation shall be undertaken in accordance with Annex II no. 2.2. and 2.3 in order to specify the risk. Should the risk be confirmed, the necessary measures must be

established (under Article 11 WFD). It is only necessary to determine information that identifies the risk more closely.

- If the assessment made under Annex II, 1.5 leads to the identification in the survey periods of surface water bodies which are not likely to meet the environmental quality objectives, the causes of the lack of good status must be designated by undertaking, from 2004, an additional characterisation from which we can optimise the design both of the monitoring programme to be set up under Article 8 of the Directive and the programme of measures to be set up under Article 1. To the extent that detailed data are needed for the additional characterisation, they will, in individual cases, have to be collected as an additional measure. The scope of this deeper examination will depend to a very great extent on the specific conditions of the area.

In the case of groundwater, the respective activities are to be carried out by the end of 2004 in the further description. Where new findings are available, they will also be taken into account in the development of the action plans.

1.1 Surface waters

The following sections provide a systematic explanation of the steps to be taken with regard to surface waters as part of the inventory required under Art. 3 and 5 and Annex II of the Water Framework Directive.

In accordance with the technical specifications in Annex II of the Water Framework Directive, the surface water bodies shall be grouped together into river basin districts, allocated to categories and differentiated according to type. The next step is to determine type-specific reference conditions for each water body as a basis for the assessment procedure.

The first step is to assign all territorial catchment areas to their respective river basin district as required under Article 3 of the WFD. In Germany, this is shown on the map of the ten river basin districts (cf. Annex 3.1). These river basin districts are:

- Eider
- Schlei/Trave
- Warnow/Peene
- Oder
- Elbe
- Weser
- Ems
- Rhine
- Maas
- Danube

The navigation canals are assigned proportionately to the respective river basin.

Within the river basin districts consideration shall be given to those water bodies that count as discrete and significant elements of surface water in accordance with the definition given in Art. 2 section 10 of the WFD. Further information on the designation of water bodies is provided in the CIS guidance document entitled “Identification of water bodies”.

A water body is a coherent sub-unit of a river basin district seeking to meet the environmental objectives of the WFD. Thus, a water body must be selected so that its status can be precisely defined and compared with the environmental objectives of the WFD. To this end, the size of the water body must be determined in such a way that it can achieve these goals in a consistent and effective manner. Fragmenting the river basin district into very small units may prove counterproductive in this respect, while also contradicting the WFD requirement that a water body forms a significant element of its respective river basin district.

The identification of water bodies is an iterative process, which does not have to be concluded by 2004. The verification and refinement of water body boundaries is still possible until the publication of the initial management plan.

However, although the CIS guidelines allow for such a procedure, the boundaries of water bodies should, if at all possible, be fairly soundly defined already during the inventory stage. This is important to facilitate the tasks of recording data, reviewing progress in connection with “water body” entities and providing transparency in reporting to the EU and the public.

Water body boundaries should only be subsequently relocated after 2004 in exceptional cases, e.g. in connection with the final designation of heavily modified water bodies.

Demarcation of surface water bodies

A "surface water body” within the meaning of the WFD is a discrete and significant element of a surface water body, e.g. a lake, a reservoir, a running water body, a river or canal, but also a part of a running water body, river or canal, as well as a transitional water or a strip of coastal water.

The term “discrete” refers to the following conditions to be considered when demarcating water bodies:

- no overlapping water bodies
- boundary at the transition between one water category (river, lake, transitional water, coastal water) and the next
- boundary at the transition from one water type to the next
- boundary where there are significant changes in physical (geographical and hydromorphological) characteristics
- boundary at the transitions between natural, possibly heavily modified, and artificial water (segment)

In addition, locally acquired knowledge can be used to develop further criteria for demarcating surface water bodies, for example where very large segments of main rivers are still left after applying the above criteria.

- boundary if the status of significant water elements allocated to a water body under the above criteria has changed

- boundary at the transition from a protected to a largely unprotected area

Aggregated assessment of surface water bodies

Data availability in Germany and the Directive's requirement that water bodies contain "significant" elements indicates that a fine breakdown into small areas would be a mistake. On the other hand, cruder breakdown into large areas would lead to worries about incorrect classification. The CIS guidelines emphasise that within water bodies no major difference should occur with respect to the status of its water elements. So if, in a particular water body, elements with good status and moderate status were classified as "good" overall, there would appear to be no reason for measures to upgrade the "moderate" element.

Where dense data are available for the water body and allows very detailed findings (e.g. for the systematic mapping of river morphology using the on-site method), appropriate transparent aggregation rules should be derived.

Grouping of water bodies

Water bodies can be grouped together for monitoring , reporting and management purposes, as well as to judge whether they are achieving the WFD objectives (risk assessment).

The possibility of grouping together water bodies depends largely on the characteristics of the respective river basins and the type and extent of the resulting pressures. For instance, the requirement for surveillance monitoring is that it is carried out at a sufficient density to allow areas with a catchment of 2,500 km^2 to be reliably evaluated for pressures.

Considering this requirement in the context of the grouping option granted under the WFD, we recommend for the inventory that water bodies be grouped by hydrological conditions so that "reporting units" result with a catchment size of up to 2,500 km^2.

1.1.1 General description (elements) of the river basin district under Article 5 and Annex II

1) Reference to Directive

Article 5

Annex I, ii

Annex II, 1

2) Technical background

The Water Framework Directive requires that the geographical coverage of the river basin district be marked along with a description of its general characteristics.

3) National provisions

The following are to be used for the general description:

- catchment area boundaries

- names of the most important rivers in the river basin district
- important cities and traffic routes
- State and *Länder* boundaries

4) Source material

For Germany, “Lage und Grenzen des Wasserkörpers”, a map showing the “location and boundaries of the water bodies” in accordance with Annex 3.2, No. 3.

5) Necessary activities

For the general description, the essential and most significant characteristics are to be referred to in an introductory chapter and are to be presented with the above-mentioned layers as a map.

6) Points to note

The waters network layer (BD2-L5W) of the basic map, showing all the waters of the catchment areas larger than 10 km^2, will be compiled by the BKG in collaboration with the Länder from the DLM1000. This work is expected to be completed by mid-2003. Specifications for stationing are still to be defined.

1.1.2 Development of typology for surface waters (mapping of ecoregions and surface water body types)

1) Reference to Directive

Annex II No. 1.1ii) and No. 1.2

2) Technical background

The Water Framework Directive requires that bodies of surface water be assigned to the categories of rivers, lakes, transitional waters and coastal waters. In addition, the artificial waters shall be designated and a preliminary classification as heavily modified is to be made.

The designation of artificial waters and a preliminary classification as “heavily modified” is made in accordance with the requirements set out in Chapter 2.1.5 (activity steps 1-6). The artificial and (initially) heavily modified water bodies are then assigned to the natural water types most similar to them.

The final designation of surface water bodies as heavily modified then occurs by the end of 2009 following further examinations (e.g. under Art. 4 (3) of the WFD).

In general, the following types of waters are to be included in this classification:

- rivers and streams with a catchment area of more than 10 km^2
- lakes with a surface area of more than 0.5 km^2
- transitional waters

- coastal waters up to a line of one nautical mile seawards from the baseline; with regard to chemical status, the territorial limits form the decisive boundary.

Under Annex II No. 1.1ii a further differentiation of water body types is to be made within each surface water category.

The water body types form the basis of the assessment of the ecological status of waters in accordance with biological communities specific to certain ecoregions.

Adopting a common approach for the whole Germany, LAWA undertakes a typology of water bodies using types as required under system "B", taking into account, for the running water types, the substrate conditions as an optional factor. Starting with the geomorphological map of Germany's aquatic landscapes (sub-ecoregions), we follow Briem's approach by differentiating running waters (streams and rivers) or individual water elements into water body types in terms of biocenotic criteria and catchment size. This approach produces a typology consisting of various types of running waters.

The following list presents the biocenotically relevant types of stream and types of lake and types of transitional and coastal water:

Short titles for the biocenotically relevant stream types in the Federal Republic of Germany (results as of 24 March 2003 from survey by T.Pottgiesser & M. Sommerhäuser)**Types of Alps and pre-Alpine foreland**

Type 1: running water in the Alps (c)

Type 2: streams of the pre-Alpine foreland (s)

Type 3: young moraines (c)

Type 4: rivers of the pre-Alpine foreland (c)

Types of Central German Uplands

Type 5: silicatic Central Upland streams (s)

Type 5.1: fine material-rich, silicatic Central Upland streams (s)

Type 6: fine material-rich, carbonatic Central Upland streams (c)

Type 7: carbonatic Central Upland streams (c)

Type 9: silicatic Central Upland streams (s)

Type 9.1: carbonatic Central Upland streams (c)

Type 9.2: rivers of the German Central Uplands (c)

Type 10: main rivers of the German Central Uplands (c)

Types of the Northern German Plain

Type 14: sandy lowland streams (s, c)

Type 15: sandy and loamy lowland streams (c)

Type 16: gravelly lowland streams (s, c)

Type 17: gravelly lowland rivers (c)

Type 18: loess-loamy lowland streams (c)

Type 20: streams of the lowlands (c)

Type 21: lake-discharged running waters (c)

Type 22: marshland waters (c)

Suspected type 23: backwater or brackish Baltic feeders (c)

Independent types of ecoregion

Type 11: organically characteristic streams (o)

Type 12: organically characteristic rivers (o)

Type 19: running waters of bottom-lands (c)

Biocenotically significant types of running water bodies in the Federal Republic of Germany – quality elements of macrozoobenthos

Survey as of 24 March 2003 by: M. Sommerhäuser & T. Pottgiesser (on the basis of Schmedtje et al. 2000)

Selected aquatic landscapes and regions taken from Briem (2001)	**biocenotic type**			
	Longitudinal zoning			
	Stream	**Small river**	**Large river**	**Main river**
Ecoregion 4: Alps altitude > 800 m				
Limestone Alps, flysch zone	1			
Ecoregion 9 (and 8): Central German Uplands and Alpine foreland, altitude approx. 200 - 800 m and above				
Alpine foreland				
Tertiary hills, lower terraces, older terraces, old moraines	2			
Young moraines	3			
Riparian meadows (wider than 300 m)		4		
Central German Uplands				
Gneiss, granite, slate, other volcanic areas	5	9	9.2	
Variegated sandstone, sand covering	5.1			
Loess regions, keuper, chalk	6	9.1		
Shelly limestone, Jura, marl, lias, lower oolite, chalk	7			
Riparian meadows (wider than 300 m)				10
Ecoregion 14: Northern German Plain, altitude < 200 m				
Sands, sand covering, ground and terminal moraines	14	15		
Loess regions	18			
Ground and terminal moraines, oler terraces	16	17		
Riparian meadows (wider than 300 m)				20
Sands, ground and terminal moraines	21			
Marshlands	22			

Independent types of ecoregion				
Sands, loess regions, riparian meadows (bogged)	**11**	**12**		
Riparian meadows (wider than 300 m)	**19**			

Lake types (lakes with a surface of 0.5 km^2 and above)

Ecoregions 4 and 9: Alps, altitude > 800 m, and Alpine foreland, altitude 200 – 800 m

- calcareous*, unstratified pre-Alpine lake with relatively large catchment**
- calcareous, stratified*** pre-Alpine lake with relatively large catchment**
- calcareous, stratified pre-Alpine lake with relatively small catchment
- calcareous, stratified pre-Alpine lake with relatively small or large catchment

* calcareous lakes: $Ca^{2+} \geq 15$ mg/l; lime-poor lakes: $Ca^{2+} < 15$ mg/l

** relatively large river basin: ratio of surface of above-ground catchment (incl. lake surface) to lake's volume (volume quota VQ) > 1.5 m^2/m^3 relatively small catchment: VQ ≤ 1.5 m^2/m^3

*** it is recommendable to classify a lake as stratified if the thermic stratification of the lake's deepest point remains stable over a period of at least 3 months

Ecoregions 8 and 9: Central German Uplands, altitude approx. 200 – 800 m

- calcareous*, stratified Central Upland lake with relatively large catchment
- calcareous*, unstratified Central Upland lake with relatively large catchment
- low-calcareous, stratified Central Upland lake with relatively small catchment
- chalk-poor, stratified Central Upland lake with relatively large catchment
- chalk-poor, stratified Central Upland lake with relatively small catchment

Ecoregions 14 and 14: Northern German Plain, altitude < 200 m

- calcareous, stratified lowland lake with relatively large catchment
- calcareous, unstratified lowland lake with relatively large catchment and a retention period of > 30d
- calcareous, unstratified lowland lake with relatively large catchment and a retention period of > 3d and < 30d
- calcareous, stratified lowland lake with relatively small catchment
- calcareous, unstratified lowland lake with relatively small catchment

Transitional waters (estuaries with a catchment of 10 km^2 and larger)

The designation of transitional waters depends, in accordance with the definition given in the Directive, on three main criteria:

geographical: the proximity to a river mouth

chemical: the salt content derives from neighbouring coastal waters

physical: the water dynamics largely correspond to those of a running water. Transitional water of significant size within the meaning of the Directive only occur for rivers that feed into the North Sea.

The Bodden (coastal inlets and peninsulas) along the Baltic Sea do not meet the physical criteria. Their dynamics, including water exchange with the open Baltic Sea, are driven by wind and water-mark differentials. They therefore fall within the category of coastal waters.

Type of North Sea estuary:

Type N0: tidal estuary of the flatland coast

Coastal waters

Types of coastal waters in the North Sea

Type N1: mesotidal euhaline outer coast

Type N2: mesotidal euhaline Wadden coast

Type N3: mesotidal polyhaline outer coast

Type N4: meso-macrotidal polyhaline Wadden coast

Type N5: mesotidal cliff coast

Types of coastal wasters in the Baltic Sea

Type B1: oligohaline inner coastal water

Type B2: mesohaline inner coastal water

Type B3: mesohaline outer coast

Type B4: mixohaline outer coast

3) National provisions

The map of biocenotically significant types for Germany must be used for the differentiation of running waters.

4) Source material

- Maps of water types D and excerpts as FGE maps

For further outcomes of R&D projects, see Working Paper 1 in the annex.

5) Necessary activities

Points to note

The lakes, transitional and coastal water types must be integrated in the aforementioned maps of the biocenotic types of running water bodies.

1.1.3 Defining the reference conditions for surface waters (establishing comparability)

1) Reference to Directive

Annex II No. 1.3

Annex V No. 1.2

2) Technical background

Under Annex II No. 1.3 of the Water Framework Directive, reference conditions are to be defined for all types of surface waters in line with the normative characterisation of high ecological status pursuant to Annex V, 1.2 of the WFD. The characterisations of good ecological status and of the differences between high and good as well as good and moderate will be determined at a later point in time (after 2004) and then "benchmarked" in the intercalibration process.

Reference waters are selected according to hydro-morphological characteristics (water balance, continuity and morphological conditions) and to existing pollution impact characteristics (water quality map, other environmentally relevant pressures). The selection is reviewed by surveying all the biological elements and additionally verified by analytical determination of the chemical elements (general physico-chemical parameters and specific pollutants).

For the individual water body types, the characterisation of surface waters to be completed by 2004 in compliance with Annex II of the WFD requires that a sufficient number of reference monitoring sites be designated to meet the statistical requirements (i.e. at least three per type if possible).

3) National provisions

4) Source material

Nation-wide provisional description of the water body types in terms of hydromorphological and geological characteristics and initial biocenotic data (sheets explaining water body types are compiled centrally).

5) Necessary activities

The setting of reference conditions does not call for any additional activities. It is only necessary to assign the water body under consideration to a water body type (along with the respective reference conditions). These activities continue until the end of 2003.

Points to note

The reference conditions will probably be available at the end of 2003/early 2004 for all water body types. If no reference waters are available for certain water body types, recourse must be taken to model scenarios or analogies. In addition to the national research projects in Germany, the findings of ongoing EC research projects should also be considered when defining reference conditions. A clear definition can only be expected after intercalibration.

1.1.4 Establishing significant anthropogenic pressures

The Member States must compile and archive data on the type and magnitude of significant anthropogenic pressures. In particular, attention should be given to pressures from point and diffuse sources, water abstraction, flow regulation, hydromorphological alterations and land use. The aim is to arrive at an assessment

of whether these pressures pose a threat to the good status of bodies of surface water and warrant the implementation of operational monitoring. The data are needed to draw up the programme of measures pursuant to Art. 11 and for the management plans pursuant to Art. 13 of the WFD.

In accordance with CIS Guidance 2.1 (IMPRESS), significant pressures are those pressures that are a notable factor behind the fact that a water body is failing to meet the general environmental objectives of the WFD or is at risk of failing to meet these objectives.

Extensive data on immissions and water quality are available in Germany, providing a basis for arriving at a sound risk assessment, i.e. risk assessment is generally supported by actual observations of impacts and not merely by modelling the possible impacts of existing pressures. We therefore (only) need to examine the significance of pressures for water bodies / survey areas that are classified as being at risk or potentially at risk. For such water bodies / survey areas the pressures are collated as a basis for determining which pressures are critical to the existing threat. As a rule, this assessment is made locally. An attempt to derive universal rules here is of little use because the most varied sets of relationships have to be considered.

The announcement and designation of significant pressures is the starting point for public discussion, in particular, and for an initial estimate of the measures that may be needed. Whether the “significant” pressures must be reported has not yet been decided and this question will probably be clarified in the Commission Decision on reporting scheduled for June 2003.

The general approach to determining the anthropogenic pressures significant to risk assessment is described in detail in the Criteria Paper (Working Paper No. 3) and can be summarised in three steps (cf. the schematic chart below):

1. Scrutiny of existing data

The first step is to examine nothing but the existing water resource management data. The WFD sets out in Annex II, 1.4 the data primarily to be considered. They include databases on point sources, diffuse sources, water abstractions, flow regulation, morphological modifications, on other anthropogenic impacts and on land use structures (in accordance with subsections 1.1.4.1 to 1.1.4.7 below). Data on these features are available, to varying degrees of comprehensiveness, in each *Bundesland* and should be compiled, which simply means going through the existing sources of water resource management data.

The existing data to be assigned to point sources include above all data on local authority water treatment plants, industrial direct dischargers and food processing plants as well as combined sewer outlets.

In the case of diffuse sources, the principal data concerns nutrient emissions (nitrogen and phosphorous). Nutrient load data for whole sub-basin areas are to be archived for the general overview and the description of the features of the river basin district with regard to marine protection (water body status in coastal waters).Data from contaminated sites offer further pointers to diffuse pollution pressures.

Data on water abstraction are contained in license notifications and regulations.

Data on flow regulation measures are collected for the water registers and the systematic river morphology mapping procedures.

Data on morphological modifications are collected through the systematic river morphology mapping.

In addition, there may be other anthropogenic impacts that can be determined and evaluated using local knowledge on site.

Land use structures can be seen from the CORINE Landcover layers and ATKIS data, and fishery use from, from example, the figures on the implementation of the Directive on fresh water fish and shellfish waters.

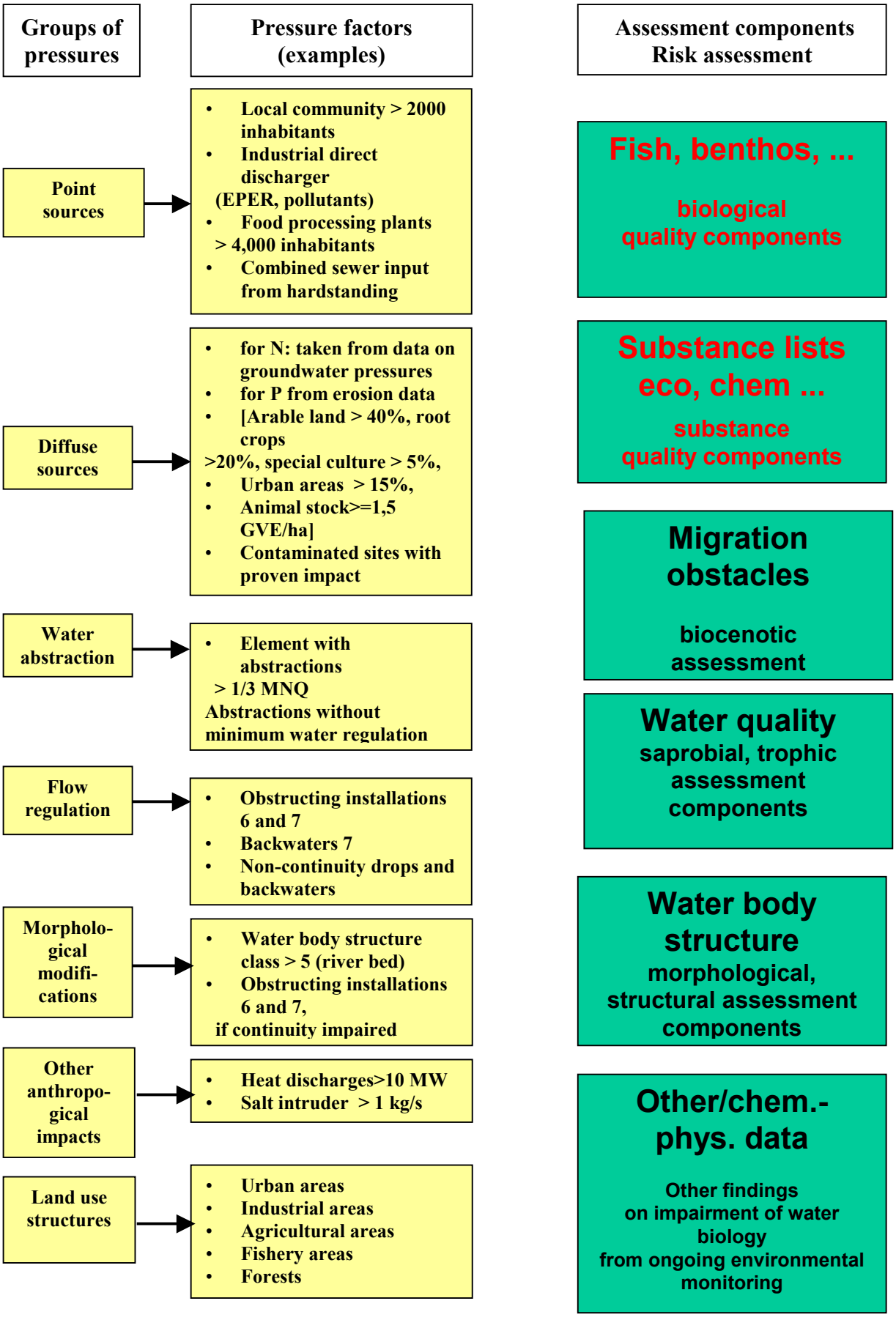
2. Collation of data on signification pressures

The second step is to extract from this data pool the data on those factors that might have an impact on the biocenosis and the chemical status (cf. step 3) and as such are to be regarded as significant. They are differentiated in the following seven sub-sections.

These data are to be collated and archived – if already possible and desirable by hydrological areas (sub-basin areas, sub-basin survey areas). Precisely which data and how much and in what form they should be included as an annex in the 2004 Report is still to be agreed through discussions in LAWA (and, where necessary, in the river basin districts).

3. Evaluation and risk assessment (cf. Chap. 1.1.5)

The *Länder* already have immissions data on all areas, which has already been used for quality assessments. It is therefore quite logical that this data be referred to as a basis for judging the likelihood of a water body failing to achieve the environmental objectives set under the WFD (risk assessment) and included in the 2004 Report to the Commission. Further details are given in Chap. 1.1.5.



*) as soon as available

1.1.4.1 Establishing significant anthropogenic pressures by point sources, especially by the substances referred to in Annex VIII

1) Reference to Directive

Annex II, 1.4, 1st and 2nd paragraph:

2) Technical background

To determine significant anthropogenic pressures from point sources it is necessary to make a description of significant pollution coming from urban, industrial, agricultural and other installations and activities via point sources, in particular by the substances referred to in Annex VIII.

To this end, the findings of previous reports for the relevant EC water protection directives cited below shall be evaluated; the dates of the reports last submitted to Brussels and of the subsequent follow-up report are added in brackets:

- in accordance with Articles 15 and 17 of the Directive 91/271/EEC on the treatment of urban waste water (2000/2002)
- in accordance with Articles 9 to 15 of the Directive 96/61/EC on the integrated pollution prevention and control (-/2003)
- with respect to the first River Basin Management Plan pursuant to Directive 76/464/ EEC Article 11 concerning pollution caused by the discharge of certain dangerous substances (1999/2002)
- with respect to the first River Basin Management Plan in accordance with the Directives

75/440/ EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States. (1999/2002)
76/160/EEC concerning the quality of bathing waters (2001/2002)
78/659/EEC on the quality of freshwaters needing protection or improvement in order to support fish life (1999/2002)
79/923/EEC on the quality required of shellfish waters (1999/2002)

To establish the physico-chemical elements, we must refer to the, by not means exhaustive, list of the pollutants in Annex VIII of the Water Framework Directive:

1. Organohalogen compounds and substances which may form such compounds in the aquatic environment
2. Organophosphorus compounds
3. Organotin compounds
4. Substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment.

5. Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances
6. Cyanides
7. Metals and their compounds
8. Arsenic and its compounds
9. Biocides and plant protection products
10. Materials in suspension
11. Substances which contribute to eutrophication (in particular, nitrates and phosphates).
12. Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.).

This catalogue corresponds in many points with the substances contained in Lists I and II of Directive 76/464/EEC ('dangerous substances'), so a relatively large set of data is available for the initial characterisation.

3) National provisions

Criteria Paper from LAWA (Working Paper No. 3)

4) Source material

Reports submitted so far as required under the above Directives.

5) Necessary activities

Evaluation of the reports submitted under the EC water protection directives (checking for non-compliance with quality objectives, cases of continued exceedance, previous investigation of causes, previous actions ...) using the above-mentioned criteria.

Identifying the significant point-source pressures for bodies of surface water on the basis of Working Paper 3 (Criteria Paper, cf. Part 4) and taking into account the results of the assessment of existing impacts (Chap. 1.1.5)

1.1.4.2 Establishing significant anthropogenic pressures from diffuse sources, particularly by the substances referred to in Annex VIII

1) Reference to Directive

Annex II, 1.4 (3rd paragraph):

2) Technical background

Annex II of the WFD requires that the inventory contains an estimation and identification of significant pollution coming from urban, industrial, agricultural and

other installations and activities via diffuse sources, in particular by the substances listed in Annex VIII, inter alia using information gathered under

- Articles 3, 5, 6 of Council Directive 91/676 concerning the protection of waters from pollution by nitrates from agricultural sources (2001/2004)
- Articles 7 and 17 of Directive 91/414/ EEC on the marketing of pesticides (1998)
- Directive 98/8/EC on the marketing of biocide products
- with respect to the first River Basin Management Plan in accordance with the Directives

75/440/ EEC	concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (1999/2002)
76/160/EEC	concerning the quality of bathing waters (2001/2002)
78/659/EEC	on the quality of waters needing protection or improvement in order to support fish life (1999/2002)
79/923/EEC	on the quality required of shellfish waters (1999/2002)
76/464/EEC	on pollution caused by certain dangerous substances discharged into the aquatic environment (1999/2002)

In the case of diffuse sources, nutrient emissions are of primary importance.

When considering nitrogen pollution, we have to look at inflows from groundwater bodies into the surface water; the situation regarding nitrogen pollution in the groundwater body is covered by the groundwater chapters and the data given there can be referred to.

Regarding phosphorous pollution, erosion conditions give an indication of this pressure. Methods are available to determine erosion conditions along with the relevant map layers.

Data on nutrient loads for entire sub-basin areas are to be kept for the general overview and the characterisation of features of the river basin district that affect marine protection (water body status in coastal waters).

Data from contaminated sites offer further evidence of diffuse sources of pollution.

Instances of exceedance of quality standards for pesticides (cf. substances on the list of specific pollutants and further river basin-specific plant protection agents that are present) can also be assigned to the diffuse sources.

3) National provisions

LAWA Criteria Paper (Working Paper No. 3)

4) Source material

Data covering the area of the entire Federal Republic of Germany is available on phosphorous and nitrogen discharge that can be attributed to diffuse sources, e.g. in:

- WENDLAND, F., ALBERT, H., BACH, M. & SCHMIDT, R (1993): Atlas zum Nitratstrom in der Bundesrepublik Deutschland; Berlin.
- BACH, M.; FREDE, H.-G.; SCHWEIKART, U. & HUBER, A. (1999): Regional differenzierte Bilanzierung der Stickstoff- und Phosphorüberschüsse der

Landwirtschaft in den Gemeinden/Kreisen in Deutschland. – UBA-Texte 75/99; Berlin.

- BEHRENDT, H., HUBER, P., OPITZ, D., SCHMOLL, O., SCHOLZ, G. & UEBE, R. (1999): Nährstoffbilanzierung der Flussgebiete Deutschlands. – UBA-Texte 75/99; Berlin.

5) Necessary activities

Identifying the significant diffuse pressures for bodies of surface water on the basis of the aforementioned criteria.

1.1.4.3 Estimation and identification of significant water abstractions including seasonal fluctuations

1) Reference to Directive

Annex II, 1.4 (4th paragraph)

2) Technical background

An estimation and identification of significant water abstraction is required for urban, industrial, agricultural and other uses, including seasonal variations and total annual demand, and of water losses in distribution systems.

Data on water abstraction are contained in permit and approval notifications and regulations.

3) National provisions

LAWA Criteria Paper (Working Paper No. 3)

4) Source material

5) Necessary activities

Identifying the significant quantitative pressures on bodies of surface water in accordance with the above-mentioned criteria.

1.1.4.4 Estimation and identification of significant anthropogenic pressure due to water flow regulation, including water transfer and diversion, on overall flow characteristics and water balances

1) Reference to Directive

Annex II No. 1.4 (5th paragraph)

2) Technical background

We must provide an estimation and identification of the impact of significant water flow regulation, including water transfer and diversion, on overall flow characteristics and water balances.

The engineering structures and measures designed to achieve flow regulation will include above all dams, flood retention basins, obstructing features (weirs, river-bed constructions) and river hydropower stations. Water transfers and water diversions can occur between different sub-basin areas or as a transfer of water between rivers and navigation canals.

A key criterion for estimating the impact of morphological modifications on the ecological condition of a water body is continuity enjoyed by aquatic communities. It is therefore important to identify any artificial obstructing features causing high drops and smooth slides and to assess their effect on the continuity of aquatic fauna (upstream and downstream movement).

3) National provisions

LAWA Criteria Paper (Working Paper No. 3)

4) Source material

5) Necessary activities

The pressures on surface water bodies mainly caused by flow regulation measures must be designated in accordance with the aforementioned criteria taken from the systematic river morphology mapping data.

1.1.4.5 Establishing significant anthropogenic pressures from morphological alterations to bodies of surface water (cf. Annex II, 1.4)

1) Reference to Directive

Annex II No. 1.4

2) Technical background

Morphological alterations affect the channel patterns, width and depth variations, flow velocities and substrate conditions as well as the structure and conditions of riparian zones.

Data on the morphological modification are collected via the systematic river morphology mapping exercise.

3) National provisions

LAWA Criteria Paper (Working Paper No. 3)

4) Source material

Systematic mapping on river morphology by LAWA

5 Necessary activities

Identification of significant morphological alterations in accordance with the above criteria.

1.1.4.6 Establishing significant anthropogenic pressures from other significant anthropogenic impacts on the status of other bodies of surface water

1) Reference to Directive

Annex II No. 1.4

2) Technical background

For other anthropogenic impacts, data on other pressures can compiled on a case-by-case basis taking into account local conditions and integrated in the risk assessment.

3) National provisions

LAWA Criteria Paper

4) Source material

5 Necessary activities

Identification of other significant anthropogenic pressures that exist in the region.

1.1.4.7 Evaluation of land use patterns, including identification of the largest urban, industrial and agricultural areas, and also, where relevant, of fishery areas and woodlands

1) Reference to Directive

Annex II No. 1.4

2) Technical background

The requirement of the Water Framework Directive is interpreted as meaning that this point is primarily a question of the plausibility of the pressures identified under the other points, i.e. that a rough guide to the environmentally relevant activities (driving forces) of the river basin under consideration is expected here. This will, however, already be included in the general characterisation of features.

3) National provisionsLAWA Criteria paper.

4) Source material

Among other material, the Corine Landcover layer in Annex 3.2. No.0, H2 “Background” and the relevant ATKIS data can be used for this; freshwater fish and shellfish waters Directives.

5) Necessary activities

Presentation of the land use patterns and – if possible – links between land use patterns (driving forces) and significant pressures.

1.1.5 Assessing the impact of pressures, defining bodies of surface water at risk of failing to meet objectives (bodies of surface water at risk)

An assessment is to be made of how the pressures (cf. sections 1.1.4.1 to 1.1.4.7) affect surface water bodies and estimate the likelihood that these pressures will worsen current status, causing waters to fail to meet the required good status.

The risk assessment must also include an evaluation of the sensitivity of surface water bodies to the anthropogenic influences already identified. This risk assessment entails three steps:

- data on discharges and quality must be collated to describe the existing situation;
- this data shall be evaluated integrally (interrelating all the components) and aggregated at the level of a water body or, where appropriate, a larger unit (spatially);
- where we know of changes that will, without further measures being taken, lead to a change in the status of the water body by 2015, this prognosis shall be described in writing.

1) Reference to Directive

Annex II, 1.5

2) Technical background

In the *Länder* emissions data are available for all areas and have already been used for quality assessments. It is therefore only logical to draw on this information when identifying a failure to meet the WFD's environmental objectives and making the risk assessment for the 2004 Report to the Commission.

An environmental objective defined by the WFD is the achievement of good ecological status (still being elaborated by an EU intercalibration project under the new CIS 2 A Working Group using EQRs being defined there). This requires consideration of two quality elements:

1. the biological elements (fish, benthos and aquatic flora) and
2. the pollutants specified in WFD Annexes VIII No. 1-9, IX and X.

When determining biological quality, we make use of hydromorphological (structure), the chemical (the substances listed in WFD Annex VIII, 10-12) and the physico-chemical (quality) elements. These elements are referred to as assessment elements (*Bewertungskomponenten*).

Data on specific pollutants are available from the reporting required under Directive 76/464, even though mainly via the rough LAWA monitoring network and via the EPER lists of the IPPC Directive.

Biological data are being collected in the *Länder*, but there are gaps here and the data will not be available until 2006.

Comprehensive data are however available on the supporting assessment elements from quality monitoring and structure surveys:

- data on the saprobial status of waters and on the trophic status as well as quality values measured for the substances in WFD Annex VIII, 10-12:
- morphological structure data, usually including data on the biological continuity.

Using the data on specific pollutants and the data for the supporting elements (including continuity data), possibly including further regionally specific knowledge of physico-chemical pressures particular to a water body, it is possible to undertake a risk assessment and offer an opinion on the likelihood of the water body failing to meet good ecological status.

A further aim is to achieve good chemical status. For a list of priority and priority-hazardous substances, which is currently being compiled by the Commission, it is necessary to comply with quality standards, which are also to be laid down by the EU in a daughter directive. Where EU-wide quality standards have been agreed for these substances, they are listed in LAWA's model ordinance in the table in Annex 4.

Data on certain priority and priority-hazardous substances are available via the reporting required under Directive 76/464, even if most of the data comes from the rough LAWA monitoring network and from the EPER lists in the IPPC Directive.

The risk assessment does not produce final definitions. Nor is there any point in arriving at a definition of risk is the data are inadequate and if it is not technically feasible. That is why we recommend a distinction, as presented in the IMPRESS guidance document, between two risk groups: definitely at risk and probably at risk. Both qualify for the category of "at risk".

3) National provisions:

LAWA Criteria paper (Working Paper 3)

CIS Guidance 2.1

4) Source material

LAWA objectives concept

LAWA quality maps

LAWA structure map

The reports of the *Länder* on Directive 76/464 and IPPC Directive 96/61. The databases on water-obstructing installations.

5) Necessary activities

Compiling existing data and element-specific appraisals

Integral cross-element evaluation in accordance with LAWA Criteria Paper

Possibly aggregating evaluation with reference to the water bodies or survey area, as stated in Criteria Paper.

1.1.5.2 Prognosis for status in 2015

1) Reference to Directive

Annex II, No. 5

2.) Technical background

The Directive demands an assessment of the risk of water bodies failing to achieve status objectives. Although the objectives do not have to be met until 2015, there should certainly be no deterioration beforehand. Nevertheless, it may be useful, especially with a view to the requirements for the economic analysis, to provide a verbal description of modifications that are already known, and in some cases regulated, and will lead to an alteration in the status of the water body by 2015. One might refer here, for example, to framework operational planning or mining site closure arrangements that are subject to regulation under the law.

3) National provisions:

CIS Guidance 2.1

4) Source material

5) Necessary activities

Länder-specific analysis of knowledge about relevant modifications

1.2 Groundwater

1.2.1 Initial characterisation

The following chapters provide details of the steps to be taken in performing the work required under the Water Framework Directive. A graduated approach is taken here.

As a first step, the general characteristics of all groundwater bodies must be ascertained ("initial characterisation"). This means determining the protective properties of the groundwater cover as well as the potential hazards to which groundwater bodies are exposed. By overlaying the data collected, we can make a selection of the groundwater bodies which are at risk of failing to meet environmental objectives ("groundwater bodies at risk"). Only those groundwater bodies will then, in a further step, be subject to more detailed analysis to establish the facts that relate to the specific risks identified ("further characterisation").

The results of these two steps must be available by the end of 2004. However, since the second step depends on the first and since transboundary co-ordination is needed not only between different *Länder* but, where necessary, with other EU Member States or non-member countries, there is *de facto* much less time (completion target: mid-2002) left for the initial characterisation and the resulting selection of groundwater bodies at risk of failing to meet environmental objectives. For the **initial characterisation** of the pressures to which the groundwater body many be exposed, the WFD distinguishes between

- diffuse sources of pollution sources
- point sources of pollution
- abstractions and
- artificial recharges

Deterioration of the quantitative and the chemical status of groundwater as a result of one or more pressures due to human activities are designated as impacts.

The data to be compiled (and archived) under the terms of Annex II 2.1 and, where appropriate, 2.2 in the course of the status review should show the type and extent of anthropogenic pressures affecting the groundwater bodies in the river basin district or catchments and sub-basin areas.

In the first instance, the compilation of this information and of the pressures listed in 2.1 of Annex II and their mapping is undertaken, as part of the initial characterisation, irrespective of the assessment of their impacts.

In relation to groundwater, the WFD does not refer to significant pressures but pressures or **anthropological impacts**. There are no set cut-off criteria, so all the

aforementioned pressures causing real impacts on the groundwater body must be recorded and fed into the analysis.

The reference unit of the WFD is the groundwater body. Having identified the pressures, the next step is to estimate how great an individual pressure is and whether it, or the sum of all similar pressures, can threaten the groundwater body as a whole, putting it “at risk”. When appraising the pressure from a pollutant, the emissions from different pollution sources must be compiled. To perform the risk assessment called for as part of the initial characterisation, a groundwater body shall generally be considered “at risk” if the sum of the similar pollution sources impacts on at least a third of the surface area of the groundwater body. This “1/3 cut-off criterion” should not, however, be applied statically. The resulting findings have to be reviewed to see whether the key areas under pressure have in fact been identified. If necessary the criterion should be changed or the groundwater bodies should be redefined. This process of iteration is primarily intended to exclude those areas that are definitely not at risk, thus reducing the workload required for further procedures and the further characterisation.

For pollution sources that are so minor that they cannot endanger the groundwater body we may work out “negligibility limits”. However, even those pollution sources to be regarded as “negligible” are in principle factors in the risk assessment.

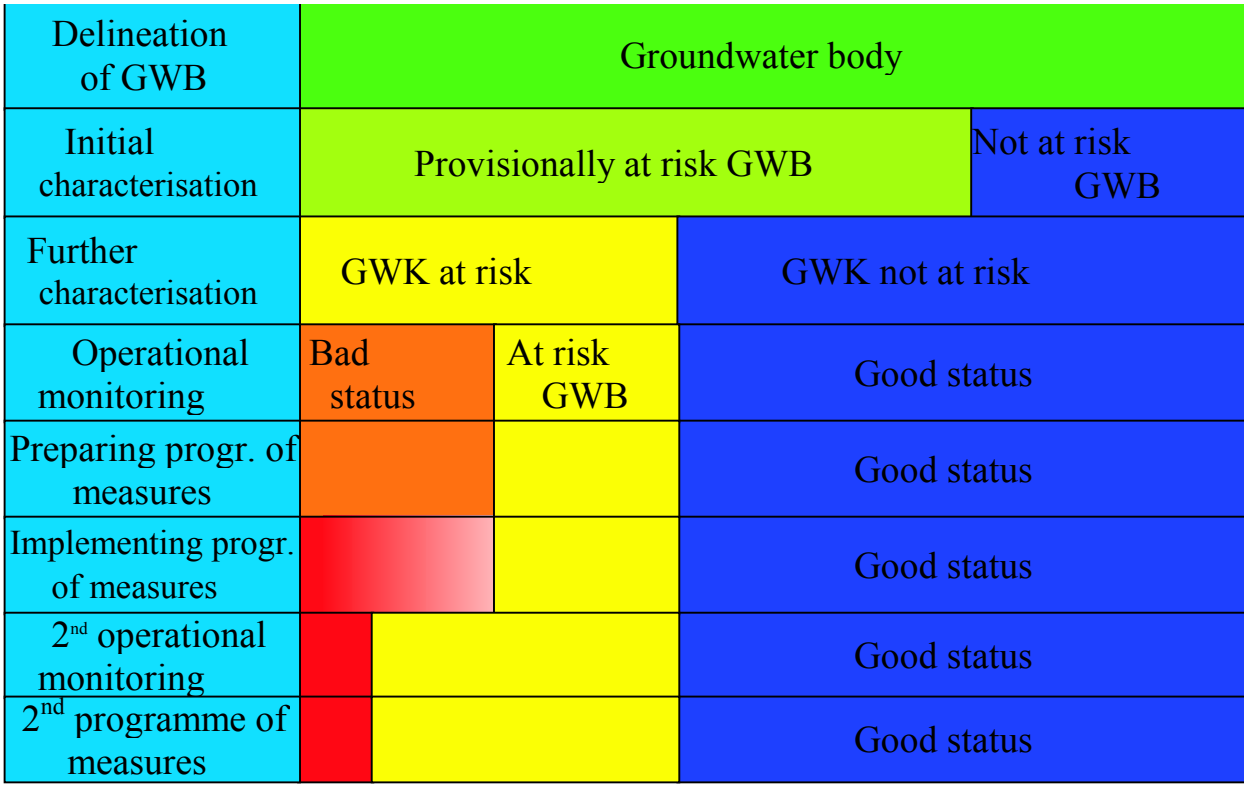
The data used to ascertain risk can involve a certain degree of imprecision since it is only for an initial judgement. In the case of groundwater bodies for which a risk has been identified in the initial characterisation, detailed risk assessments will be undertaken in the subsequent process of further characterisation. The identification of a risk in the initial characterisation does not therefore have any influence on possible actions or monitoring plans.

In the case of groundwater bodies or groups of groundwater bodies for which a risk of failing the objectives has been identified in the initial characterisation there is a requirement under Annex II 2.2 to conduct a **further characterisation** in order to

- judge the extent of this risk and
- establish the information needed to derive measures required under Article 11.

The information listed under items 2.2 and 2.3 of Annex II does not have to be gathered for every groundwater body and does not have to be comprehensive, but shall only be collected for the groundwater bodies at risk and only **to the extent required** in the further characterisation. In other words, we only need the information that is likely to enable us to judge more precisely the extent of the risk facing the groundwater body. As a rule this will entail *inter alia* finding out the details of the pressures resulting from the pollution sources.

The following diagram is intended to clarify the sequence of individual steps from the initial characterisation to the programme of measures.



1.2.1.1 Location and boundaries of groundwater bodies

1) Reference to the Directive

Article 2, items 12 and 13

Article 5

Annex II, section 2.1 and 2.2

Annex VII, section A 1.2

2) Technical background

The Water Framework Directive requires an overall management regime for water bodies in river basin districts that assigns the groundwater bodies to sub-basin areas that can be delineated by the surface catchment boundaries.

Within the meaning of the WFD, a "groundwater body" is defined under Article 2, item 13 as a distinct volume of groundwater within one or more aquifers. It is the smallest indivisible unit of evaluation and the unit to be used for the (later) determination of activities. To delineate water bodies the first task is to identify all aquifers in accordance with the definition given by the WFD. The WFD gives two criteria to be fulfilled by a geological layer of rock that counts as an aquifer within the meaning of the WFD. It specifies that an aquifer has to have a sufficient degree of permeability to ensure either

- a significant flow of groundwater or
- the abstraction of considerable groundwater volumes (10 m^3/d).

In practice this definition means that almost all groundwater deposits in the Federal Republic of Germany lie within an aquifer and the whole surface area should therefore be considered for the delineation of groundwater bodies.

The Directive makes no stipulations for the delineation of individual groundwater bodies. However, from the Directive's provisions on reporting and monitoring obligations we can derive the requirement to draw boundaries in such a way that, wherever possible, the groundwater body represents a homogenous entity to allow for clear estimation, description and monitoring of both quantitative and chemical status.

For the assessment of the quantitative status it is therefore advisable to draw boundaries that produce the hydraulically most discrete system possible, i.e. the groundwater flow from a body to the next is either negligible or can be easily estimated.

With regard to chemical status, knowledge of the

- natural groundwater properties (derived from the geology) and
- the extent of anthropogenic degradation (derived, in cases where there is no groundwater monitoring data, from use-related risk potentials as an indicator of status)

may help to delineate possibly homogenous units.

Groundwater bodies are three-dimensional. First of all consideration is given only to upper main aquifers that are contiguous over wide areas. Although the interactions mainly, and raising matters of urgency, affect the upper part of an aquifer (system), the deeper parts cannot be excluded from the analysis because they are crucial to drinking-water supplies and the possible impacts that deeper abstractions may have on surface waters and terrestrial ecosystems. If deeper aquifers are present and are used for water supply or are to be used for water supply, they should also to be taken into consideration and marked accordingly on the map. In such case a boundary should be set below which any action of pressure sources (land uses) on the groundwater status or, conversely, of the groundwater (quantitatively and chemically) on surface waters and terrestrial ecosystems can be excluded. Above all in areas where groundwater is layered in storeys we must decide, on a case-by-case basis, whether deeper parts of an aquifer (system) should be designated as separate groundwater bodies or the whole system as a "layered" groundwater body. This decision must be based on a knowledge of the extent of groundwater exchange and of the condition of groundwater.

While the subdivision of aquifers (aquifer systems) in to groundwater bodies must allow adequate characterisation and risk assessment, it is also important to avoid fragmentation into a confusingly large number of small units. For the purposes of characterisation and risk assessment and of monitoring, we may take the option, as described in Annex II of the WFD, of grouping together groundwater bodies. These groups of groundwater bodies should be as uniform as possible in terms of their division into landscape units and the use pressures affecting them, so they will also behave similarly with regard to target achievement.

The drawing of boundaries can only be understood as an iterative process. It may be assumed that the boundaries will have to be modified as more is known in the course of the initial characterisation and with the activities conducted after 2004, from the first monitoring results to the preparation of the management plan. From then on, however, the boundaries should remain unchanged until the end of the management period.

3) National provisions

none

4) Source material

The presentation of the “location and boundaries of groundwater bodies” shall be completed in accordance with Annex 3.2, No. 5.

5) Necessary activities

The delineation of groundwater bodies starts with the sub-basin areas. Congruence of surface and underground watersheds has to be examined in each case (cf. Art. 3, Para. 1 (3) of the WFD).

Within the areas demarcated in this way the individual groundwater bodies will usually be determined by the groundwater flow conditions of the upper aquifers. These conditions are established by measuring groundwater levels and shown as isohypeses and flow arrows. Especially in areas of consolidated rock, the underground catchment areas can be designated with the help of hydrogeological parameters. Where there is unconsolidated material, further hydrogeological differentiation is not, as a rule, required.

During the initial characterisation of these groundwater bodies it may prove useful to make a further subdivision in terms of the predominant land uses or the chemistry of the groundwater in order to assign the “at risk” areas, or rather areas in which measures need to be taken, to another separately delineated groundwater body.

The location and boundaries of the groundwater bodies shall be presented with the above-mentioned layers.

Points to note

The groundwater bodies determined with the aid of river catchment areas should, wherever possible, be identical with the group of surface water bodies, since this enables us to simplify various steps in the exercise (e.g. establishing land use, diffuse sources) regarding the assessment of surface water bodies and groundwater.

The work of delineating groundwater bodies is therefore to be closely co-ordinated with the selection of the survey areas. In this respect, the group of groundwater bodies and the group of surface water bodies should correspond and be referable via the existing water identification numbers.

1.2.1.2 Characterisation of groundwater bodies

1) Reference to Directive

Article 5

Annex II, section 2.1 and 2.2

Annex VII, section A 1.2

2) Technical background

In the “initial characterisation”, the groundwater bodies are to be assessed to find out the extent to which they are used and determine how high the risk is of their failing to achieve the objectives required under Article 4 of the Water Framework Directive. In order to make an assessment of the groundwater body with regard to meeting the objectives, it is necessary first of all to establish and describe a hydrogeological inventory of the individual groundwater bodies. Groundwater bodies can be dealt with as groups.

In the course of the initial characterisation, it is sufficient to make a rough breakdown of the prevalent rock entities in terms of hydraulic and geochemical criteria.

3) National provisions

none

4) Source material

see above (1.2.1.1)

5) Necessary activities

In the framework of the initial characterisation of the groundwater bodies, the main aquifers must be described by reference to their various geochemical and hydraulic characteristics. They are then subdivided into pore, fissure and cavern groundwater aquifers, since these aquifers have to be assessed differently owing to their hydraulic properties. A further subdivision is only necessary where marked differences in the groundwater chemistry can be reckoned with due to variations in the petrography. Stratigraphic boundaries need not necessarily represent structuring elements.

For the initial characterisation there are a maximum of nine different aquifer types. Special cases, such as a aquifer with a high content of organic substances, can be additionally included as Type X:

Pore groundwater aquifer	silicate	I
	silicate/carbonate	II
	carbonate	III
Fissure groundwater aquifer	silicate	IV
	silicate/carbonate	V
	carbonate	VI
	sulphate	VII

Cavern groundwater aquifer	carbonate	VIII
	sulphate	IX
Special cases		X

1.2.1.3 Characterisation of the overlying strata

1) Reference to Directive

Annex II, No. 2.1

2) Technical background

As part of the “initial characterisation” of all groundwater bodies, we must undertake a “general characterisation of the overlying strata”. To this end we shall refer here not to overlying strata but to groundwater cover, a term which also encompasses the unsaturated part of the groundwater body.

The purpose of characterising overlying strata must be to exclude those areas which display conditions particularly favourable to the protection of groundwater. This is the case wherever the properties of high pollutant retention and low vertical water permeability occur. All other areas are to be regarded as more or less unfavourable for the purpose of identifying “at risk” groundwater bodies (cf. 1.2.1.9).

However, it is important to point out that even favourable conditions do not rule out a risk to the groundwater but can usually only delay such a risk. A change in marginal conditions or a weakening of the capacity to retain material can lead to substantial substance intrusions into the groundwater. To the extent that substances have accumulated over many years in these layers, it will take a long time for rehabilitation measures to restore the original condition.

In assessing its protective effect, groundwater cover shall be differentiated into the following categories:

favourable – medium – unfavourable

favourable:

Favourable conditions occur where the cover is continuous, expansive and of great thicknesses (of > 10 metres) and predominantly cohesive constitution of the cover (e.g. clay, silt, marl).

medium:

Medium conditions occur where there are strong variations in the thickness of groundwater cover and predominantly cohesive constitution (examples as above) or where there are very great thicknesses yet high water permeabilities and low pollutant-retention properties (e.g. silty sands, jointed claystones and marlstones).

unfavourable:

Unfavourable conditions occur where, despite a cohesive constitution, there are low thicknesses or where, despite great thicknesses, there is predominantly high water permeability and low pollutant-retention capacity (sands, gravels, jointed and above all karstified consolidated rocks)

Since the vertical movement of substances in the unsaturated zone depends on the height of groundwater recharge, the rate of recharge - if known – must also be considered in the assessment. Thus, under “medium conditions” of groundwater cover, low groundwater recharge rates (< 100 mm/a) can shift the outcome of the assessment into the “favourable” category, and high groundwater recharge rates (> 200 mm/a) into the “unfavourable” category.

A favourable situation is also indicated by confined hydraulic conditions, especially where the groundwater is characterised by artesian confinement.

In case of doubt, the classification should always err on the side of the less favourable category. Alternative procedures are permissible if they enable differentiation into the three classes mentioned above and produce comparable results.

A material assessment of the groundwater cover – examining, for instance, its buffer capacity and its retention and degradation potential as well as the residence time of the percolating water - is only necessary when it comes to assessing the degree of vulnerability to pollution and deriving measures, so this work forms part of “further characterisation”.

3) National provisions

Pedological mapping guidelines, *Bodenkunliche Kartenanleitung* – 4th edition: 392 pages – issued by a scientific working party: *ad-hoc-AG Boden der Geologischen Landesämter und der Bundesanstalt für Geowissenschaften und Rohstoffe in der Bundesrepublik Deutschland* [publ.] (1994).

4) Source material

Hydrogeological general map, scale 1 : 200,000 (HÜK200): map showing protective capacity of groundwater cover

Pedological general map, scale 1:200,000 (BÜK200) or 1:50,000 (BÜK50)

Geological general map, scale 1:200,000 (GÜK200) or 1:100,000 (GÜK100)

5) Necessary activities

The point of characterising the groundwater cover is to enable an evaluation of the protection offered by these upper confining strata from potential pollutant intrusions and in terms of the risk assessment already referred to. What is problematic here is the fact that many pollutants are either not decomposed and retained or decomposed and retained only for a limited period of time. The protective effect of a

slightly permeable groundwater cover tended for many years to be overestimated, so to be on the safe side one should assume that no sustained protection is afforded.

For the initial characterisation we therefore recommend that the upper confining strata not be considered in the risk assessment.

Points to note

1.2.1.4 Bodies of surface water and terrestrial ecosystems dependent on groundwater

1) Reference to Directive

Article 4

Article 5

Article 8

Annex II, section 2.1

Annex VI, Part A x

Annex VII, section 5

2) Technical background

The Water Framework Directive aims to achieve the ecologically sound management of water bodies. Surface water bodies and terrestrial ecosystems that are directly dependent on groundwater are the crucial elements in this approach.

The ecosystems under review here concern not only areas in which there are shallow accumulations of groundwater or where spring-water emerges, such as mires and fens or marshland, but also those linked with groundwater-dependent surface water bodies.

With the terrestrial ecosystems dependence on groundwater is determined by the threshold depth to the water-table, which is defined by the maximum root penetration depth, which depends on the density of the vegetation and on the thickness of the capillary fringe, which for its part depends on the respective type of soil. As a rule there is no groundwater-dependency beyond a threshold depth of 3 m, although at certain groundwater-dependent woodland sites, especially oak-hornbeam woods, threshold depths may extend down to 5 m.

Groundwater-dependent terrestrial ecosystems are exposed to a multitude of threats. If the groundwater level is lowered by groundwater abstraction or by drainage trench construction to a level that will no longer ensure groundwater supply to the vegetation, the ecosystem will sustain (usually irreversible) damage.

When considering local habitats located at running waters hydraulically linked with groundwater, we cannot usually clearly determine the contribution of the groundwater body to their existence or character. Generally speaking, the influence of the surface

waters will dominate; the wider the riparian meadows, the greater the influence of the groundwater. Surface water ecosystems dependent on groundwater can be adversely affected when dry weather flow is reduced by groundwater abstraction. Impacts of this kind can above all be found in the headwaters and the upper reaches of the water bodies.

A rise in groundwater level, for example in connection with artificial recharge or with the flooding of brown coal open-cast mines, can also pose a threat to a terrestrial ecosystem, especially at woodland sites with a vegetation that is not adapted to high levels of groundwater. The WFD does not, however, contain any provisions on these matters.

As a rule, terrestrial ecosystems are sensitive to anthropogenic alterations to groundwater quality. This applies all the more to nutrients in the groundwater.

3) National provisions

The groundwater-dependent surface-water and terrestrial ecosystems may also be, but are not necessarily, protected areas under the Habitat Directive and Wild Birds Directive. The WFD has a wider objective here. The examination must therefore be based not only on the biotopes designated or registered under German or European law but also on the ecosystems that can only survive thanks to their direct connection with groundwater even though they do not enjoy a special protective status.

4) Source material

- biotope mapping by the *Länder*; biotope types can be classified by their groundwater-dependency using the lists coordinated by the BfN (Federal Office for Nature Conservation) and compiled by the Erftverband as part of the LAWA project (see below),
- forestry and agricultural site mapping where available,
- the following layers from Annex 3.2, No. 11 on “protected areas” can used for the review, although it must be determined for each of these areas whether they are groundwater-dependent, e.g. by checking with the above-mentioned list of groundwater-dependent biotope types:
- nature conservation areas (layers are also available for other protected areas under the Federal Nature Conservation Act (BNatSchG)
  - specially protected areas
  - areas designated under the Habitat Directive
  - bird protection areas.
- an indication of groundwater-dependent terrestrial ecosystems can be given by the pedological overview map or watertable depth maps.
- Erftverband project: identification, description and assessment of groundwater-dependent surface water bodies and terrestrial water bodies with regard to damage originating in groundwater. Report on Part I of the project:“*Erarbeitung und Bereitstellung der Grundlagen und erforderlicher praxisnaher Methoden zur Typisierung und Lokalisation grundwasserabhängiger Oberflächengewässer und Landökosysteme*“ (Developing and providing the fundamentals and requisite practical methods for classifying and localising groundwater-dependent surface

waters and terrestrial ecosystems), Bergeheim; download on the internet: www.wasserblick.net

5) Necessary activities

In seeking to identify a risk, the first task is to compile a register of all groundwater-dependent terrestrial ecosystems. The presence of groundwater-dependent ecosystems is indicated by the points where biotope maps showing where potentially water-dependent ecosystems overlap with watertable-depth maps or with pedological maps capable of confirming groundwater-dependency. The mere presence of hydromorphic soils is not, however, an adequate indicator of groundwater-dependent ecosystems.

Where there are no human activities with a possibly harmful impact on the ecosystems, there is no need to include those groundwater-dependent ecosystems in the survey. If groundwater abstraction is taking place in the immediate vicinity of a groundwater-dependent ecosystem, the risk of possible damage can hardly be ruled out in advance.

In identifying the risk more precisely, the next step is to make a preliminary selection of those ecosystems facing possible degradation and therefore requiring more detailed information for the further characterisation.

This can be done by excluding terrestrial ecosystems with a negligible likelihood of significant damage. This is the case if

- in the vicinity of the ecosystem there is no groundwater abstraction affecting the ecosystem, or
- the ecosystem has been allocated a groundwater monitoring point that documents no lowering of the watertable, or
- it has been shown by official enquiries that groundwater abstraction has no harmful impact, or
- the ecosystem is dependent on retained moisture and is not connected to the groundwater.

Following this method, we can first of all exclude those ecosystems not suffering any damage. For the rest, there is at least a possibility of damage or that damage has even occurred. They are then to be surveyed more closely as part of the further characterisation.

Points to note

1.2.1.5 Description of pollution from point sources

1) Reference to Directive

Article 2, item. 30

Article 10

Article 11, para. 3g

Annex II, section 2.1

Annex VII, section A2

2) Technical background

Via point sources, pollutants can enter the groundwater directly (discharges) or indirectly via an underground pathway (contamination focus in or on the soil surface). While the sources are confined to a small area, the pollutants may spread over a large area in the groundwater. Characteristically, point sources can be localised well as a rule but cannot always be traced back to a single polluter, and the resulting pressure by pollutants on the groundwater is comparably large.

Point sources are frequently a result of accidents or are due to a longer term inappropriate treatment of substances that are hazardous to water. However, it is old deposits (landfills that are no longer in use) and disused sites (closed down industrial sites) that have the greatest relevance to potential groundwater contamination. Where we can specifically demonstrate pollution of the soil and/or of the groundwater that goes beyond the at-risk threshold, we shall refer to the presence of a contaminated site.

Landfills, industrial installations and installations used for handling substances hazardous to water that were built using best available technology shall not be treated as point sources. An estimation of the direct introduction of pollutants can be derived from the information already gathered in accordance with the EC Groundwater Directive.

The significance of point sources of pollution for a risk to the good chemical status of a groundwater body is defined by the impact of the point sources on the groundwater body as a whole. Only in exceptional circumstances will an individual point source of pollution threaten the good status of the groundwater body. However, it is possible that a risk is posed by an accumulation of point sources.

For the presentation of the identified point sources, each point source shall be considered to have an assumed impact area of 1 km^2 as an appropriate range.

The *Länder* may set other sizes on which to base their estimates.

It is not absolutely necessary to determine the concrete range of the pollutant flag for every relevant point source.

Groundwater bodies identified as being at risk of failing to meet the WFD objective should undergo a further characterisation. This risk will then be assumed to exist if the sum of the areas calculated to be affected by point sources comes to more than 33 % of the area of the groundwater body.

We will now show how point sources of pollution can be assigned to a groundwater body. However, it should be noted that the first samples have shown that this method very quickly reaches its limits and the results must always be reviewed to see whether they reflect the real situation. Since work on the elaboration of the daughter directive on groundwater protection pursuant to Article 17 of the WFD has led to a discussion on assigning point sources to risk zones, no special importance should be attached to the risk assessment undertaken in this way.

In presenting the identified point sources of pollution and appraising their significance for the respective groundwater body, drawing up a comparative site-balance represents a viable method that can be applied without delay.

3) National provisions

The Federal Soil Protection and Contaminated Sites Ordinance (*Bundes-bodenschutz- und Altlastenverordnung; BBodSchV*) sets national standards for the assessment of contaminated sits.

We can also bring in the recommendations on the assessment of pressures on groundwater bodies issued by LAWA in 1994 ("*Empfehlungen für die Erkundung, Bewertung und Behandlung von Grundwasserschäden*") and the draft (status: 27.01.1999) LAWA paper on the principles of groundwater protection in waste recycling and product use, which gives sampling values for assessing groundwater damage (here: thresholds for insignificance).

4) Source material

Reports for EC Groundwater Directive 80/86/EEC and the registers of contaminated sites kept by the respective competent authorities.

5) Necessary activities

The initial characterisation of groundwater bodies is to be based exclusively on existing data and knowledge and demands no new surveys or examination of individual cases.

Consequently, only those point sources should be considered that have already demonstrated an actual release of pollutants that are leading or can lead to groundwater damage (previous emission, ongoing emission or predicted emission).

As a rule, such findings about groundwater damage or a threat to groundwater are available for contaminated sites where a detailed examination has been carried out. Consideration is also given to cases where such findings have already been produced at an earlier stage of the examination.

Decontaminated and secured industrial deposits and production sites and highly localised spots of groundwater damage are not taken into account here.

Points to note

In the context of developing the daughter directive on groundwater protection pursuant to Article 17 of the WFD there has been discussion on assigning point sources to particular risk zones as management units, thus dispensing with the need to transfer the point sources onto the groundwater body. The proposed methods for transferring a point source to a groundwater body would then be unnecessary. With this in mind, it may make good sense to assign to each significant point source a definite, case-dependent pollution-affected area. More details on this are to be

provided in a special working party paper on further characterisation, which is expected to be published in summer 2003.

1.2.1.6 Description of pollution from diffuse sources including a summary description of land use

1) Reference to Directive

Article 5

Article 10

Annex II, section 2.1

Annex VII, section A 2

2) Technical background

Potential pressures from diffuse sources of pollutants have to be identified in order to establish any threats to groundwater bodies. Diffuse sources are understood as spatial or linear substance emissions that cannot be traced back directly to a single polluter or to a point emission source.

Generally of relevance to groundwater bodies are the following diffuse sources:

- air pollution from industry, transport, domestic households and agriculture
- agriculture
- urban areas
- extensive industrial zones and transport installations

Emissions from diffuse sources can result in an alteration of natural groundwater quality. The types and quantities of substances that actually enter the groundwater depend on the retention and degradation processes undergone by the respective substance on its way to the groundwater.

The Water Framework Directive requires a review of emissions that starts with land use. For example, increased pesticide and nitrogen emissions can be reckoned with in land used for agricultural purposes. In built-up areas, leaky sewers, washing away of hardstanding areas and other factors can be expected to cause pressures on water bodies.

Due to their tendency to occur over large areas, diffuse pollution pressures present a particular threat to groundwater bodies. The prevention of pollution emissions from diffuse sources is a problem with European dimensions. They play a major role in the consideration of risks facing groundwater.

Following the sort of model approach called for in the Guidance Document 2.1 – IMPRESS, the risk assessment must take the following into account:

- in general all emission sources must be included that can cause pressure on groundwater,

- the totality of all pressures from the same pollutants must be considered along with their impacts on the groundwater body,
- "negligibility limits", i.e. where certain pollution sources can be ignored from the outset, can be determined if it is certain that no risk to the groundwater body will be overlooked by applying these limits.

3) National provisions

none

4) Source material

The diffuse airborne pollutants transported are primarily sulphur and nitrogen compounds, which have led to an acidification of groundwater especially in regions where the soil has only a minor buffer effect.

The UBA (Federal Environment Agency) Project "Mapping of critical loads for the import of acids ..." (Report on R & D Project 29773011 of Dec. 2000) contains deposition data valid for 1995, which can be called up in arcinfo format. The continuation of this project provides data for 1999. It will be concluded in 2004. The maps show the exceedance of critical loads by overlaying the deposition on the sensitivity of ecosystems (mapping the critical loads). The results for the latter based on data from 2000 are available for woodland, permanent grassland and near-natural ecosystems over around 1/3 of the area of Germany. The data sets with the new data on depositions and critical loads are available from spring/summer 2003 at the UBA.

Airborne imports of organic substances have no relevance under the terms of the WFD because of their very low concentrations (threat to groundwater from organic airborne pollutants – cf. DVWK-Materialien 1/2000).

Databases for the other diffuse sources of pollution from **agriculture, urban areas and extensive industrial zones and transport installations** are taken from land use data, farming statistics (emissions approach) and groundwater data (immissions approach). Land use data can be gathered from aerial and satellite pictures, regional planning documents or land development plans or from topographical maps.

The following geodata models (digital thematic maps) are currently available for the Federal Republic of Germany:

- ATKIS: Amtliches Topografisch-Kartografisches Informationssystem
- CLC: CORINE Land Cover (Coordination of Information on the Environment)
- Landsat TM-Szenen

ATKIS offers a high-resolution, low spatial and positional error, Gauß-Krüger projection.

The European land use project CORINE Land Cover is particularly useful if "the job has to be done quickly". Data are available Europe-wide. From databases we can distinguish, at an initial level, the land use classes built-up areas, agricultural areas, woodlands and near-natural areas, wetland areas and water areas, and at a further level these can, if required, be further differentiated.

The disadvantages are the low resolution and the related low positional accuracy and thus greater spatial error. Lambert Projection.

If the data for an area no longer reflect the current status, we can fall back on the IRS-1C satellite data from 1998. However, satellite data surveys are time-consuming and expensive.

Data on phosphor and nitrogen emissions that can be ascribed to diffuse sources is available for the entire territory of the German Federal Republic, e.g. in:

- WENDLAND, F., ALBERT, H., BACH, M. & SCHMIDT, R (1993): Atlas zum Nitratstrom in der Bundesrepublik Deutschland; Berlin.
- 1999 national report under Articles 3, 5, 6 of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- BACH, M.; FREDE, H.-G.; SCHWEIKART, U. & HUBER, A. (1999): Regional differenzierte Bilanzierung der Stickstoff- und Phosphorüberschüsse der Landwirtschaft in den Gemeinden/Kreisen in Deutschland. – UBA-Texte 75/99; Berlin.
- BEHRENDT, H., HUBER, P., OPITZ, D., SCHMOLL, O., SCHOLZ, G. & UEBE, R. (1999): Nährstoffbilanzierung der Flussgebiete Deutschlands. – UBA-Texte 75/99; Berlin.

5) Necessary activities

Presentation of the diffuse substance discharges and of land use on the basis of the material referred to under 4) and the latest data analyses. It is not necessary to quantify these imports right through to the groundwater. It is sufficient to give the substance emissions at the respective sources as accurately as possible.

In the following we present various approaches that can be taken as models. They vary above all in their complexity, which in turn is determined by the data situation. Which approaches are most suitable will depend on the respective conditions in (*inter alia* type of aquifer, heterogeneity of the hyrogeological conditions and the land-use patterns, the available data and scope for its evaluation) the *Länder* or river basin districts. The simple approaches have the advantage that they can be implemented without much difficulty. On the other hand, they only offer a rather crude evaluation. They are conceived in such a way that the risk assessment remains on the safe side, i.e. that they tend to result in an “at risk” conclusion. When deciding which approaches are appropriate, it is helpful to consider the remarks given directly under the descriptions below. In choosing an approach one should note that the meaningfulness of results gained from the initial characterisation is not identical. Thus, the appraisal of risk solely on the basis of land uses is obviously less meaningful than it would be if, say, nitrogen surpluses (inputs over outputs) also entered into the assessment. For this reason, it was decided in some cases to reject the simple approach originally envisaged in favour of a more discerning approach. This has resulted in a decline in the number of groundwater bodies designated as “at risk” after the initial characterisation and an increase in acceptance. The disparity will, however, disappear in the course of the further characterisation. In those cases where the simple approaches were followed the level of information will have to be significantly raised in the further characterisation. On the other hand, where the more sophisticated approaches were taken, considerably less additional data now needs to be collected. However, what is decisive for further activities is solely the outcome of the further characterisation, since only the groundwater bodies designated as “at

risk" at this stage will be have to undergo enhanced monitoring and – if "bad status" is then demonstrated – be accorded action plans.

Approach 1: Emissions perspective via land use

The groundwater bodies or grid areas shall be regarded as potentially at risk from diffuse pollution emissions if the sum of the areas used for agriculture or the sum of areas covered by settlements and roads makes up more than 33 % of the total site area of a groundwater body or a grid area,

Where more finely discriminating site data or more precise risk assessments are available, these should be used since a more careful analysis will presumably narrow down the area to be considered at risk. Approach 1 can also be checked against discharge data, where available.

Land uses are determined by means of CORINE Land Cover (CLC) and possibly ATKIS or satellite data.

CLC identifies the following types of use as potential diffuse sources of pollution of groundwater:

- 2.1 arable land and 2.2 permacultures or non-urban uses,
- 1.1 urbanised areas, and
- 1.2 industrial, commercial and transport areas ,

Approach 2: emissions perspective for grid elements

The risk assessment is related to grid elements (e.g. 25 km^2). Potential threats are understood in terms of the spatial intensity of agricultural use (arable farming, special crops) and groundwater replenishment. In addition, cattle stocking density and settlements are taken into account. The data are gathered from an evaluation of CORINE Landcover data and from statistical material at local authority level.

Where the following proportions of the total area of a given grid element are exceeded, it is currently assumed that the groundwater lying beneath that element is potentially at risk:

- **Arable land**

Groundwater recharge (mm/a)	Crop area in relation to total area of grid element
less than 100	bigger than 30 %
100 to 300	bigger than 40 **%**
more than 300	bigger than 50 %

- **Units of cattle per hectare of agricultural land**

Woodland share of communal land	Cattle units per ha agricultural land
less than 50 %	**> 1.0**
50 % to < 60 %	> 1.3

more than 60 %	not relevant

- **Special crops A** (vines, soft fruit, vegetables, hops, asparagus, tobacco) **> 2.5 %** of area of a grid element
- **Root crops and fodder plants** (maize, potatoes, sugar beet) **> 10 %** of area of a grid element.
- **Settlement share,** taken from CORINE, **> 30 %** of the area of a grid element

A further description of a grid element or group of grid elements is required if land use creates a threat and the pollution data for the groundwater (Simple Updating Kriging) demonstrate that good status has not been reached. Contiguous grid elements with these characteristics represent an at risk groundwater body. If, however, the pollution data fails to demonstrate any "at-risk pressure" on the groundwater and yet a threat is still suspected due to land uses, an examination should be made in the course of the further characterisation of the presence of pollutant retention or decomposition and whether it is sustained. If the capacity for retention is expected to decline over time, monitoring must be intensified.

Approach 3: Combined approach (emissions and immissions)

Groundwater bodies are regarded as potentially at risk from diffuse pollutant parameters if they

- show a mean nitrate concentration of 25 mg/l and more or
- show a nitrogen immission of more than 170 kg/ha and at least
- a third of the area of the groundwater body is used for agriculture and
- the area covered by settlements according to CORINE Landcover – types of use 1.1 (mainly urban areas) and 1.2 (industrial, commercial and transport areas) comprises at least 33 % of the total site area of the groundwater body.

The mean nitrate concentration is calculated by relating the results of the groundwater and raw-water monitoring by establishing a spatially weighted average. The *Land* (state) is covered by a grid of 100 by 100 m. For the monitoring points, arithmetical mean values of the nitrate concentration are calculated over a period of at least 5 years. The nearest monitoring point is then determined for each grid cell and the mean value of the monitoring point is transferred onto that grid cell. The value for the site area (mean value of nitrate concentration of a groundwater body) is then calculated from the mean value of all the grid points of the respective groundwater body.

For groundwater bodies that show mean nitrate values (currently) below 25 mg/l but do not have sufficient monitoring points, the probability of a future risk is estimated from the nitrogen quantities being exported from manure spreading. Consideration of potential diffuse pollution immissions from agricultural uses is based on the data for the agricultural land provided by CORINE and the data for nitrogen export from manure.

Approach 4 (similar to Approach 3 but with different data sources)

Groundwater bodies are regarded as being potentially at risk from diffuse pollution immissions if land used for agriculture exceeds 33 % of the total site area where groundwater nitrate concentrations are higher than/equal to 25 mg/l or if the land covered by settlements and transport infrastructure exceeds 33 % of the total area of the groundwater body. The technical steps here are:

1. collation of nitrate values in groundwater from groundwater monitoring programmes of the *Land* groundwater services and of water suppliers
2. regionalisation of nitrate values across the area of each *Land* (applying the Spline method)
3. ranking these regionalised nitrate values into Class 1 (nitrate concentration less than 25 mg/l) and Class 2 (nitrate concentration greater than/equal to 25 mg/l)
4. forming the common overlap of the Class 2 area and the composite categories of “arable land” and “grassland” taken from the satellite data IRS-1C 1998 (alternatively: CORINE data)
5. establishing the areas of settlement /transport infrastructure from satellite data IRS-1C 1998 (alternatively: CORINE data)
6. evaluation: groundwater bodies are regarded as being potentially at risk from diffuse pollution imports if the land identified under point (4) or the land identified under point (5) exceeds a proportion of 33 % of the total site area of the groundwater body.

Approach 5: emission approach for nitrogen imports

Groundwater bodies are classified as being potentially at risk from nitrogen imports if the N surplus for all site areas of a groundwater body lies on average above 20 kg/ha x a.

For the agricultural area of a groundwater body, the N-surplus is calculated in accordance with the Bach/Frede method. For all other areas a N-surplus is defined as 5 kg/ha x a.

The values for the annual N-balance surplus (following Bach/Frede[1]) on agricultural land is available for every rural district in the whole of Germany.

The N surplus is not considered in terms of individual agricultural practices (e.g. units of cattle or proportion of land under soft fruits) but determined by drawing up an area-based balance taking into account N-inputs and N-outputs. This balance-sheet methodology is one of the approaches underlying the Federal German Government’s reporting to the EU and to the States party to OSPARCOM and is also used for calculating the sustainability indicator “nutrient surplus” in a recently published strategy paper on sustainability entitled “Nachhaltige Entwicklung für Deutschland”. Thus, the proposed method is already understood by the agricultural sector.

Setting location and boundaries of groundwater bodies

Identifying land uses by means of CORINE data for each groundwater body

[1] "Regional differenzierte Bilanzierung der Stickstoff- und Phosphorüberschüsse der Landwirtschaft in den Gemeinden und Kreisen in Deutschland"
Bach, Frede, Schweikhart und Huber Institut für Landeskultur, Universität Gießen, 1999
published in Behrendt, Huber, Opitz, Schmoll, Scholz, Uebe (1999)
"Nährstoffbilanzierung der Flussgebiete Deutschlands" UBA-texte 75/99, Umweltbundesamt, Berlin (289 pages.), annex II

Overlaying the areas for Corine use types (arable land, grassland, woodland, vegetation, water areas, wetland, special crops, settlements) on the sites of the districts showing N-surpluses (in accordance with Bach/Frede) in each groundwater body.

The resulting sub-areas now contain both the land use and the N-surplus for agricultural land (arable land and grassland). For all the other land uses (woodland, vegetation, water areas, wetlands, special crops, settlements) we set the N-surplus at an imputed value of, say, 5 kg/ha/a (there may be cases in which higher values must be set, such as for exposed forests, individual settlements etc.).

The sub-areas thus determined are multiplied by the respective N-surplus value for their respective land use and aggregated. This sum is then divided by the size of the groundwater body area. The resulting figure is a spatially-weighted N-surplus for the whole of the respective groundwater body in kg N /ha /a.

Approach 6: extended emissions perspective

This approach seeks to determine the combined impact of various human activities on the groundwater body by means of just a few selected key parameters. The idea is to determine the pressure on groundwater from various pollutant sources, e.g. from agriculture or waste-water seepage, and enable a comparison between these sources. Here, too, we can distinguish in the evaluation between urban uses and transport infrastructures.

The assumption behind this approach is that, taking into account an average groundwater recharge, seep water polluted by local sources will achieve 80 % of the permissible quality standards at the transition point between good and bad status or comparable values. From this, a critical load can be derived per unit of site area that comes to 20 kg/ha x a for nitrate as key parameter for agriculture and waste-water, and 40 kg/ha x a for chloride as the key parameter for transport and industry. If the area produced by adding all the pollutant sources exceeds 33 % of the area of a groundwater body area, that body will be designated as at risk.

	Pressure sources	areas to be counted
a) Agriculture		
N-surplus	2 t/km^2 x a	
	(equivalent to 20 kg/ha x a)	1 km^2
	4 t/km^2 x a	2 km^2
	6 t/km^2 x a	3 km^2

b) Waste-water seepage

without pre-treatment	per 700 inhabitants	
biological treatment	per 1,300 inhabitants	1 km^2
advanced treatment	per 2,700 inhabitants	

It is only necessary to determine the total number of existing waste-water seepages in a groundwater body. A local reference is unnecessary.

c) Leaking sewers

poor condition	per 25,000 inhabitants	
with irregular maintenance	per 75,000 inhabitants	1 km^2
with regular maintenance	per 150,000 inhabitants	

d) Transport

the sum of road salt spread	per groundwater body	
	per 4 t chloride/a	1 km^2

e) Industrial sites

only sites on which building rubble, mining debris, scrap and similar waste is dumped as well as shunting yards, docks, landfills for rubble if they are not identified as point sources

per 0.1 km^2	1 km^2

Each of the site shares of a), b) and c) or d) and e) are added. If the sum of these areas exceeds 33 % of the site area of the groundwater body, further characterisation is required.

If the critical load in a groundwater body does not exceed a maximum of 1 % of the site area, it can be ignored since it falls under the negligibility limit.

Guidance on the choice of the most suitable approaches:

On Approach 1: CORINE Land Cover tends, for methodological reasons, to overestimate the pressures from agricultural and, in particular, arable land. On the other hand, where large arable areas do occur, the nitrate surplus is less than for small areas because the technical level improves with the size of the cultivated land. The method should therefore be applied above all where the land use structures are clearly defined and agriculture is dominant.

On Approach 2: The division of surfaces of a *Land* (state) into grid elements leads to greater differentiation that allows us to identify focuses of pressure. Since the groundwater bodies are not defined until this information is considered, this approach is particularly good at defining and delineating those districts where the groundwater is at risk or measures are needed. At the same time, the workload for the unaffected districts is kept to a minimum.

On Approach 3 and 4: An advantage of this procedure is that it can tell us a great deal about groundwater-polluting nitrogen run-off from agricultural land. However, the methods are relatively crude for other types of land. The Bach/Frede evaluation of the N-surplus is primarily attuned to livestock. For special crops or the high use of mineral fertilisers, other surveys must be consulted to determine the surplus.

On Approach 6: The approach is particularly suited to districts marked by a diversity of land uses since it seeks to specify the pressures from both agriculture and urban uses related to industry, transport and waste-water and to compare these pressures. This also offers a way of leaving out of the analysis those pollutant sources in a groundwater body that are so negligible that they do not need to be recorded or considered.

If it is demonstrated that particular pollutants, such as pesticides sprayed on tracks and roads, are entering a groundwater body as a result of human activity, a further characterisation will be required irrespective of which approach has been chosen.

Points to note

1.2.1.7 Description of pressures for the quantitative status regarding abstraction and artificial recharge

1) Reference to Directive

Article 2, items 26 and 27

Article 5

Annex II, section 2.1

Annex VII, section A 2

2) Technical background

The most widespread impact on the quantitative status of a groundwater body is from long-term groundwater abstractions. We should above all mention here:

- abstraction for drinking and industrial water supply
- flooding measures in connection with mining/large-scale building schemes
- lowering of groundwater levels when rock and earth is abstracted
- abstraction for sprinkling and irrigation
- long-term hydraulic groundwater remediation measures
- recharges

Groundwater abstraction also has an impact on groundwater levels or on the groundwater flow field in the wider surroundings of the abstraction point and, in some cases, in several aquifers. When groundwater levels are lowered, surface water bodies or upward sources may run dry, groundwater close to the surface may sink and, in connection with this, surface water bodies and terrestrial ecosystems may be impaired.

Groundwater abstraction that is not geared to the of the usable groundwater capacity results in an impairment of the quantitative status over a wide area (well beyond the abstraction site) because it upsets the quantitative balance. We must refer here to groundwater hydrograph lines and evaluate them to obtain a measure of the status of the groundwater body (cf. Points to note).

Groundwater abstractions which, due to excessive resource exploitation, result in a noticeable change in pressure conditions or major interference in the flow field can lead to negative changes to groundwater quality. In coastal regions, saline intrusions may occur, while in other places there is a danger of the ascent of highly mineralised water from deeper layers. Moreover, we can frequently observe how, despite the presence of near-surface groundwater barriers, pollutants break into lower levels if pressure has been released here, for instance in connection with drinking-water abstraction.

Artificial groundwater recharges result in an increase in groundwater levels and therefore represent an interference in the quantitative status of the groundwater. However, such artificial groundwater augmentation is generally aimed at mitigating the impact of excessively long or excessively widespread exploitation of groundwater resources through abstraction and at re-stabilising the groundwater quantitative balance. With respect to the quantitative status of the groundwater, careful artificial groundwater augmentation does not represent a pressure and therefore must as a rule be designated.

3) National provisions

none

4) Source material

The maps in Annex 3.2 no. 5 on the “Location and boundaries of groundwater bodies”, no. 9 “Quantitative status of groundwater”, and no. 10 “Monitoring networks for groundwater bodies (quantitative and chemical)”

5) Necessary activities

The initial characterisation can only provide a rough assessment of conditions since both the groundwater recharge and the data on the location of the abstraction points and the groundwater volumes being abstracted there must still presented in the further characterisation (Annex II, 2.2) or as part of the review of the impacts of human activities (Annex II, 2.3). Thus, in the initial characterisation it is only possible to undertake a rule-of-thumb estimation of the total volume (including industry, agriculture, mining and building) of water abstracted from the groundwater body and the total volume of water fed in to the groundwater body in the form of groundwater recharge. A list of the individual abstraction-recharge points is not required.

There are two possible methods of making the preliminary determination of risk:

Either the estimate of the abstraction volume is compared to groundwater recharge, which is derived from the available information coming nearest to the groundwater body under consideration. If the known, or perhaps newly recorded, abstractions are so minor as to be considered negligible, we can dispense with further characterisation since a risk has been ruled out. Whether or not the abstractions are negligible, must be decided on a case by case basis, although a condition for negligibility is that the abstractions constitute less than 10 % of the recharge. However, even where calculations of the recharge/abstraction balance are already available in a specifc case and show higher percentages, it may still be found that that there is no risk.

Alternatively, long-term monitoring data series compiled from groundwater level monitoring in the groundwater body can be referred to and compared with estimates of the groundwater use trends. The time series must be long enough to model the hydrological conditions correctly. Initial considerations of this question suggest that regional rainfall fluctuations, for instance, can be adequately taken into account over a thirty year monitoring period. If these time analyses of individual monitoring points fail to show any sustained anthropogenic and statistically sound reduction in groundwater levels, then, again, there is no requirement for the further characterisation.

The preparation of a detailed water balance to assess the condition of the groundwater body, for which the elements of this balance (precipitation, flow, evaporation, recharge) must first be determined, may be required as part of the further characterisation (cf. Points to note).

Points to note

The methodology for assessing groundwater hydrograph lines (statistical analysis etc.) is described in more detail in the chapter on "Monitoring quantitative status".

Drawing up a quantitative water balance requires an area-wide examination of groundwater recharge. Numerous methodological approaches using different methods of calculation are available for this purpose. (cf. among others. ALTMANN et AL. (1977) METHODEN ZUR BESTIMMUNG DER NEUBILDUNGSRATE.- GEOL. JB., C 19, S. 3 – 98, 30 ABB., 9 TAB.; HANOVER). Since, with respect to the area of a groundwater body, very different climatic, hydrological, pedological and hydrogeological site conditions exist, one may have to apply several methods in order to take these conditions into account. The groundwater recharge is therefore calculated in accordance with the Directive only as part of the further characterisation if this is helpful in assessing the impacts on the groundwater body of groundwater abstractions.

1.2.1.8 Analysis of other anthropogenic impacts on groundwater status

1) Reference to Directive

Article 11 (3)

Annex VII, section A 2

2) Technical background

In addition to pressures on the quality of groundwater from point and diffuse sources and impairments of the quantitative status by groundwater abstractions and augmentations as described in Annex 2.1., we also need to describe "other anthropogenic impacts on groundwater status". We refer here to those pressures that cannot be clearly assigned to chapters 1.2.1.5 to 1.2.1.7. Both quantitative and chemical aspects usually have to be taken into account for the anthropogenic impacts on groundwater status described below. We must assess, on a case by case basis, whether the impacts referred to affect such a large area that they are relevant for the scale that is applicable.

- Land sealing by housing and industrial areas and transport areas
  Widespread land sealing results in a considerable reduction of the groundwater recharge rate. Moreover, groundwater quality may also change as the groundwater temperature rises and gas exchange is inhibited.
- Changes in vegetation conditions
  Widespread changes in vegetation status can, by affecting water retention and evaporation conditions, lead to alterations in the water balance and thus influence the quantitative status of the groundwater. For example, by reducing the transpiration rate, large-scale clear-cutting of forest and woodland will lead to an increase in groundwater recharge and therefore, in some cases, to a rise in the groundwater level, posing a possible threat of waterlogging and alterations in flow direction and speed. In more markedly uneven hilly and mountainous regions, however, we would expect to see a reduction in the groundwater recharge rate accompanied by greater surface runoff and the subsequent problems it causes.
- Dewatering
  Draining measures in connection with mining and long-term dewatering as part of large-scale construction and remediation schemes can result in groundwater levels dropping beyond the point of intervention and impair the quantitative status of the groundwater.
- Flooding underground and open-cast mines
  Open expanses of water created by flooding of underground and open-cast mines can have an impact both on the water balance and on the quality of groundwater by altering groundwater levels and the groundwater flow conditions.
- Expansion of water bodies, building of canals, reservoirs, dam steps
  Water engineering work on surface waters, e.g. straightening of water bodies and modifying their beds, result in changes in groundwater level and flow conditions in hydraulically connected aquifers. The construction of reservoirs and dam steps leads to an increase in groundwater in the headwater area and a reduction in groundwater below the construction site and therefore, by forcing a sharper gradient pattern, to a greater groundwater flow speed and, in some cases, to a significant diversion of groundwater flow. In the course of alterations to the flow field, the chemistry of the groundwater may also change.
- Land-improvement drainage measures
  Drainage measures for land improvement carried out in an area of high groundwater lead to the groundwater surface sinking over a wide area, causing an impact on the quantitative status of the groundwater.
- Waste-water sprinkling and irrigation
  Waste-water sprinkling and irrigation does contribute to groundwater recharge, but it can have a negative impact on groundwater quality.
- Introducing (purified) waste-water into an infiltrating surface body of water
  In some areas, filtrating bodies of surface water can make a considerable contribution to groundwater recharge. If waste-water is fed into these waters, this may impair groundwater quality.

3) National provisions

none

4) Source material

none

5) Necessary activities

In accordance with the statements in 2) Technical background, the impacts referred to above in the area under observation are to be checked and, if necessary, described.

Points to note

The management plan requires an analysis of the "other anthropogenic impacts on the groundwater". However, we recommend that, as part of the initial characterisation, an examination of possible impacts already be undertaken in accordance with the references taking into account chapters 1.2.1.5 to 1.2.1.7.

1.2.1.9 Identifying the groundwater bodies at risk of failing to meet the environmental objective

1) Reference to Directive

Article 5

Article 11 (3)

Annex II, 2.1 and 2.2

Annex VII, Section A 2

2) Technical background

If it is found from the initial characterisation that a groundwater body is at risk of failing to meet the objectives of the Directive, it may turn out from the greater level of detail explored in the further characterisation that the risk is, contrary to the original assumption, in fact negligible and the objectives of the Directive are indeed met. The action programmes could then be deemed unnecessary. This groundwater body will then be presented as not at risk in the 2004 Report, and special monitoring measures and action programmes are no longer called for.

The approaches presented in sections 1.2.1.5, 1.2.1.6 and 1.2.1.8 to the description of pollution sources do not always draw on the findings of groundwater monitoring. Data from the *Land* groundwater resource management services and other monitoring services relevant to groundwater can, however, always be used in support of the risk assessment. If, despite a prognosis to the contrary, the presence of pollutants in groundwater is detected, we must then either review the original assessment of vulnerability to pollution or search for other causes (e.g. lateral inflow of polluted groundwater from neighbouring aquifers). A failure to find pollutants in groundwater analyses does not mean that a threat to the groundwater can excluded as a necessary conclusion. Rather, all the relevant factors (especially location, strength and active duration of pollution sources, constitution of groundwater cover, development of monitoring networks and position of monitoring sites in the

groundwater flow field) should be integrated. Thus, the assessment of the risk to the groundwater must always be made on a case by case basis. It may be easier here to exclude those areas for which there obviously is no risk.

If the analysis of pressures or of the immission data shows that a groundwater body as originally defined cannot be meaningfully assessed, e.g. because of widely differing characteristics in terms of land use (e.g. large contiguous woodland areas or concentrated settlements), the boundaries of the groundwater body can be redrawn.

3) National provisions

none

4) Source material

- results of the initial characterisation
- data from the *Land* groundwater resource management services and other monitoring services relevant to groundwater

5) Necessary activities

From the results of the evaluation of the individual potential pressures from anthropogenic influences described in sections 1.2.1.4 to 1.2.1.7 we can identify the groundwater bodies or groups of groundwater bodies that are at risk, or exposed to several risks, of not meeting Directive objectives. Apart from designating this risk or these risks, we are also required to state what information will have to be used for the further characterisation in order to appraise the risk more precisely and develop possible measures. Other anthropogenic impacts, as referred to in section 1.2.1.8, should be included in the assessment so that no risks remain unconsidered. The decision is to be made on a case by case basis, taking the above guidelines into account. The risk assessment shall be presented in a clear and transparent manner.

A further characterisation is required for all groundwater bodies that cannot be unambiguously classified.

Points to note

1.2.2 Further characterisation

1) Reference to Directive

Article 2,

Article 5

Annex II, No. 2.2

2) Technical background

In the further characterisation of the groundwater bodies (in accordance with section 1.2.2.1) at risk of failing to meet the environmental objectives detailed data are required that will permit detailed description of the aquifers, the hydraulic conditions, the groundwater balances and groundwater cover. The aim is to take appropriate measures pursuant to Annexes V and VII, having estimated the protection potential and having made a forecast of the possible impact on surface water bodies and terrestrial ecosystems. Some of the information, for example on the groundwater cover, gathered here is less helpful to the refining of risk assessment than to the development of appropriate measures.

As stated in section 1.2.1.9, the further characterisation shall entail the gathering of only the data that are relevant to narrowing down the risk. What data these might be will depend on the type and acuteness of the risk that was presented in the initial characterisation.

When deriving the appropriate measures called for in the case of groundwater bodies at risk, it is generally necessary to provide information on pollutant loads finding their way into the groundwater. Depending on which approach was chosen in the initial description of diffuse sources, spatially based load data has to be provided by the next stage, the further characterisation. Closer guidelines on this are being prepared by the LAWA working group, which, when formally agreed, will be included in the WasserBLIcK in the summer of 2003.

To simplify the terminology, the term “further characterisation” is used below to cover those items listed in Annex II No. 2.2 and – where relevant – Annex II No. 2.3. For transboundary groundwater bodies, too, further characterisation always means the items listed in Annex II No. 2.2 and 2.3. The layout of this Guidance Document is nevertheless based on the numbers of Annex II WFD.

3) National provisions

- hydrogeological, pedological and geological mapping guidelines issued by the State Geological Services (*Staatliche Geologische Dienste*)
- Hölting et al (1995):. *Konzept zur Bewertung der Schutzfunktion der Grundwasserüberdeckung der Staatlichen Geologischen Dienste* in: GEOLOGISCHES JAHRBUCH, REIHE C, HEFT 6; HANOVER 1997

4) Source material

- maps and other material of the State Geological Services
- UAG „*Hintergrundwerte“ (background values) by the Ad-hoc-AG Geochemie der Staatlichen Geologischen Dienste* in: GEOLOGISCHES JAHRBUCH, REIHE G, HEFT 6; HANOVER 1997
- Map (in accordance with Annex 3.2. no.5) of the “Location and boundaries of groundwater bodies”)

5) Necessary activities

The following are guidelines for the treatment of the characteristics of groundwater bodies as listed in Annex II 2.2 of the WFD. A “further characterisation“ is only

required for those elements that are relevant to determining the type of hazard threatening a body of water and the resulting measures.

on: Geological characteristics of the groundwater body

The groundwater body must be related to the natural conditions of the area under review. This is followed by a description of the geological units constituting the groundwater body.

The spatial delineation of the geological units is carried out on the basis of the available geological maps (1:25,000, 1:50,000), taking existing geological surveys (maps) into account.

The description should contain:

- geometry
- stratigraphic classification/genetic description
- lithological-petrographic description
- tectonics

on: hydrogeological characteristics

The spatial delineation of the individual aquifers is accomplished with the aid of the available hydrogeological maps. Depending on the types of cavities (pore, fissure and cavern groundwater aquifers) and the permeability coefficients, the hydrogeological units shall be classified into aquifers (kf>= 10^{-5} m/s), aquitards (kf= 10^{-5} m/s to kf=10^{-9} m/s) and aquicludes (kf<=10^{-9} m/s).

The permeability of the aquifers is defined in accordance with the classification used in the hydrogeological mapping instructions. In the case of non-homogenous aquifers, hydraulic permeability is represented by a mean value over the thickness. This has to be taken into account when developing further measures.

Furthermore, the effective porosity (specific yield of pore space in accordance with DIN 4049) must be specified. This refers to that proportion of the fissure or pore space through which groundwater can flow freely. It is an important parameter both for the water balance and calculations of travel time and should therefore be included in the description instead of simple porosity (cf. definition of the aquifer in Article 2).

In addition, the confinement status of the aquifer is to be noted, since it provides important clues as to the protective function of the groundwater cover. Moreover, it is important in further assessments for the measures to be taken (monitoring, remediation). Artesian conditions are to be presented separately.

on: characteristics of groundwater cover, including soils

For the groundwater body, the strata overlying the groundwater shall be described with reference to the movement of percolating water and their ability to retain pollutants.

The parameters determining the potential to retain pollutants, i.e. thickness, permeability, cavity volume, absorption capacity and usable field capacity are either directly or indirectly referred to in the "*Konzept zur Ermittlung der Schutzfunktion der*

Grundwasserüberdeckung“ (concept to establish the protective function of groundwater cover) of the State Geological Services and are linked with the amount of percolating water.

on: Stratification characteristics of the groundwater body

In developing further monitoring and remediation measures, the following characteristics are of key importance:

- hydrochemical differentiation
- density and temperature stratification
- age stratification (determined by e.g. isotopes, FCHC, etc.)

on: Groundwater recharge:

Groundwater recharge can be established with different methods - cf.: K. Altmann et. al. (1977): *Methoden zur Bestimmung der Neubildungsrate*.- Geol. Jb., C 19, pp. 3 – 98, 30 illustrations, 9 tables; Hanover. We can only decided on a case by case basis which method is suitable for the regional circumstances and whether the data required for the calculations is already available.

on: Inventory of surface water bodies and terrestrial ecosystems that are hydraulically connected with the groundwater body:

Of relevance here, and thus to be integrated in the further characterisation, are those ecosystems that can be significantly damaged by human activities. The WFD states that no damage shall occur in the period after the adoption of the WFD. Retrospective consideration of whether ecosystems were damaged by existing groundwater abstractions and whether an improvement of partially damaged ecosystems can be achieved is therefore not a matter governed by the provisions of the WFD. If, on the other hand, an ecosystem is still intact and the first anthropogenic damage is found to occur, it will as a rule fall under the provisions of the WFD.

When identifying a case of significant damage to groundwater-dependent terrestrial ecosystems, thresholds for non-exceedance must be set on a case by case basis. These limit values, which are set for sites displaying a special plant sociology, can be derived using monitoring series over many years (at least ten), taking account of site-specific capillary suction heads. Moreover, local surveys may be necessary, especially to understand the dynamics of the groundwater run-off. A spatially comprehensive survey of groundwater abstractions and discharges to groundwater is not required. It is only necessary to identify those for which we cannot rule out an impact on the ecosystems.

In the case of unconsolidated rock, this means that drawdowns in the ecosystem area calculated at less than 0.3 m can be neglected.

on: Estimating the flow direction and exchange rates between ground and surface water bodies

The question of when a slowing down of groundwater influx into a surface water leads to a failure to meet ecological quality objectives or to a significant reduction in the quality of this water body can only be addressed from the perspective of the

surface water body. Only if there are concrete indications of possible impairments is it necessary in the further characterisation to estimate the flow directions and water exchange rates between ground and surface waters.

If water table contour plans are available, the general flow direction can be stated immediately. Otherwise, the flow characteristics have to be derived in the form of a model (i.e. highly schematic presentation) by taking into account the hydrogeological and geomorphological criteria. We have to determine the mean exchange quantities, which max involve, for example, the measuring of dry weather runoff quantities in the case of smaller water bodies, the analysis of the transport of substances, hydraulic calculations, isotope studies, and abstraction balances for bank filtrate extraction, among others.

on: Hydrochemical characterisation of the groundwater including anthropogenic impacts

A geochemical inventory of the percolation and groundwater space as well as, in the case of certain ingredients, the vegetation plays a crucial role in determining the natural quality of the groundwater.

For each aquifer of the groundwater body, mean concentrations are calculated from selected groundwater content analyses for each constituent ingredient so that we can define the groundwater types. Anthropogenic impacts are indicated if the concentrations of certain ingredients lie outside the ranges or if substances can be identified that would not naturally occur in the aquifer. The inflow of groundwater from other aquifers and the rise of more highly mineralised water from deeper layers has to be considered here.

Points to note

If there are major discrepancies between surface and underground watersheds, these areas are to be represented and taken into account in the quantitative balance.

This also applies to groundwater bodies at deeper levels with which recognisable water exchange occurs.

1.2.3 Examining the impact of human activities on groundwater

(for bodies of groundwater which possibly do not meet the environmental objectives and for transboundary bodies of groundwater).

1) Reference to Directive

Annex II, sections 2.1, 2.2, 2.3

2) Technical background

To examine the impacts of human activity on the groundwater and take any appropriate measures, the Water Framework Directive requires that further information is made available with regard to groundwater uses and land uses for those groundwater bodies that

- transcend borders between Member States or
- may not meet the objectives under Art. 4 of the Directive

Since the initial characterisation (Annex II, 2.1) only provides a rough overview of the quantitative and qualitative pressures on the groundwater body, the additional information (Annex II, 2.3) together with the more precise hydrogeological data from the further characterisation (Annex II, 2.2) form the basis for the assessment (examination of impacts) of anthropogenic impacts on the groundwater. The assessment results flow into the management plans (Annex VII A 2, estimation of contamination, pressures, impacts)

3) National provisions

none

4) Source material

Notifications under water legislation (water rights register)

Drinking and raw water analyses by water supply companies

Groundwater analyses from government groundwater quality monitoring services

Land use data from the CORINE programme

5) Necessary activities

As part of the examination of the impacts of human activities it may be necessary to develop a more concrete understanding of possible risks by recording the locations and the annual rates of those groundwater abstractions of more than 10 m^3/d and recording the location and discharge rates of direct discharges. (A seepage through the soil in hollows or the classic seepage pit does not constitute a direct discharge, but will be registered in case of doubt in the data on groundwater recharge!) This does not apply to temporary water abstractions that do not cause any sustained change to the water table.

In individual cases quantitative pressures on groundwater bodies may occur as a result of introductions such as groundwater recharges or surface-water damming or development. The impacts must be examined accordingly.

Where intensive use pressures on a groundwater body are revealed by long-term analysis of groundwater level monitoring or the balance estimate, the examination of impacts should take into account calculations of mean groundwater recharge. Particularly in the case of abstraction volumes that come close to the recharge it is important to draw up a balance to show any potential risk arising from the high user pressures. In addition to calculating the groundwater recharge, we determine the share of the useable groundwater resource. If we cannot exclude the possibility that the abstractions may in future exceed the size of the available groundwater resource, the groundwater body is at risk.

In addition to the information listed in the initial characterisation on groundwater abstractions and recharges, more information must be compiled on the location, quantity and properties. It is also necessary to provide details of actions being taken

in the catchment area of the groundwater bodies that could exert an influence on resource availability or quality.

Only information of relevance to the type of risk should be compiled. Relevant information shall also include those measures which, alone or in concert, lead us to expect a clear change in the natural quantitative and/or qualitative conditions.

In the case of transboundary groundwater bodies, the relevance criteria must be set in consultation with neighbouring states.

A relevant chemical pressure on the groundwater can be expected to occur where rainwater is being directly introduced from large intensively used surface areas (e.g. transport infrastructure, industrial sites, surfaces salted in winter) without first seeping through the biotic soil zone (run-off via drains). The sinking of liquid waste in very deep groundwater aquifers can, under certain hydrogeological conditions, have effects on surface-near aquifers. All such impacts are to be considered in the review process.

The collection of data on uses and actions in the catchment area (Annex II, 2.3, g) is also limited to relevant phenomena. These may include changes in land use across wide areas, raw material extractions, soil sealing or irrigation and drainage measures. The necessary data (type, location, area) can be obtained from maps and aerial pictures, or from the relevant authorities (mining, agriculture).

Points to note

1.2.4 Examining the impact of changes in groundwater levels

1) Reference to the Directive

Article 4, para. 7

Article 5

Annex II, 2.4

2) Technical background

Where, in exceptional cases for which reasons are given, less stringent quantitative objectives are to be set for groundwater bodies under Article 4, the environmental impacts must be examined more closely in accordance with Annex II 2.4. The key parameter for quantitative status is groundwater levels (cf. Chapter 2.2.1 and 2.2.4)

It may be necessary to set less stringent quantitative objectives in a situation where impacts on the groundwater level that cannot be overcome in the medium-term are occurring above all due to the following activities (cf. Chap. 1.2.1.7 and 1.2.1.8 of this Guidance Document):

- drinking water and industrial water extraction
- abstraction for irrigation and spraying
- forking of mines and de-watering in large-scale building projects

- sealing of ground surfaces by housing developments, industrial and commercial sites and transport areas
- long-term groundwater remediation procedures
- artificial raising of groundwater levels

Before less stringent quantitative objectives are established, we must check whether, in accordance with Article 4 (5), the purpose for which the change in groundwater level was undertaken cannot be achieved by other means which would have less serious environmental impacts while not being unreasonably expensive. Moreover, Annex II 2.4 requires that we determine what the effects of changes in groundwater level are on

- surface waters and connected terrestrial ecosystems (cf. Chap. 1.2.1.4 and 2.2.4 of this Guidance Document)
- water regulation, flood protection and land drainage
- human development.

A final listing of those groundwater bodies for which less stringent targets are to be set is not required in the 2004 Report. Rather, the WFD envisages a two-stage approach: until the 2004 Report only those groundwater bodies must be identified for which subsequently, in a second step, less stringent environmental objectives are to be laid down. Thus, by 2004 it is sufficient to select among groundwater bodies classified as “at risk” after further characterisation all those, or those with a particularly high risk, for which – after obtaining and evaluating monitoring results for defining the good/poor status – less stringent environmental objectives shall apply. This stipulation does not, however, have to be made until 2009.

3) National provisions

none

4) Source material

Information which has been collected when preparing the Initial Characterisation (Annex II, 2.1), the Further Characterisation (Annex II, 2.2) and the “Review of the impact of human activity on groundwaters“ (Annex II, 2.3). In addition, data are to be used from the monitoring of groundwater levels.

We can also draw on documents that have been produced in connection with environmental impact assessments, regional planning procedures, landscape planning and framework planning for operators engaged in raw material extraction.

5) Necessary activities

For the 2004 Report only those groundwater bodies are to be identified for which there is a possibility that less stringent environmental objectives will be defined having taken into consideration further information, particularly the results of groundwater monitoring. The final designation is only made following an evaluation of the monitoring data. Should less stringent environmental objectives be established for groundwater bodies, the consequences for the aspects referred to in point 2)

must be examined. The results are to be documented for the report to the Commission and for the management plan.

Points to note

To explain the criteria for establishing those groundwater bodies to which exemptions, less stringent environmental objectives may apply, LAWA is drawing up an "Exemption paper" specifically on this subject.

1.2.5 Examining the impacts of pollution on the quality of groundwater (less stringent environmental objectives)

1) Reference to the Directive

Article 4 (5)

Article 5 (1)

Annex II, 2.1 to 2.3

Annex II, 2.5

2) Technical background

Where, in justified cases, less stringent quantitative objectives for chemical groundwater status are to be set for groundwater bodies under Article 4 (5), this will, in accordance with Annex II, 2.5, only be possible if

- the natural groundwater quality is characterised by chemical monitoring values that lie outside groundwater quality standards;
- the costs for remediation of the groundwater body (or parts thereof) are unreasonably high;
- no procedure exists that is suitable for remediating the polluted groundwater body or part thereof.

If a human activity has prevented the environmental objectives from being achieved, we must examine whether other measures could be taken which also fulfil the intended aim but would have small environmental impacts while not being unreasonably expensive. If there is no alternative to the human activity, it should be ensured that it is carried out in a way that causes the least possible impairment to groundwater quality.

If less stringent objectives have been set for a groundwater body, no further deterioration in groundwater status may occur.

A final listing of the groundwater bodies for which less stringent targets are to be set is not required in the 2004 Report. Rather, the WFD envisages a two-stage approach: until the 2004 Report only those groundwater bodies must be identified for which subsequently, in a second step, less stringent environmental objectives are to be laid down. Thus, until 2004 it is sufficient to select among the groundwater bodies

classified as at risk after the further characterisation all those, or those with a particularly high risk, for which – after receiving and evaluating monitoring results for defining the good/poor status less stringent environmental objectives shall apply. This does not, however, have to be defined until 2009.

3) National provisions

none

4) Source material

This may include information which has been collected when preparing the Initial Characterisation (Annex II, 2.1), the Further Characterisation (Annex II, 2.2) and the "Review of the impact of human activity on groundwaters" (Annex II, 2.3). In addition, data can be used from survey of groundwater quality that are already available.

5) Necessary activities

For the 2004 Report only those groundwater bodies are to be identified for which there is a possibility that less stringent environmental objectives will be defined having taken into consideration further information, particularly the results of groundwater monitoring. The final designation is only made following an evaluation of the monitoring data. The less stringent objectives and the reasons for setting them as such are to be documented for the management plan.

Points to note

To explain the requirements for establishing those groundwater bodies to which exemptions, less stringent environmental objectives may apply, LAWA is drawing up an "Exemption paper" specifically on this subject.

1.3 Protected areas

1.3.1 Identification and mapping of protected areas (register)

1) Reference to the Directive

Art. 6, Annex IV

Article 7

2) Technical background

Under Article 6 the Member States shall ensure that a register be established of all areas lying within each River Basin District which have been designated as requiring special protection under specific Community legislation for the protection of their surface waters and groundwater or for the conservation of habitats and species directly depending on water. Article 6 refers only to protected areas designated under EC laws and regulations, but not to protected areas designated solely under national law. The German version of Article 6 para. 1 might lead to misunderstanding

on this point. From the original English text, however, it is clear with regard to both the protection of surface and ground water and the conservation of habitats and species that the reference is only to provisions under EC law. With this in mind, we must also read Annex IV of the WFD accordingly, since wording of points 1 v and 2 lacks clarity and might be misinterpreted to mean that only protected areas designated under national law should be listed.

The required registers contain all protected areas listed in Annex IV and the water bodies identified in accordance with Article 7 paragraph 1.

The register of protected areas established under Article 6 thus contains the following types of protected areas:

i) areas designated under Article 7 for the abstraction of water intended for human consumption (drinking-water protection areas with legally binding designation which, pursuant to Art. 7 para. 3 (2), fall within the category of protected areas designated under European law),

ii) areas designated for the protection of economically significant aquatic species (e.g. shellfish waters, fish waters),

iii) water bodies declared under statutory regulations as recreational waters, including areas designated as bathing waters under the Directive on bathing waters (76/160/EEC),

iv) nutrient-sensitive areas, including areas designated as Vulnerable Zones under the Nitrates Directive (91/676/EEC), and areas designated as Sensitive Areas under the Urban Waste Water Treatment Directive (91/271/EEC),

v) areas designated for the protection of habitats or species where the maintenance or improvement of the status of waters is an important factor in their protection, including the relevant Natura 2000 Sites designated under the Habitats Directive (92/43/EEC) and the Birds Directive (79/409/EEC).

vi) all water bodies from which more than 10 m^3/d is abstracted for human use or from which more than 50 persons are supplied with drinking-water – even if they have not been designated as protected areas.

vii all water bodies from which more than 10 m^3/d will in future be abstracted for human use or from which more than 50 persons are in future to be supplied with drinking-water – even if they have not been designated as protected areas.

According to Article 4 para. 1 (c) of the WFD, the objectives and standards of the WFD are to be achieved in the protected areas within 15 years. In contrast to the provisions for surface waters and groundwater in Art. 4 para. 1 (a) and (b), no explicit reference is made here to possible exemptions and extensions. The interpretation that these possibilities may not be used for protected areas and that good status must be achieved already by the end of 2015 for water bodies in these protected areas is not, however, accurate. All provisions in Article 4 paragraphs 4 to 7 refer only to the objective in paragraph 1 without distinguishing between the objectives in subparagraphs (a) to (c). Moreover, no other provision in the WFD, even in the annexes, suggests that the exemption arrangements and extension options do not apply to water bodies in protected areas. Thus, when transposing the WFD into the Federal Water Act (WHG), provisions were included to allow for extensions for the achievement of the WFD objectives also in protected areas, e.g. under Section 25 c para. 4 WHG.

3) National provisions

Federal Nature Conservation Act (*Bundesnaturschutzgesetz*)

Nature conservation legislation of the *Länder*

Ordinances and acts of the *Länder* governing protected areas with international protection status

4) Source material

For the mapping of the "protected areas" designated under Community law, the following layers are available in Germany:

- drinking-water protection areas
- selected recreational and bathing waters
- nutrition-sensitive areas
- fish waters
- shellfish waters
- national parks
- biosphere reserves
- nature conservation areas
- Habitat areas
- EC bird protection areas

in accordance with Annex 3.2, No. 11.

5) Necessary activities

The protected areas to be included here must be compiled in tables.

They shall include:

- water protection areas (abstraction of water for human consumption)
- shellfish waters
- recreational and bathing waters
- nutrient-sensitive and vulnerable areas under 91/271/EEC
- fish waters
- Habitat areas with aquatic protection targets
- EC bird protection areas with aquatic protection targets
- water bodies from which more than 10 m^3/d is abstracted or from which more than 50 persons are supplied with drinking-water
- water bodies from which more than 10 m3/d will in future be abstracted or from which more than 50 persons will in future be supplied with drinking-water

The following information must be provided:

- name of the protected area
- type of protected areas
- assignment to the respective river basin district

- names of the statutory provisions under which the protected areas were designated

The protected areas are to be presented in maps with the layers specified under 4).

Points to note

1.4 Economic analysis of water use pursuant to Art. 5 and Annex III a

1) Reference to the Directive

Art. 5 (1), 9 and Annex III (as well as Art. 4, 11)

2) Technical background

The Water Framework Directive requires an economic analysis of water uses for each river basin district.

Water uses means water services and other actions that under Article 5 and Annex II have significant impacts on water status. Water services mean all services which provide the following for households, public institutions or economic activity:

a) abstraction, impoundment, storage, treatment and distribution of surface or groundwater;

b) waste water collection and treatment facilities which subsequently discharge into surface water

The functions of the economic analysis as given in Annex III of the WFD can be interpreted in different ways and therefore require specification. According to Annex III the economic analysis should contain enough information in sufficient detail to:

1. perform calculations necessary for taking into account under Article 9 the principle of recovery of the costs of water services giving consideration to long-term forecasts of supply and demand for water in the river basin district levels and, where necessary, the relevant investment;
2. make judgements about the most cost-effective combination of measures to be included in the programme of measures required by 2009.

Under Annex III of the WFD the costs of collecting the relevant data are to be considered. This point is reinforced by the explicit proposal in Annex III that estimates be made of the relevant information.

Building on the work of WATECO (“WATer ECOnomics”) working group, which has developed practical guidance for the WFD at EU level with regard to the economic analysis, the economic questions are to be dealt with in three steps:

1st step: to the end of 2004

2nd step: to the end of 2007

3rd step: to the end of 2009

Here, the decisions to be made by 2009 and 2010 at the latest shall be taken into account even during the first implementation step.

For the decisions required by 2009:

- In relation to the programme of measures decision must be taken as to what measures are needed. In this context the economic analysis has the task of

showing in relation to water level forecasts until 2015 how economic factors influencing water status will develop.

- The type of measures also has to be decided. This means choosing the most cost-effective measures.

For decisions required by 2010:

- The Member States have to take into account the principle of covering the costs of water services, which include environmental and resource costs. Under Art. 9 of the WFD cost-recovery means inter alia that water charging policies give appropriate incentives for the efficient use of water resources and the users make an appropriate contribution to the costs of water services taking into account the polluter-pays principle. When deciding on implementation by 2010, the Member States have scope to take into account the consequences of cost-recovery and, in particular, special regional circumstances. For certain water uses they may deviate from the above roles as long as environmental objectives are not called into question.

In the initial economic analysis by 2004 (1st stage) the following material must prepared for presentation:

- general description of the river basin district and the economic significance of water uses (chapter 5.1)
- a “baseline scenario” with a time horizon of 2015 (chapter 5.5)
- figures for the water services and the covering of their costs
- information for an estimation of cost-efficient combinations of measures
- information on the further work to be done (chapter 5.5)

In the 2nd stage, to be completed by 2007, the economic questions shall be further analysed and the analysis refined for the respective operational levels (river basin districts, sub-basin survey areas or even smaller). It is then possible to determine the economic contribution for the identification of the most important water management issues to be published by 2007 in accordance with Article 14 para. 1 sentence 2 letter b of the WFD.

In the 3rd stage (by 2009) the cost-effective measures are prepared. Here in particular, it is important to have close integration between technical and economic aspects. The implementation of the programme of measures takes place from 2009. Moreover, recourse to exceptional circumstances under Art. 4 when drawing up the programme of measures must be justified inter alia on the basis of economic considerations. The studies needed to set out these circumstances are not part of the pre-2004 economic analysis but must be undertaken later.

3) National provisions

The relevant substantive points in the Federal Water Act (Wasserhaushaltsgesetz - WHG) and the municipal laws on water charges are presented here with the following excerpts:

Section 42 WHG: adjustment of *Land* (state) law

(2) The *Länder* shall ensure that the provisions of Article 9 of Directive 2000/60/EC be implemented in the statutory regulations of the *Land* by 21010 notwithstanding federal statutory regulations.

Section 93 Hesse Local Government Code (as an example for the *Länder*): Principles of revenue acquisition

(2) The municipality has to raise the revenues necessary to perform its functions
1. where justifiable and proper from payments for their services,
2. or otherwise from taxes if the other revenues are not sufficient.

Section 10 Hesse Municipal Charges Act (as example for the *Länder*): use charges

(1) The municipalities and districts may levy use charges in return for the use of their public facilities.

(2) The rates charged shall generally be set to cover the costs of the facility provided. The costs include the expenditures for its ongoing administration and upkeep, payments for outside services, adequate depreciation costs and an appropriate yield on capital investment; in calculating the yield, those shares of capital raised from contributions and grants made by third parties shall not be considered. The validity of Section 127a of the Hesse Local Government Code remains unaffected.

(3) The charge is to be set according to the type and scope of the use made of the facility. Minimum rates may be laid down in the statutes. The levying of a standing charge in addition to a charge set pursuant to subsections 1 or 2 is also permissible.4) Source material

To characterise water users and water services we can, with only a few exceptions, use the data of the statistical offices of the *Länder* and data from the inventory compiled under Annex II. Central sources are:

- the environmental statistics
- the local government finance statistics
- the statistics on publicly controlled facilities and undertakings.

The statistical data referring to water management matters are assigned by the statistical offices of the *Länder* to river basin districts by catchment keys known as *Leitbänder*. These keys link the data of a municipality or (in the case of larger towns or communities) of a part of a municipality, depending on its focal location, to a river basin (at least up to 3-digit water catchment indicator). The non-water resource management data have not so far been assigned to the river basins, a task yet to be completed.

These simple keys in the form of *Leitbänder* lead to a lack of precision because the focal location can be misleading in some areas (especially where large towns are situated on the boundary between water resource management areas).

A more accurate alternative is offered by the qualified catchment keys, which distribute the municipality-based statistical data among the respective river basin districts by the percentage of settled area concerned. They are made by means of a geographical overlay of municipal areas, settlement areas and river basins.

These qualified keys are to be used for the economic 2004 analysis. The overlays required here will be done by the *Land* Environment Office of North Rhine-Westphalia on behalf of al the other *Länder*.

Further background material:

- European Commission 2000: Communication from the Commission to the Council, the European Parliament and the Economic and Social Committee on “Pricing policy as a policy instrument for enhancing the sustainability of water resources”, COM (2000) 447 final of 26 July 2000

For a more detailed interpretation of the economic aspects of the Water Framework Directive and the positions reached in discussions at EU level:

- background report on the economic provisions of the WFD*: "Ökonomische Anforderungen der EU-Wasserrahmenrichtlinie*", Ecologic, as of July 2001 (produced as part of the UFOPLAN project to develop criteria and instructions: "*Erarbeitung von inhaltlichen Kriterien sowie einer Handlungsanleitung für die Durchführung von wirtschaftlichen Analysen in Flussgebieten nach Artikel 5 und Anh. III der EU–Wasserrahmenrichtlinie*")
- "Guidance" document of the EU working group on the economics of the WFD (WATECO Group) contains specifications for the practical implementation of the economic analysis (English report of August 2002)
- provisional final report of the "Mittelrhein" pilot project on the implementation of the economic analysis in Germany, June 2002.

5) Necessary activities

The level of presentation for the economic analysis is always the river basin district, although the source material/reporting elements are generally compiled at the level of the sub-basin survey area[2] (in line with the inventory under Annex II).

The practical guidance for the economic analysis represents the minimum data collection required. However, every *Land* is free to call up further data for use in the economic analysis.

5.1 General characterisation of the river basin district and the economic significance of water uses

General characterisation of the river basin district:

As a general introduction, the first step is to describe the river basin district. The landscape features needed for this are already described in the inventory under

[2] A sub-basin area, or sub-basin survey area, refers here to a *Bearbeitungsgebiet* (some *Länder* use the term *Koordinierungsraum*), which is the next level below the river basin district (*Flussgebietseinheit*).

Annex II. The most important landscape features are again listed here systematically in a table (cf. table 5.1.1)

➨ The following data are to be collected in the sub-basin survey areas:

Table 5.1.1: General data

Landscape features	**Description**	**Source**
rivers	length, of which navigable	inventory in accordance with Annex II WFD
climate	annual precipitation	
navigation canals	canals in km	
lakes	lakes > 20 km^2 , size in km^2	
storage reservoirs	storage volume in million m^3	
land	land sites by type of actual use	
Population	**Description**	**Source**
population data	population density/ area and population	inventory in accordance with Annex II WFD
total gainfully employed	inhabitants and employment	LDS

➨ The data from the survey areas are to be aggregated and collated at the level of the river basin district.

General characterisation of the economic significance of water uses:

A description is required not only for the river basin district but also for the economic and social significance of water uses in the various parts of a river basin district. Since water uses by definition exert an influence on the status of waters, this description helps us to assess the socio-economic impacts of measures influencing water uses when we design the programme of measures.

In the presentation we have to show what importance individual economic sectors have in the river basin district to the extent that they constitute water uses within the meaning of the WFD (e.g. agriculture, industry, navigation). The selection of water uses must be made with reference to the description in Annex II. Moreover, those economic sectors are to be described that are heavily dependent on waters and their quality (e.g. fisheries). The aim here is to represent the relative socio-economic significance of these economic sectors associated with water uses.

The existing central data in the *Länder* statistical offices can be compiled for the description and analysis of water uses, where they are significant. This data to be used is set out in the following tables:

Table 5.1.2: data on water uses in the sub-district survey area

	Water uses		Socio-economic data					
	Water abstraction[4]	Waste-water introduction[5]	Length	No. of employees	Total employment (in %)	Yield (e.g. sales, crop volumes, transport volumes energy production in kWh, etc.)	Share of the gross value added[6]	No. of farms, operating units
Sectors of water uses								
Public waster supply	LDS	0	0	LDS[7]	0	LDS[8]	0	LDS
Local water disposal	0	LDS	0	LDS[6]	0	LDS[9]	0	LDS[10]
Agricultural,	LDS	LDS	LDS[11]	LDS	LDS	LDS[12]	LDS	LDS[13]
of which with own extraction	LDS	0	0	0	0	0	0	0
Forestry	0	0	0	LDS	LDS	0	LDS	0
Fisheries (at B-level only deep sea fisheries)	0	0	0	0	0	Fed. Stats. Office[14]	0	0
Manufacturing industry	LDS	LDS	0	LDS	LDS	LDS[15]	LDS	LDS[131]
of which with own extraction	LDS	0	0	0	0	0	0	0
of which direct discharge	0	LDS	0	0	0	0	0	0
Inland navigation	0	0	0	0	0	LDS[16]	0	LDS[17]
Energy	LDS	LDS	0	0	0	LDS	0	LDS[131]
Economy as a whole[18]	0	0	0	LDS	LDS	0	LDS	0
Hydroelectric power	LDS	LDS	0	0	0	LDS	0	0
Transport	0	0	LDS[19]	0	0	LDS[20]	0	LDS[21]
Private households	LDS	LDS	0	0	0	0	0	0

LDS = data available from the Statistical Offices of the *Länder*; 0 = no data available/ necessary.

4 water abstracted from nature in million m^3
5 waste-water discharge in million m^3
6 total gross value added by: agriculture, forestry, fisheries, manufacturing industry, domestic trade, tourism, transport, energy, public and private services
7 number of connected residents
8 water charges for consumers, by households and commercial undertakings
9 annual waste-water volume in total
10 number of waste-water disposers and waste-water treatment plants
11 irrigated land in ha
12 harvest in tonnes or livestock in units
13 number of farms
14 landings in tonnes
15 sales in million euros
16 transport performance in tonne-kilometre
17 number and type of vessel
18 data on “economy as a whole” do not correspond with the addition of the various water uses.
19 length in 1,000 km differentiated by motorways, national federal highways, state roads, district roads, rail network, waterways, oil pipes.
20 transport performance in tonne-kilometres on the road, rail, waterways and in oil pipes.
21 stock of means of transport on rail, road and waterway

➡ The data from the survey areas are to be aggregated and collated at the level of the river basin district.

These data are intended as a starting point and must be trimmed down to reflect the respective conditions in a river basin district or, in other cases, extended to account for water uses in a sub-basin survey area with significant impacts beyond those in mentioned above[22].

In this connection the WFD also calls for the identification of "areas designated for the protection of economically significant aquatic species".[23] This type of water use is not taken into account because only occasional protection areas for aquatic species exist in Germany and these are not generally of any economic significance. On this point the economic analysis shall therefore contain, for all river basin districts, the statement: "There are no economically significant aquatic species in the river basin district requiring the designation of protected areas."

5.2 Baseline scenario

Under Annex III of the WFD the analysis reported must contain "enough information in sufficient detail" "in order to make the relevant calculations necessary for taking into account the principle of recovery of the costs of water services, taking into account long-term forecasts of supply and demand for water " including, where necessary, reference to the relevant investment.

Furthermore, the WATECO document says that we need to identify all the economic factors by 2004 that have a relevant influence on the development of water status ("key economic drivers") and integrate these factors in the description of the development of the waters (as a baseline scenario). Going beyond the wording of Annex III, the WATECO Working Group conceives the economic analysis as an instrument in the forecasting of water for 2015. This interpretation is supported by a reference made in Art. 5 to an analysis of water uses.

For the task of elaborating the programme of measures, i.e. by 2007, the "drivers" need to be identified for each area under review so we can answer the question of whether or not measures must be taken. In preparation for this work and in response to the demands of the European directions for activities, the key factors and their development will be described at the sub-basin level by 2004 and statements will be made on the components of water resources and water demand referred to in Annex III. In addition, reference will also be made where necessary to investments already planned.

The following approach is taken:

1. Development of water resources

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[22] Where there is uncertainty about classifying an impact as significant, it is recommended that the "Signifikanzpapier" be followed..

[23] Cf. Step 1.1., last point, WATECO Document p. 29; further information on this can be found on p. 41. According to Article 6 of the WFD a register of all protected areas must be compiled by 2004. Annex IV lists the various types of protected areas, this includes the aforementioned "type" of protected areas.

Regarding the development of water resources, precipitation trends and impacts on groundwater play a quantitative role, on the one hand, and changing influences on the water balance play a qualitative role, on the other. The latter are a function of the water uses to be determined under point 2. A general statement is being prepared on this at LAWA level, possibly presenting different trends in different parts of the Federal Republic. Peculiarities in seepage conditions will be elaborated upon after the basic statement has been prepared at the sub-basin survey level.

2. Development of water demand and of water uses

The report should start from water uses that are also an object of the general characterisation of the economic significance of water uses (p. chapter 5.1). The following steps are taken in analysing the individual sectors:

a) Uses by private households

The *Land* authorities make a forecast for (regional) population trends. The data needed for this can be taken from the existing and published population projections of the competent *Land* ministries for regional development or extrapolated on this basis (regional plans, regional development plans etc.). At LAWA level general conclusions are drawn about the transformation in the fields of water supply and waste-water disposal. The *Länder* add to this presentation if they so require.

b) Uses by industry

Here, the water uses of significance in the river basin district (e.g. water uses of the manufacturing sector, the energy sector, where hydroelectric power may be especially relevant, the inland waterways, transport etc.) are to be addressed along with their consequences for the quality of the biological elements of waters and their morphology.

The underlying factors behind economic growth, the growth of individual economic activities, changes in spatial planning, changes in industrial policy, transport policy and energy policy, changes in water pricing policy, etc. will be presented by each *Land* for its part of the river catchment; the sub-basin survey areas must then integrate the contributions. Data on the development of the economy can be taken from the regional planning documents.

c) Uses by agriculture, forestry, fisheries

Water uses in the fields of agriculture, forestry and fisheries are to be addressed to the extent that they have developing effects on the quality of the biological elements of waters and their morphology.

The underlying factors, namely changes in agricultural, forestry and fisheries policy, changes in regional planning and changes in water pricing policy etc. are presented by each *Land* for its part of the river catchment; the sub-basin survey area must then be integrate the contributions. Data on the development of agriculture and forestry as well as fisheries can be taken from the regional and *Land* development plans.

d) Envisaged investment

The *Länder* have the task of presenting planned investment in the water industry (e.g. in water supply and waste-water disposal, in the recovery of wetlands, for programmes to replenish groundwater for drinking-water supplies) that will affect the water uses.

Uncertainty factors such as climate change can have effects on available water resources and water demand, although they are almost impossible to predict. The following wording is therefore to be included on this point in the economic analysis: "These forecasts must be predicated on several uncertainties. In particular, factors such as climate change, technological development, shifts in social values, globalisation etc. can influence the availability of water resources and the demand for water. The extent of this influence is not, however, predictable."

In connection with this point we must find out whether new activities are to be considered. It is not necessary to make statements on economic activities that have no relevant influence on the waters and will continue to have no influence. Wherever possible we should, given an affordable and justifiable effort, make use of existing studies and data.

In the case of the water industry contributions to the scenario, especially all contributions that provide an analytical prediction of water demand and supply trends, the relevant LAWA committee should formulate the position. The contributions to the scenario that do not concern water industry aspects should be dealt with by the relevant competent government departments. On each point we have to find out whether and to what extent general statements – for Germany as whole, certain parts or the respective *Land* – are necessary and possible, with a view to avoiding a duplication of efforts.

5.3 Data on water services and their cost-recovery level

Under the WFD and according to the specification provided by the WATECO document, the term water services includes:

a) public water supply (recharge, abstraction, conditioning, storage and provision of pressure, distribution, operation of impoundments for water supply purposes),
b) municipal water-disposal (collection, treatment, introduction of foul water and rainwater in combined and separation sewerage systems).

Services carried out by the users themselves are to be considered in those cases (i.e. qualify as water services) where they have a significant (considerable) influence on the water balance (if the overall water balance of a region requires their consideration). The following services must therefore be examined to find out how far they are significant[24]:

0 industrial-commercial water supply (own production),
1 agricultural water supply (irrigation),
2 industrial-commercial waste-water disposal (direct discharger).

Impoundments for the purpose of electricity generation and navigation and any measures for flood protection do not come within the definition of water services but may constitute water uses.

[24] In connection with the inventory under Annex II

5.3.1 Structure data on water services

The first task is (similar to the water uses) is to compile general information on the water services. To avoid duplication of efforts, this description should be coordinated with the work on the inventory under Annex II.

The data are available from the Statistical Offices of the *Länder*. The following parameters are used here:

On public water supply:

- the population connected to the public water supply (inhabitants or m³/year) and industry (m³/year),
- number of water supply companies,
- water supplied (consumed) in m^3/year (broken down by households and enterprises),
- water production in total (broken down by groundwater, spring water, bank-filtered water, surface water, own extraction and water purchase).

On public waste-water disposal:

- number of waste-water disposers,
- length of combined, storm-water and foul-water sewers (in km),
- inhabitants/industry/commerce connected to sewers (population equivalent),
- inhabitants/industry/commerce connected to sewage treatment plants (population equivalent),
- number of public sewage treatment plants,
- volume of purified waste-water (in m^3/year) in total and broken down by mechanical treatment, mechanical-biological treatment; proportion of rainwater (sealed surface areas).

If further activities are required for the economic perspective (e.g. direct discharges, own abstractions), the data on this should also flow into the analysis. The following data from the respective Statistical Offices of the *Länder* is useful here:

On the industrial-commercial water supply (own production):

- water volume (in m^3/year).

On agricultural irrigation:

- own extraction of water volumes (in m^3/year) in total (and broken down by groundwater, spring water, bank-filtered water, surface water),
- water yield (in m^3/year) in total (and broken down by own extraction and water purchase),
- water deployment (water volume) in m^3/year and irrigated area in ha (broken down by agricultural crops, horticultural crops and permacultures).

On industrial-commercial waste-water disposal (direct dischargers):

- discharged water volumes (in m^3/year) of manufacturing industry (total and only cooling water), also broken down by discharges into surface waters/underground,

in own waste-water treatment plants, to other enterprises and into the public sewers,
- waste-water introduction from thermal-electric power stations (in m^3/year) in total and broken down by cooling water and other waste-water, number of enterprises.

5.3.2 Costs of water services, cost recovery

The costs of water services and the extent of cost recovery are being surveyed in Germany in three pilot regions (sub-basin area of Mittelrhein, sub-catchment area of Lippe, administrative district of Leipzig). The results from the three pilot regions produce a representative picture for the whole of the Federal Republic of Germany that shows a range of cost-recovery levels. These are discussed in connection with the municipal law on water charges and the local government code presented in 3). A document dealing with this is provided by LAWA. The authorities in the sub-basin survey areas do not have to instigate any measures.

5.3.3 Environmental and resource costs

The EU sees the costs of water services not only as financial costs but also as environmental and resource costs, even if they are not met by the water provider. Environmental costs can be defined as: "[...] costs of damage that water uses impose on the environment and ecosystems and those who use the environment (e.g. a reduction in the ecological quality of aquatic ecosystems or the salination and degradation of productive soils)."[25]

Resource costs can be defined as "[...] the costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery (e.g. linked to the over-abstraction of groundwater).[26] or abstraction for cooling water and reintroduction. Moreover, resource costs can also occur where shortages of water of sufficient quality are caused by pollution.

A distinction between these two types of cost is not made. Environmental and resource costs can be used a dual term that covers all the externalities of water services.

A monetary estimate of these costs will not be possible by 2004. However, preparations should have been made in the sub-basin areas by 2004 so as to enable the compilation of environmental costs for all areas by 2009 (initial management plan, definition of combinations of measures). By 2004 we should therefore have completed an initial summarising qualitative survey of the negative environmental impacts of water services in concert with the status review under Annex II (e.g. by recording the pollution loads of waste-water dischargers), which provides a basis for a more precise study of environmental costs in the future.

A large part of the environmental and resources costs in Germany has, in varying degrees, already been internalised thanks to requirements laid down under water legislation in rulings on preventative and compensatory measures and on water charges. The rulings govern:

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25 Commission Communication: "Pricing policies for enhancing the sustainability of water resources" p.10

26 Commission Communication: "Pricing policies for enhancing the sustainability of water resources" p.10

- waste-water charges;
- water abstraction payments;
- further payments where necessary (e.g. compensation for nature conservation).

Although waste-water charges and water abstraction payments – where regulated – also form part of the financial costs of water services and have therefore been considered within the pilot projects. Since it is possible to represent already internalised costs along with them, they must be determined additionally for all areas and listed separately. Here, it is desirable to produce a presentation of the payments for the different water uses (e.g. industry, agriculture etc.) including an account of water production/introduction by undertakings. The data are not available from the Statistical Office of the *Länder* but must be specially collected and presented in each *Land* for the respective sub-district survey areas.

Other payments – where they occur – should also be presented. Here, too, details are not available from the Statistical Offices of the *Länder*, so each *Land* must present them on the basis of any relevant data that may exist. These findings are being made/compiled at *Länder* level and adopted in the sub-basin survey areas.

5.3.4 Contribution of water uses to covering the costs of water services

The WFD requires an overview of the contribution to recovering the costs of water services by the various water uses, with a minimum breakdown by private households, agriculture and industry. For water supply/waste-water disposal, this contribution is for the most part to be described in qualitative terms (and complemented in individual cases by quantitative statements). Consideration must be given, for instance, to those financial costs associated with water supply that arise from other water uses (discharges from point sources by industry, diffuse immissions from agriculture) to establish whether and how these costs are covered (in the case of point sources: waste-water charges). This means presenting payment flows by relating them to water abstraction payments and waste-water charges.

These statements will be made/compiled at *Länder* level and adopted by the sub-basin survey areas.

5.4 Information on cost-effectiveness of measures / combinations of measures

It will not be possible for the initial economic analysis (2004) to contain enough information for a complete assessment of the cost efficiency of combinations of measures designed to achieve the objectives of the Water Framework Directive. To help develop the underlying data resources, a national handbook on cost-efficient water resources protection is currently being prepared (entitled “Kosteneffizienter Gewässerschutz”, due for completion in autumn 2003). The handbook is intended to help make the strategic considerations required to select measures for a more careful examination leading up to the creation of a programme of measures. Decisions on the most cost-effective measures for the river basins can only be arrived at later. No separate presentation needs to be undertaken for the river basin district.

5.5 Further future activities

It is expected that some of the work envisaged for 2004 cannot be completed on time due to insufficient data. In such cases the WATECO guidance document

explicitly calls for the outstanding work to be listed in a separate chapter along with the plans for its completion. The remaining work and future activities will be specified in the course of the operations to undertake the economic analysis in the river basin district. In this presentation, attention should be given above all to the following areas of work:

- reviewing the data collected by 2004 and the existing data to find out whether further data must be collected for a more precise economic analysis after 2004.
- stating which data are still required and preparing for the post-2004 survey
- drawing up national standards for the key factors and the underlying methodology in order to develop and improve the "baseline scenario"
- developing a practical methodology for determining environmental and resource costs and the resulting level of cost recovery;
- specifying the contribution of individual waster users towards covering the costs of water services so as to establish an sound basis from which to integrate the principle of covering costs by 2009
- examining the data collected so far to see whether it provides a sufficient basis for selecting the most cost-effective measures when designing the programme of measures.

The necessary presentation is being prepared at the LAWA level. Having completed and evaluated the initial economic analyses, LAWA will develop proposals for the implementation of the measures recognised as necessary.

Points to note

1.5 Report to the Commission by 06/2004

1) Reference to Directive

Art. 3, para. 7 and 8

2) Technical background

The lists of the authorities responsible for each river basin district is, under Art. 3 para. 8 of the WFD, to be submitted to the European Commission with the information listed in Annex I (by 22.06.2004). According to Art. 3 para. 7, the competent authorities should be identified by the end of 2003.

3) National provisions

The authorities responsible for the respective river basin districts are the highest *Land* water authorities, i.e. the competent *Land* ministries. They coordinate the work of the subordinate authorities at *Land* level and provide technical and legal supervision. The WFD information required under Annex I section i (name and address of competent authority), section iii (legal status of competent authority) and section iv (legal and administrative responsibilities and role in the river basin district)

apply to them. For the enforcement authorities below the ministerial level information must be provided under Annex I section v of the WFD as to the number of number of offices and their position within the lines of authority regarding technical supervision.

4) Source material

5) Necessary activities

Identification and registration of the authorities with the European Commission in accordance with the maps and tables appended as an annex.

Points to note

1.6 Report to the Commission by 03/2005

[draft by 12/2002]

1) Reference to the Directive

Art. 5 para. 1; Art. 6 para. 1; Art. 15

2) Technical background

For each river basin district it is necessary to carry out an analysis of its characteristics, an examination of the impacts of human activities on the status of surface waters and groundwater and an economic analysis of water uses (Art. 5 para. 1). A register of protected areas must also be prepared (Art. 6 para. 1).

3) National provisions

4) Source material

5) Necessary activities

Maps (partly in GIS format), tables and texts are to be compiled for the report.

Points to note

At present we cannot yet say conclusively what the scope of the report and the necessary work will be. The outcomes of the EU working group EAF on "Reporting" and the CIS working group "GIS" are still awaited or have yet to be implemented.

1.7 Public information and consultation

1) Reference to Directive

Article 14 para.1 sentence 1 WFD (*Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans…*)

2) Technical background

Article 14 WFD regulates public information and consultation in the implementation of the Directive. The details in paragraph 1 only cover the 3-step consultation on the management plan, which must be introduced by the end of 2006 at the latest, in order for a management plan to be submitted within the end of 2009 deadline. Public information and consultation is not public participation in the sense of the Administrative Procedures law, but applies to the entire section of the national and international public affected by a management plan.

Article 14 para. 1 sentence 1 WFD makes it clear that this 3-step consultation is only one case of the active involvement of the public in the implementation of the WFD ("especially…."). The active involvement, which is also called for and to be promoted, must begin sooner, i.e. already in the context of the review and the decisions to be taken leading up to the management plan (e.g. on heavily modified waters, objectives for water bodies, recourse to exemptions, definition of measures to achieve the objectives). The early involvement of the public in the implementation of the WFD should be understood as an instrument for improving the decision-making process and serves the following goals:

- transparency of the implementation process;
- acceptance of the measures to be taken, especially among the associations and groups affected, confidence building;
- conflict potential, e.g. when deciding on necessary measures to improve water status, can be recognised in time and balanced solutions can be found. Conflicts that occur late, e.g. at the stage of hearings on the draft management plan, can no longer be resolved in most cases. Time delays are avoided;
- the benefits of expertise from the public can be used (e.g. insights into the biology of waters):
- interest groups and associations become competent discussion partners thanks to early involvement;
- raising awareness of water protection issues among the public.

By the term “the public” we understand natural or legal persons and their associations, organisations or groups, i.e. both the unorganised and the organised public. This definition corresponds to the provisions under European law, e.g. the definition of the public found in Directive 2001/42/EC of the European Parliament and the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment) or the Aarhus Convention.

The measures under consideration must differentiate between the organised public (environmental associations, agriculture associations, water suppliers, fisheries associations etc.) and the general, non-organised public. Furthermore, consideration should be made as to the level on which the public should participate (local, regional, central, *Land* level), and to the suitable point in time. A distinction must also be made between purely informative measures and involvement measures. With regards to the level on which the public should be involved, consideration must also be given to the measures which could insofar be taken by the offices responsible for the overall coordination within the respective river basin district, or by the international river basin commissions. The members of the river basin district decide on this.

3) National provisions

§36b para.5 Federal Water Act

4) Source material

EU guidelines paper of 11 December 2002 entitled “Guidance on public participation in relation to the Water Framework Directive.

The paper gives a detailed interpretation of Article 14 of the WFD. It presents as a series of necessary and possible steps the activities for ensuring early active involvement of the public and for implementing the three-stage consultations on the management plan. There are also two annexes listing the methods of public participation and examples from various European counties with reference to the management of waters.

The guidance paper (without annexes) is available in German translation from March 2003. This translation and the full English version appear in WasserBLIcK (*www.wasserblick.net)*. Chapter 2 and 3 of the guidance paper is particularly relevant to the issues of early active public participation.

5) Necessary work

Non-organised, general public:

In the first four years following entry into force of the WFD, the main focus is on information (cf. Chapter 5 of the guidance paper referred in 4) to above). It is important to arouse interest in water resource protection and the steps towards implementation. This will enable the public to be informed about the sense and purpose of the WFD, the work to be done and the later consultation in the course of producing the management plan.

Brochures or regularly printed or online information sheets are particularly suitable in this respect. They have been produced in most countries, in some cases as regularly published papers reporting on the current progress of implementation. The European Commission has also produced information material in every language (accessible in the public forum of *www.wasserblick.net)*.

Furthermore, in most countries information on WFD implementation is available on the homepages of the competent authorities, along with links to other internet pages. For Germany, a list of *Länder*, LAWA and Federal Government internet addresses concerned with implementation of the Water Framework Directive can be found here in Part 4 "Thematic Working Papers".

It is important that the materials are easily accessible, therefore brochures etc must be widely distributed and also be available on a local and regional level. Appropriate reference should be made to the information in the internet, e.g. with poster campaigns.

Exhibitions, films, TV spots, press articles and similar actions are also a conceivable means of informing the public about the WFD.

Contact persons should be appointed to receive reactions from the public to this information. These contacts are already listed in some of the brochures referred to above, giving both postal and email addresses and telephone numbers.

This material is being prepared and distributed by the competent highest authority or specialist authority of the Länder. In the case of pilot projects already underway or at a later stage of the WFD implementation brochures etc. on a regional level may also be appropriate.

Organised public:

The above-mentioned information options can certainly be used for this section of the public, too. The associations and other organisations concerned are, however, often already sufficiently informed about the significance and substance of the WFD and demand their involvement in implementation from the start. Relevant information events accessible to all organisations and designed to serve users at *Land* or regional level are conceivable here as a first step, and have already been or are being organised by a number of *Länder*.

A number of *Länder* are already responding to the need for early participation of the organised public. Central panels at the level of environment the ministries (e.g. advisory committees with representatives from all relevant groups) or decentralised (water body related) or topic related (agriculture, industry) panels are also suitable. In some *Länder* advisory committees or steering groups have already been set up at *Land* level. In addition, some *Länder* have already formed permanent committees at regional level to give the organised public an opportunity to play an active role in WFD implementation in areas where they are affected, namely in particular waters or in the so-called sub-basin areas (*Bearbeitungsgebiete*) of in the *Länder* in which the various steps are being carried out.

What is important here is that the organisations involved are offered active and open dialogue and receive, either within the bodies outlined above or in other ways, regular feedback so that they can see whether and how their contributions or reservations are feeding into the decision-making processes of the competent authorities.

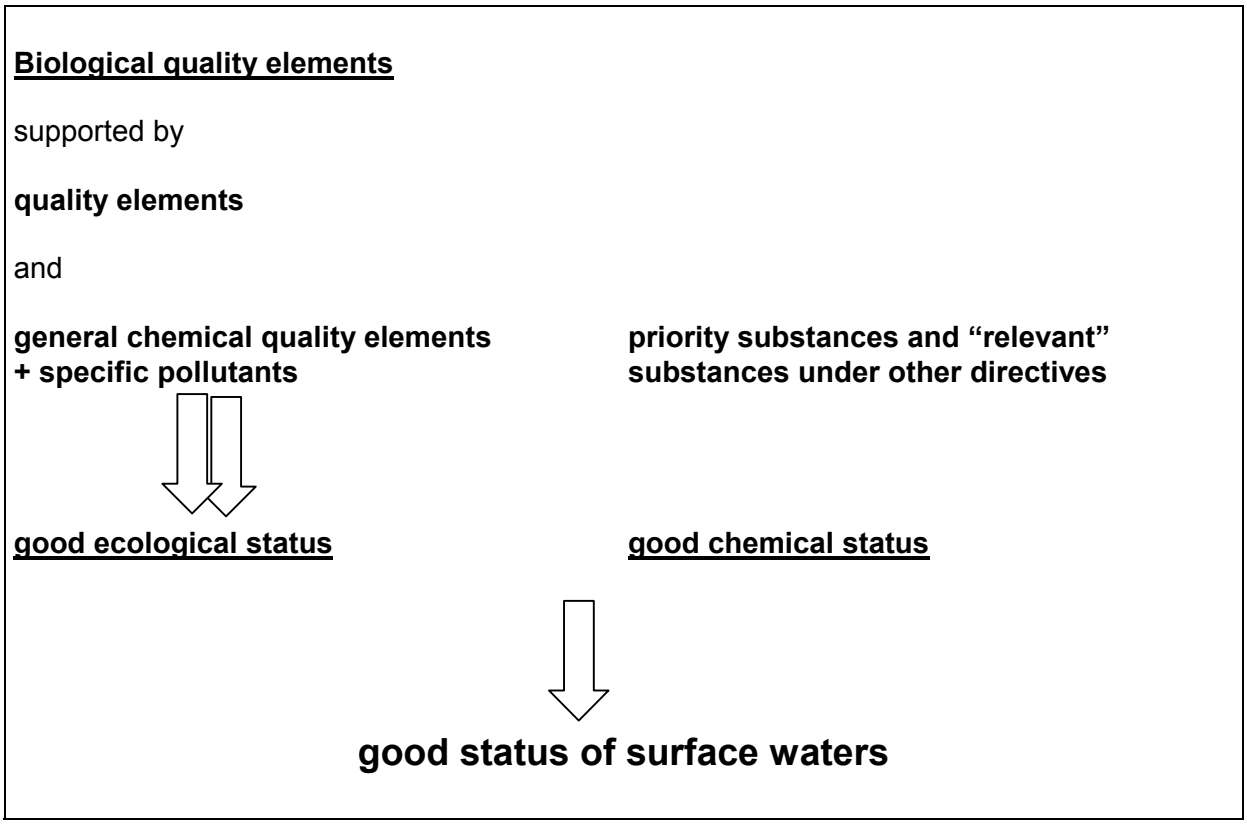
A variety of approaches is possible, with the choice depending on the administrative structure of each *Land* and on the available resources. The *Länder* should analyse in each case which interest groups are to be involved at which level and at which stage of the implementation process.In the first four years the main task is to review the situation and no decisions are made concerning classification of the status of water bodies or the measures for achieving the objectives. However, some important foundations are laid for the further activities (e.g. the identification of the surface water bodies and their differentiation according to type, the definition of type-specific reference conditions, the identification of surface water bodies at risk, and the identification of groundwater bodies at risk) that should not take place without public participation. If significant levels of pollution are found in the water bodies that is highly likely to lead to measures as part of an action programme, then we should ensure that those expected to be effected by later measures (farmers, those responsible for maintenance, those with fishing rights) are involved during the inventory (review) phase.

2 Necessary activities to be prepared by 12/2006 and thereafter implemented

Sections 2, 3, and 4 below need to be revised in view of new information and understanding emerging from the CIS process and the experience of implementing the WFD.

2.1 Monitoring and presentation of the status of bodies of surface water

The underlying objective of the Water Framework Directive (WFD) is to achieve good quality status of water bodies which, according to the definitions given in Article 2, Nos. 22 and 24 of the WFD is defined as the condition achieved by a surface water body when both its ecological status and its chemical status are "good". Chemical aspects are included in both status characterisations following the approach illustrated in the following diagram.



Elements of good status for running water bodies

The quality elements named in the diagram are to be monitored. Detailed requirements are being defined in the respective *Länder* ordinances in order to implement Annexes II and V of the WFD.

The monitoring requirements presented below do not in principle have to be ready for application until 2006. However, since the screening studies are already being conducted in the inventory phase, the technical requirements should also be applied as far as possible to these studies. The biological methods are to be intercalibrated by 2006 throughout Europe.

The entire field of monitoring and assessment demands many more studies and specifications for the whole area of methodologies, assessment procedures, standardisation and intercalibration. An overview of ongoing studies is given by the list of R&D projects and EU working groups on "strategy papers to implement the WFD" in the annex.

2.1.1 Quality elements for the ecological status

1) Reference to the Directive

Annex V, 1.1

2) Technical background

The ecological status shall be determined for all bodies of surface water (cf. No. 1.1.2).

The list of quality elements contains biological (priority), hydromorphological (supporting) and physico-chemical quality elements (supporting) in accordance with the table below. The ecological status is primarily determined by the following groups of biological quality elements: aquatic flora, invertebrate fauna and fish fauna. We must always establish the species composition and species abundance, as well as the age structure for fish fauna (except in the case of transitional waters) and the biomass for phytoplankton (except in rivers).

Quality elements	**Sub-elements**	**Rivers**	**Lakes**	**Transition-al waters**	**Coastal waters**
Water flora	Phytoplankton	X*	X	X	X
	Macroalgae or angiosperms			X**	X**
	Macrophytes, phytobenthos	X*	X	X**	X**
Benthic invertebrate fauna	Macrozoobenthos	X	X	X	X
Fish fauna		X	X	X	

* In plankton-dominated waters phytoplankton is to be identified, in non-plankton-dominated waters macrophytes or phytobenthos is to be identified.

** In addition to phytoplankton, those sub-components are to be identified that are suitable in each case.

Hydromorphological quality elements

Quality elements	Sub-elements	Rivers	Lakes	Transitional-waters	Coastal waters
Hydrological regime	Flow quantity and dynamics	X			
	Connection to groundwater bodies	X	X		
	Water level dynamics		X		
	Water residence time		X		
Continuity		X			
Morphology	Depth and width variations	X			
	Depth variation		X	X	X
	Structure and substrate of bed	X			X
	Quantity, structure and substrate of bed		X	X	
	Structure of riparian zone	X	X		
	Structure of tidal zone			X	X
Tidal regime	Fresh water flow			X	
	Wave pressure			X	X
	Direction of predominant current				X

Chemical and physico-chemical quality elements (italics: interpretation of WFD)

Quality elements	Parameters	Rivers	Lakes	Transitional waters	Coastal waters
General	Transparency (m)		X	X	X
	Temperature (°C)	X	X	X	X
	Oxygen (mg/l)	X	X	X	X
	Chloride (mg/l) Conductibility (µS/cm)	X	X	X X	X X
	pH-value	X	X		
	Total-P (mg/)l o-Phosphate-P (mg/l)	X X	X X	X X	X X
	Total -N (mg/l) Nitrate-N (mg/l)	X X	X X	X X	X X
Specific pollutants	synthetic pollutants* (for import in significant quantities)	X X	X X	X X	X X
	non-synthetic pollutants* (for import in significant quantities)	X	X	X	X

* The substance are listed in Annex 4 No. 2 of the model ordnance implementing Annexes II and V of the WFD. The model ordinance, including the explanatory memorandum, can be accessed online at www.wasserblick.net (keyword: Öffentliches Forum, Materialien der LAWA).

The normative definitions for the **biological quality elements** contain descriptions for a five-class system based on the gradations of high, good (objective) and moderate, with waters below that status being classified as poor or bad.

The following characterisations apply to the three high classification levels for the four types of water body: no or only very minor changes from the natural condition (high), minor deviation from the natural condition (good), moderate deviation from the natural condition (moderate).

Deviating from this patterns, artificial or heavily modified water bodies shall be classified according to their maximum ecological potential, good ecological potential and moderate ecological potential. The maximum ecological potential defines the reference condition. This does not correspond to the natural condition, but to what is possible in practice.

The **hydromorphology** is only described by its quality elements within the class of ”high status”. The other classes are characterised by the biological elements, i.e. good hydromorphological status is established where the biology demonstrates at least good quality. The hydromorphology serves only the selection of anthropogenically undisturbed reference water bodies and is therefore merely a supporting factor in the identification of ecological status.

Physico-chemical quality elements serve not only to establish the reference conditions but to assess ecological water status. In the case of synthetic and non-synthetic pollutants defined under Annex VIII of the occurring in river catchment areas (other than the priority list substances taken for the identification of chemical water quality), environmental quality standards must be formulated for the ecological asset aquatic biotic communities on the basis of longer term ecotoxicological impact data. *The environmental quality standards, which also secure the protection status of drinking-water abstraction, are defined in the ordinance on the implementation of Annexes II and V and shall be applied as minimum requirements across all river basin districts. This does not affect the option of setting more stringent requirements in a river basin district. No environmental quality standards are to be set for the general physico-chemical parameters*

3) National provisions

LAWA procedure for assessing the ecological status of bodies of surface water.

4) Source material

Reference conditions for the various categories of water body and the related water types and assessment systems corresponding to the normative definitions.

5) Necessary activities [NB: this work is only required after six years]

Performing studies in accordance with the procedure referred to point 3.

Collecting the data.

Applying the assessment systems.

Points to note

Starting from the potential natural condition as the reference, the first task must be to develop biological survey methods aimed at elaborating the normative descriptions and defining class boundaries, which requires a considerable amount of research work in certain areas. Here, we must find out which quality elements are appropriate

or inappropriate to the description of categories of water body and, among these categories, of the types of water body to be designated. The descriptors must be capable of reflecting all the anthropogenic factors influencing water bodies.

After developing the procedures and successful intercalibration, a thematic map for "ecological water quality" shall be prepared.

2.1.2 Quality elements for the chemical status

1) Reference to the Directive

Annex V, 1.4.3

2) Technical background

In emphasising the protection of waters from pollutants, the Water Framework Directive introduces the achievement of at least "good chemical status" as a concrete environmental objective. The chemical status must be established for all bodies of surface water.

The requirements are set in Annex V of the WFD in point 1.4.3, which states that good chemical status is achieved through compliance with the following environmental quality standards:

- Annex IX (18 substances, governed EU-wide by the Daughter Directive to Dangerous Substances Directive 76/464/EEC),
- the 33 priority substances under Art. 16 and Annex X of the WFD, and
- all other relevant Community regulations in which environmental quality standards are set.

These provisions demand compliance with diverse environmental quality standards. In particular, the conditions set under earlier water protection directives also have to be observed. An overview gives us the following environmental quality standards:

- for 18 substances from List I of Directive 76/464/EEC (Daughter Directives)
- pursuant to Nitrate Directive 91/676/EEC: 50 mg NO_3/l
- the requirements of Fresh Waters Directive 78/659/EEC will be replaced from 2007 by the biological monitoring of fish fauna
- the provisions of Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States will be replaced from 2007 by environmental quality standards for the ecological status which also cover the standards for drinking-water abstraction.

The environmental quality standards for the classification of chemical status are listed in Annex 5 of the model ordinance implementing Annexes II and V. The model ordinance, including the explanatory memorandum, can be accessed online at www.wasserblick.net (keyword: Öffentliches Forum, Materialien der LAWA).

The **priority substances** under the Water Framework Directive replace the list of candidate substances (132 substances and substance groups of Directive

76/464/EEC) contained in the Commission Communication of 22 July 1982. The Daughter Directive of Directive 76/464/EEC are not affected by this as long as they are not rescinded or amended. The environmental quality standards for the substances requiring EU-wide regulation cover all the protection aspects relevant to water management, i.e. not only the protection of aquatic biotic communities but also the protection of human health. With regard to the priority substances, proposals on environmental quality standards are to be put forward by the Commission by October/November 2003 and, having been adopted by the Council/Parliament, implemented by the Member States. These standards form the main basis for the determination of chemical status (all ecological assets in accordance with the quality objectives of Directive 76/464).

Among the priority substances, the so-called priority hazardous substances have special position: these substances or substance groups are particularly critical in terms of marine protection and other aspects. Their emissions, discharges and losses are to be gradually eliminated no later than 20 years after the adoption of EU-wide provisions for these substance in order to achieve the ultimate aim as defined in Art. 1 of the WFD, namely to ensure that their concentrations in the marine environment fall to values that remain at background levels for naturally occurring substances and fall close to zero for man-made synthetic substances.

A third group among the priority substances is still subject to possible revision; the classification as “priority” or “priority hazardous” will only be made after further information is available, but no later than one year after the priority list has been adopted (October/November 2002).

Compliance with the environmental quality standards will be checked by calculating annual mean values from all individual measurements per monitoring point (76/464/EEC). The test value for the environmental quality standards for priority substances will be set internationally (decision pending).

3) National provisions

For the priority substances requiring EC-wide regulation, proposals on environmental quality standards are to be put forward by the Commission by October/November 2003 and, having been adopted by the Council/Parliament, then implemented by the Member States. These standards form the most important basis for establishing the chemical status.

A thematic map for “chemical status” is to be produced, presenting the pollution situation of water bodies and evaluating it in terms of the quality standards (defined pursuant to Annex IX, Art. 16 and all other pertinent regulations set by the Community).

4) Source material

Determinations of the EU committee on “Priority Substances” (drawing up Daughter Directives to the WFD to elaborate environmental quality standards and emission limits for the priority substances); results from the EU working group on “strategy papers on WFD implementation” on the subject of monitoring.

5) Necessary activities

Application of the assessment system

Points to note

For the priority substances, a thematic "chemical status" map must be drawn up once the environmental quality standards have been defined.

2.1.3 Monitoring requirements, monitoring frequency

1) Reference to the Directive

Annex V, 1.3

2) Technical background

We distinguish between three types of monitoring activities to be carried out as part of management plans:

Surveillance monitoring:

The surveillance monitoring programme is intended for

- assessing the long term changes in the natural conditions and long term changes resulting from significant human activity,
- supplementing and validating the impact assessment procedure detailed in Annex II of the WFD for anthropogenic influences on surface waters, and
- the efficient and effective design of future monitoring programmes.

Representative monitoring sites are to be selected for surveillance monitoring. The sites likely to be most promising for such monitoring are places

- where the rate of flow is significant within the river basin district as a whole, including points on large rivers where the catchment areas is larger that 2,500 km^2 (areas with up to 2,500 km^2 per monitoring site),
- which are used for EC scheme for information exchange on surface freshwater data (LAWA monitoring site network),
- monitoring network of the BLMP (joint Federation-*Länder* Monitoring Programme) for surface and coastal waters
- where significant water bodies cross Member State borders, and
- with a large water resource like lakes or reservoirs (suggestion: with a surface area of more than 10 km^2)**.**

Over the period of the management plan surveillance monitoring must be undertaken for each monitoring site at least once a year in accordance with the WFD for the following parameters:

- all biological, hydromorphological and general physico-chemical parameter,
- the priority list substance where they are being discharged, and
- all other pollutants being discharged in significant quantities. The criterion for including these substances is whether they are likely to exceed environmental quality standards.

Operational monitoring:

Operational monitoring shall be undertaken as an additional measure for those bodies of surface water identified as being at risk of failing to meet their environmental objectives under Article 4 and must be performed on an ongoing basis throughout the period of a management plan in order to

- establish the status of endangered bodies of surface water and
- assess any changes in the status of these bodies of surface water resulting from the programme of measures.

The operational monitoring is to be carried out in bodies of surface water if

- the impact assessment under Annex 2 or the surveillance monitoring programme has shown that, at least, good water status does not occur,
- priority list substances are being introduced. Monitoring sites are to be selected here in accordance with the statutory provisions laid down for the relevant environmental quality standards.

The other monitoring sites are, depending on the source of pollution, to be established in river basins in such a way that they can measure the significant pressures responsible for non-compliance with the targets.

Operational monitoring should only be used to monitor:

- those parameters referred to in 1.1.3. that have proved to be most sensitive in the assessment of individual quality elements (selected biological and hydromorphological characteristics)
- all priority list substances, and
- other pollutants of relevance to the river basin that are discharged in significant quantities. [The criterion for the latter is a potential exceedance of environmental quality standards.]

Investigative monitoring:

Investigative monitoring shall be performed in individual cases where

- the reasons for any exceedance of environmental quality standards are unknown,
- the surveillance monitoring programme reveals that the objectives set for bodies of surface water are not likely to be achieved and operational monitoring has not yet been established (e.g. where pollution pressures on coastal waters due to nutrient loads from river basins are recorded, although the focus of these pressures still has to be determined). The aim is to determine the causes of the failure to achieve the objectives, or
- the magnitude and impact of accidental pollution should be ascertained.

Investigative monitoring should not be equated with alarm monitoring, which is designed to detect accidents and sudden damage incidents.

The approach to establishing the required monitoring network and the frequency of monitoring must be directed at the problems posed on a case-by-case basis.

Supplementary monitoring requirements for protected areas:

Additional special provisions apply to drinking-water abstraction points (> 100 m^3 per day abstraction) and water bodies which form habitat and species conservation areas. The former are subject to a requirement for operational monitoring (only

chemicals, where relevant), while the latter must at least undergo surveillance monitoring, and if necessary, i.e. where good status is at risk under the terms of Annex II, operational monitoring.

3) National provisions

[Working Paper 3]

4) Source material

For the presentation of the ”surface water monitoring network”, the following layers are available in accordance with Annex 3.2 no. 6:

- surveillance monitoring
- operational monitoring
- sites for investigative monitoring
- drinking water abstraction
- habitat monitoring sites
- reference monitoring sites

Results of the CIS process

5) Necessary activities

The minimum frequencies for surveillance and operational monitoring are set in Annex V, chap. 1.3.4.

Additional requirements in respect of monitoring frequencies shall apply to protected areas, especially for drinking water abstraction points.

Where there is good water quality and (still) no risk posed by anthropogenic pressures as defined in Annex II of the WFD, the surveillance monitoring programme only needs to be carried out in every third management plan.

Compared to previous monitoring practice, a far greater effort is required to establish ecological quality with regard to the fish fauna, the macrophytes and the phytoplankton.

The ”surface water monitoring networks” shall be represented by means of the above-mentioned layers.

Points to note

Criteria are to be developed for the selection of operational monitoring and investigative monitoring

2.1.4 Classification and presentation of monitoring results (ecological and chemical status)

1) Reference to the Directive

Annex V, 1.4.2

2) Technical background

The ranking of the **ecological status** of bodies of surface water is made on the basis of assessments of quality elements classified as relevant, starting from the worst-case approach and giving special weight to the biological elements.

“High status” is achieved when the biological quality elements correspond to the reference conditions.

“Good status” occurs where the biological elements are classified as good and there is no exceedance of the environmental quality standards set by Member States for specific pollutants. Failures to meet the environmental quality standards lead to the downgrading of waters to the status of “moderate” even where good biological conditions occur.

“Moderate”, “poor” and “bad” status are defined purely in terms of the biological quality elements.

The map presentation of the ecological status of surface water bodies takes the form of colour-coding for the five status classes shown in bands. Artificial or heavily modified discrete and significant elements of a water (cf. 2.1.5 below) are classified into four classes with reference to the ecological potential and colour-coded analogously (the best class of “good and better” is presented – dispensing with the blue marking – in green for “high ecological status”; to distinguish them from natural waters, the respective blocks of colour are marked with dark-grey stripes (for heavily modified bodies of surface water) or light-grey stripes (for artificial bodies of surface water).

If good ecological status / good ecological potential is not achieved due to an exceedance of environmental quality standards for specific pollutants, the respective water bodies shall also be marked with black dots.

Chemical status is determined on a yes/no principle as follows: If all the environmental quality standards for priority substances under the Daughter Directives of Directive 76/464/EEC and the Nitrate Directive are achieved (cf. chap. 2.1.2), the chemical status is classified as “good” and the body of surface water is marked in blue on the required map. But even if one quality target is not reached, the chemical status must be classified as “not good” and coded accordingly in red. The same approach shall also be applied to the chemical status of artificial and heavily modified bodies of surface water.

3) National provisions

None

4) Source material

For the presentation of the ecological water quality, the following layers are available in Germany:

- artificial water bodies
- heavily modified water bodies
- ecological quality of surface waters (biology and chemistry, general)

in accordance with Annex 3.2, No. 7

For the presentation of the chemical water quality, the following layers are available:

- chemistry of surface waters (Annex V, section 1.4.3) (specific pollutants)

in accordance with Annex 3.2, No. 8

5) Necessary activities

Having developed the procedure and established intercalibration, we must compile a thematic map for ecological water quality. For the priority list substance that apply EC-wide, a thematic map of the chemical water quality must be prepared once the environmental quality standards have been established.

Points to note

LAWA is developing criteria for the establishment of networks for surveillance and operational monitoring as well as the monitoring network maps. It is necessary to check against the model ordinance on the implementation of Annex II and V.

2.1.5 Designation of artificial or heavily modified bodies of surface water

1) Reference to the Directive

Article 2(8)+(10), Article 4 (1 a iii)+(3) and Annex V nos. 1, 2, 3, Article 5 (1) and Annex II.

2) Technical background

Article 4 (3) prescribes that the designation of an artificial or heavily modified water body is presented and justified in the management plan required under Article 13. While the final designation of these heavily modified water bodies must be carried out by 2008/9 and reviewed every 6 years, bodies of surface waters in the categories rivers, lakes, transitional waters and coastal waters (see No. 112) must already be provisionally identified as artificial surface water bodies or heavily modified surface water bodies pursuant to Annex II of the WFD, by 2004. The provisional identification as “heavily modified” is undertaken where necessary for those bodies of water which are not expected to achieve good ecological status due to hydromorphological interventions and are, in their physical character, heavily modified. Subsequently, a study must be made by 2008/9 of the necessary improvement measures to achieve good ecological status and their impacts on uses, and other environmental options are to be examined (Article 4, (3), a, b). The findings of this study will determine the final designation or non-designation of a water body.

Under Article 2 (8) of the WFD an "artificial water body" means a body of surface water created by human activity. We have here a surface water body that was created at a site where no water body previously existed. An artificial water body has, moreover, been created neither by the direct physical alteration of an existing water body nor by its repositioning or levelling. Where an existing water body has been

altered or relocated (i.e. to a site that had previously been dry land), it should be classified, if appropriate, as heavily modified and not as artificial. The same applies to water bodies that have been assigned to another category as a result of physical alterations. Such water bodies (e.g. impounded lakes crated from a river by damming) are to be classified as heavily modified water bodies and not as artificial water bodies. The category of artificial bodies of surface water includes, for instance:

- canals built for the purposes of navigation, for hydropower uses and for irrigation and drainage, which meet the above conditions,
- lakes formed in pits, quarries and open-cast mines, ponds,
- impounded reservoirs and artificial storage basins fed by transferred water,
- docks.

These surface waters can be designated as artificial water bodies, but they do not have to be so designated. Under certain conditions they may also be classified as natural water bodies (e.g. old lakes formed in mining landscapes. Artificial bodies of surface water are, however, certainly not natural waters that have been modified by hydroengineering measures, e.g. to become canals or reservoirs. These are usually to be regarded as heavily modified water bodies. Thus, artificial water bodies cannot, by definition, be designated as heavily modified water bodies (see also Working Paper No. 4 in Part 4).

All other bodies of surface water are first to be treated as natural waters, and their reference condition should be set in accordance with high ecological status.
If it can be demonstrated that an ecological status of at least “good” can be achieved as part of the management plan within 15 years of the WFD entering into force, a designation of the water/body of surface water as heavily modified is not possible.

However, bodies of surface water which are being considered for classification as heavily modified must be provisionally classified as such by 2004. A heavily modified body of water is, under Article 2 No. 9 of the WFD, "a body of surface water which as a result of physical alterations by human activity is substantially changed in character".

Should the environmental objective of “good ecological status” under Art. 4 not be achievable in an designated body of surface water, we must then examine whether the reason for the failure to meet targets does in fact lie in anthropogenic physical changes. If this is the case, and if the conditions defined in Art. 4 (3) a and b (negative effects, technically unfeasible, disproportionate costs, ...) are not fulfilled, the water or body of surface water may be designated as heavily modified.

The designation of heavily modified bodies of surface water therefore occurs as the final step of an examination. Thus, an initial and provisional classification of bodies of surface water as “heavily modified” should be made in the course of the inventory by 2004, and the formal designation by 2008/9. The designation shall be subject to regular reviews every six years.

Unlike the case of natural water bodies, the reference condition for artificial or heavily modified bodies of surface water is the “maximum ecological potential” (review every six years).The maximum ecological potential is derived from the water body type which is most similar to the body of surface water. In view, e.g. of the continuity of the water body, this is the best possible status that could be achieved after taking every appropriate measure that would be attainable (cf. Annex V, WFD). As an

objective, the good ecological potential deviates only slightly from the maximum ecological potential in terms of biology.

As for the assessment of chemical status, the same requirements apply to artificial and heavily modified bodies of surface water as to natural water bodies.

3) National provisions

The CIS Working Group 2.2 HEAVMOD has produced guidance for the identification and designation of heavily modified and artificial waters that was adopted by EU Water directors in November 200 in Copenhagen. Artificial and heavily modified surface water bodies are to be designated in accordance with these guidelines. Practical examples of preliminary classification and of designation can be found in a synthesis of 34 European case studies and a collection of examples (toolbox).

4) Source material

cf. 3)

5) Necessary activities

The work of characterising waters under Annex II involves a preliminary classification of heavily modified bodies of surface water , while the final designation shall only be made after various checks have been carried out as part of the production of the first management plan (cf. chap. 1.1.5.6 –presentation of results-).

The artificial or heavily modified bodies of surface water are to be established in accordance with the criteria via a series of steps, bearing in mind that a distinction must be made between preliminary classification and the actual designation (Working Paper 7):

1st step: Survey to identify water bodies

2nd step: Designating bodies of surface water created by human activity as artificial waters (continues at step 8)

3rd step: “Screening” – exclusion of water bodies without hyromorphological alterations from the further process of designation (for the objective of good ecological status)

4th step: Establishing water bodies with significant hydromorphological alterations (according to structure classes 6 and 7) and description of these significant alterations

5th step: Identifying surface water bodies that might fall short of good ecological status due to significant hydromorphological alterations (check whether the type-specific “biology” is correct)

6th step: Preliminary classification as “heavily modified” if water bodies have been significantly altered in character in the form of physical changes resulting from human interventions 7th step: Determining improvement measures that would be needed to achieve good ecological status. Examining whether these measures have significant impacts on the environment in the broad sense or on the “uses listed” (if no negative impacts , the objective will be good ecological status)

8th step: Examining whether the uses cannot be realised by other, much better environmental options if these are technically feasible and not unreasonably expensive (if yes, then the objective will be good ecological status; for artificial waters, optimised ecological potential)

9th step: Designating heavily modified or artificial bodies of surface water in the management plan by 2008/9 (review every six years)

10th step: Defining the maximum ecological potential, by including all measures to limit ecological damage in the calculation which ensure the best approximation to ecological continuity (migration of fauna, appropriate spawning and growth habitats)

11th step: Defining good ecological potential where only a minor deviation of the biological parameters from the maximum ecological potential is calculated

Points to note

2.1.6 Comparability of biological monitoring results

1) Reference to Directive

Annex V, 1.4.1

2) Technical background

Comparability of biological evaluation systems is needed Europe-wide. The first step here is to convert the findings of each biological monitoring method into a so-called "ecological quality ratio" (EQR), which lies on a scale from 0 (biologically blighted) to 1 (reference status, upper range of the "high" class).

The boundary between good and satisfactory, which is decisive for triggering programmes of action, shall be internationally intercalibrated for specific types to set the class boundaries between high/good and good/moderate and ensure comparability of the results of biological monitoring methods.

This means, for example, that when a particular biological quality (e.g. fish fauna in the case of rivers) is applied, the type-specific class boundaries originally chosen may have to modified after intercalibration in line with the international scale. In this way, national classification systems that are relatively "soft" will be tightened and vice versa.

3) National provisions

Progress is being made on this by the EU working group on "intercalibration". Type-specific monitoring points are to be integrated in the intercalibration procedure by 2003 and into the biological monitoring procedure.

4) Source material

Results from the working group CIS-2-A ECOSTAT on “intercalibration” and findings from the ongoing R&D projects (for list cf. Working Paper 1 in the annex 1).

5) Necessary activities

Designation of intercalibration monitoring sites

Points to noteN.B. CIS-2-A ECOSTAT

2.2 Monitoring and presentation of the status of groundwater

The Water Framework Directive demands that monitoring programmes be drawn up to ascertain the quantitative status and chemical status of groundwater. The programmes serve to validate the results of the initial and further characterisation of groundwater bodies and to assess compliance with the objectives of the Directive.

The concept of the monitoring programmes builds on the delineation of groundwater bodies (cf. section 1.2.1.1) and the results of the initial and further characterisation of these groundwater bodies (cf. sections 1.2.1 and 1.2.2). It therefore takes account of the natural characteristics of the bodies and the understanding of the hydrogeological relationships as well as the influence of human activities.

In principle every groundwater body or every group of groundwater bodies should be included in the monitoring programme and monitored for quantitative and chemical status. The monitoring programme must also be designed to detect trends among the pollutants.

Where groups of groundwater bodies have been identified to form what should be a largely consistent entity in terms of their landscape structure and their use pressures, it is not necessary to monitor every single body within this group using dedicated monitoring sites. Rather, the monitoring results recorded from a certain body or from several bodies in the group can be transferred to the other bodies. Various groupings are conceivable when determining quantitative and chemical status. As a rule, however, a grouping of groundwater bodies only makes sense if it was judged to be “at risk” in the initial and further characterisation.

The extent of the monitoring must depend on the information required for assessing which objectives can be achieved. Monitoring efforts should be proportional to the difficulty of determining the status of a groundwater body, and proportional to the possible consequences of an erroneous assessment. Thus, the monitoring of groundwater bodies for which either a good or bad status can be ascribed with relative certainty may be less extensive that the monitoring of bodies found to be close to the dividing line between good and bad status. Moreover, it is useful to carry out more extensive monitoring where there is as possibility of substantial damage occurring to ecosystems or prior to the instigation of costly and difficult measures.

2.2.1 Elements and monitoring for the quantitative status

1) Reference to the Directive

Art. 7

Art. 8

Art.15

Annex V, section 2.1 and 2.2 (quantitative status)

2) Technical background

The groundwater monitoring programmes to determine quantitative status serve to validate the results of the initial and further characterisation with regard to the abstraction and recharge of groundwater and to assess compliance with the objective of "good quantitative status". This objective shall, in accordance with Annex II section 2.1.2, be considered to have been achieved if

a) no excessive use of the groundwater takes place (abstraction and run-off are less than replenishment and recharge),

b) no quantitative or qualitative impairment of surface waters linked to groundwater and of terrestrial ecosystems directly dependent on groundwater occurs and

c) no intrusion of salt water takes place.

The principal parameter for assessing quantitative status is the groundwater level. We may, by analogy, take spring discharges as our measure. A quantitative groundwater balance will only have to be drawn up if the evaluation of the groundwater level recordings shows that good quantitative status has not been achieved or the body is at risk of failing to achieve the objective. It should also be carried out if no series of monitoring results over a number of years is available or a significant increase in abstractions is expected in the future. In the case of groundwater bodies crossing national boundaries, additional data is needed on the geometry and permeability and permeability of the aquifer (cf. section 1.2.2) in order to determine the quantity of groundwater flowing across the boundary.

The monitoring network is to be designed to ensure that negative changes of quantitative status are detected early on. A distinction should be made here between changes brought about by precipitation trends and impairment resulting from anthropogenic factors such as cases of groundwater abstraction, recharge, land sealing etc.. The key body for monitoring is generally the upper main aquifer. Deeper aquifers shall only be included in the monitoring if groundwater is being drawn out of them.

The basis for monitoring quantitative status is the existing groundwater level monitoring networks in the *Länder*. These need to be optimised with regard to the assessment and the presentation of groundwater bodies. We generally have to make a selection here. The choice of the position of monitoring sites must ensure that the spatial variability and variability over time of the groundwater surface can be sufficiently well recorded within a groundwater body. It is also necessary to establish a density of measuring sites that permits the collection of the most reliable data

possible in ecologically sensitive areas, whereas the monitoring network may be less dense in areas where land use is not dependent on groundwater. The frequency of recording times should be arranged so that the annual pattern of groundwater levels can be surveyed with sufficient accuracy.

3) National provisions

Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Grundwasserrichtlinien für Beobachtung and Auswertung Teil 1/82 - Grundwasserstand; Essen 1984

Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Grundwasserrichtlinien für Beobachtung and Auswertung Teil 4 - Quellen; Bonn 1995

Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Empfehlungen zur Optimierung des Grundwasserdienstes (quantitativ); Schwerin 2000

4) Source material

Maps and other material kept by the monitoring network operators for the groundwater level monitoring sites.

For the presentation of the “quantitative status of groundwater”, the following layers are available in Germany:

- areas
- groundwater bodies

in accordance with Annex 3.2, No. 10

5) Necessary activities

Starting with the existing groundwater level monitoring sites in the *Länder*, our task is to develop a network for monitoring the quantitative status of the groundwater body. We must take account here of the results of the inventory already made as part of the “initial characterisation” to identify the location and boundaries of the bodies of groundwater and their hydrogeological features, the location of surface waters and terrestrial ecosystems linked to groundwater and the potential risks to groundwater.

The monitoring sites are to be selected in such a way that the quantitative status of each groundwater body or each group of groundwater bodies can be represented. Taking into account the heterogeneity of the groundwater body and the distribution of the monitoring sites, an judgement must be made as to how reliable the position and dynamics of the groundwater surface can be assessed with the existing monitoring network. Where necessary, the network is to be optimised. In areas with an insufficient information density further monitoring sites are to be set up.

An account of monitoring site characteristics are to be compiled for each monitoring site selected. This characterisation shall contain all the important information, such as the geohydraulic position in the system of flows, monitoring site consolidation and land use in the river basin area, annual cycle and long term development of groundwater levels etc.. From this information we can determine the suitability of the monitoring site for the monitoring network and the optimal frequency of recording times. Where strong fluctuations occur in groundwater levels and spring discharges, it will be necessary to set shorter monitoring frequencies, with weekly or possibly even continual monitoring.

The groundwater level monitoring data shall be collected for each groundwater body or each group of groundwater bodies and checked for validity. The data must be collated and kept for the assessment (required in accordance with chap. 2.2.4.

Points to note

none

2.2.2 Elements and monitoring of chemical status

1) Reference to the Directive

Art. 7

Art. 8

Art. 15

Annex V, section 2.3; 2.4 and 2.5

2) Technical background

The groundwater monitoring programme to ascertain chemical status is designed to validate the initial and further characterisation with regard to the geogenic and anthropogenic substances contained in the groundwater and to assess compliance with the objective of "good chemical status". This objective is considered to be achieved if

a) the groundwater body does not exhibit any signs of an anthropogenic influx of saltwater or other intrusions,

b) the detected pollutant concentrations do not exceed the quality standards that apply under other Community regulations on groundwater (at present only the Nitrate and Plant Protection Products Directive set quality standards for groundwater, but the further quality targets can be expected under the new Groundwater Directive pursuant to Article 17 of the WFD), and

c) the quality of the groundwater is such that there are no grounds for concern about negative impacts on the surface waters and terrestrial ecosystems linked to the respective groundwater body.

Furthermore, the chemical monitoring programme is designed to detect significant and sustained trends among pollutants in groundwater. The precise details of the method to calculate trends is to be established in the Groundwater Directive under Art. 17 of the WFD. In general, however, we can say that all those pollutants should be included in the trend survey that, on the basis of the initial and further characterisation, may be assumed to be able to enter the groundwater body to a more than negligible extent.

The monitoring programmes are intended to provide a comprehensive overview of the condition of the waters in each river basin district. The upper aquifer is the focus of observations. Where other significant groundwater bodies, e.g. aquifers relevant to the water supply, exist, these shall be monitored separately.

The Directive differentiates between “surveillance” and ”operational” monitoring of the chemical status.

The surveillance monitoring should be designed to ensure that an overview of groundwater chemical status can be given in each groundwater body or in each group of groundwater bodies. Its task is to

- validate the characterisation of the groundwater bodies and thereby identify any information gaps.
- document the status of the groundwater bodies, i.e. whether it is in a good or bad condition, and
- detect trends towards pollutant increases.

The monitoring of groundwater chemical status is based on the ground monitoring networks in the *Länder*, which consist of base and trend monitoring sites. Where needed, special monitoring networks or the networks of third parties can also be brought into the programme. The necessary density of monitoring points is determined by the type and structure of groundwater body under review and by its anthropogenic influences on groundwater body. . We should also use representative monitoring sites to survey large-scale contiguous areas subject to relevant uses (areas used intensively for agriculture, areas of woodland and extensive land use, areas of housing and industry etc.) and large hydrogeological units. A monitoring site may be considered representative if

- the quality of the groundwater recorded at that point is typical of the wider area, i.e. similar substance concentrations occur at a considerable number of neighbouring monitoring sites, or
- we can expect the monitoring site, due to its position in the geohydraulic system and in view of existing land use in the inflow area, to be characteristic of a wider area.

It is not, however, necessary to set the number of monitoring sites according to the area fraction accounted for by the respective use or hydrogeological unit. If these area fractions are not reflected in a representative manner by the monitoring network, the individual monitoring results can be weighted according to an appropriate spatial key to determine the chemical status of the groundwater body or to identify trends.

If the further characterisation indicates a risk of a surface water or groundwater-dependent ecosystem being damaged by developments in the groundwater body, monitoring sites shall be established to provide results that allow a further assessment of this risk. It may also be necessary to draw on monitoring that sample surface waters.

To assess chemical status, regular samples are taken from the selected groundwater monitoring sites. In areas of consolidated rock, the sites should also include springs. We must establish the parameters conforming with “Anhang II.12.04 – *Austausch von Grundwasserdaten*" to the Verwaltungsvereinbarung über den Datenaustausch im Umweltbereich zwischen Bund und Ländern (Administrative Agreement on the Exchange of Data in the Environmental Field between the Federation and *Länder*). Further parameters are then to be integrated in the survey programme that, according to the findings of the initial and further characterisation, are significant in the catchment area of the groundwater body and may constitute a negative influence on the groundwater quality.

The required frequency of sampling will depend on the monitoring site characteristics. In general measurements must be made once a year. Monitoring sites that demonstrate strong fluctuations of concentration within the period of year should be examined more often. It is recommended that a minimum of two measurements be made per year (once in spring and once in autumn). The monitoring dates should be roughly equidistant in terms of the intervening time.

An "operational monitoring" programme shall be carried out as well for groundwater bodies (or parts thereof) which, under the provisions Annex II and in the light of the results of "surveillance monitoring", are at risk of not achieving the objectives of Article 4, as well as for transboundary groundwater bodies. The operational monitoring is designed to shed more light on this risk and provide further measurements with which to identify tends. It is therefore a contribution to the preparation of appropriate plans for actions that respond to the situation and can reverse negative upward trends and return waters from bad to good status. The operational monitoring is intended to improve the accuracy of the findings from surveillance monitoring and to document the success of the measures introduced.

For the operational monitoring purposes we should primarily use the monitoring sites of the surveillance monitoring programme that are already indicating increased pollutant concentrations or long term anthropogenic trends occurring to the detriment of the groundwater body. The operational monitoring network can be extended by the addition of other monitoring sites. The scope of the parameters to be measured for "operational monitoring" will generally correspond to that of "surveillance monitoring" and should be extended where necessary to include any elements polluting or threatening the groundwater. "Operational monitoring" should be carried out with at least the same frequency as "surveillance monitoring", and certainly no less than once a year.

When designing the concept for the surveillance monitoring network to record chemicals, we should make use of the monitoring network established for the Nitrate Directive. In the absence of reasons to the contrary, these monitoring sites are to be integrated in the operational monitoring programme (pollution monitoring) to ensure coherent evaluation and reporting.

3) National provisions

DVWK (1994): Bewertung und Auswertung hydrochemischer Grundwasseruntersuchungen.- DVWK-Materialien 1/1994, Bonn.

LAWA (2000): Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Empfehlungen zur Optimierung des Grundwasserdienstes (quantitativ); Schwerin 2000

LAWA (2000): Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Empfehlungen zu Konfiguration von Messnetzen sowie zu Bau und Betrieb von Grundwassermessstellen (qualitativ); Schwerin 2000

LAWA (1993): Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Grundwasserrichtlinien für Beobachtung und Auswertung, Teil 3 – Grundwasserbeschaffenheit; Bonn 1993

LAWA (1995): Länderarbeitsgemeinschaft Wasser (LAWA, eds.): Grundwasser-Richtlinien für Beobachtung und Auswertung, Teil 4 – Quellen; Bonn1995.

Verwaltungsvereinbarung über den Datenaustausch im Umweltbereich zwischen Bund und Ländern, draft 1999; Annex II.12.04 ”Grundwasser” (unpublished)

4) Source material

Maps and other material kept by the network operators for existing groundwater monitoring sites.

For the presentation of “chemical status of groundwater”, the following layers are available in Germany:

- areas
- groundwater bodies
- groundwater quality
- pollutant trends in groundwater

in accordance with Annex 3.2, No. 9

5) Necessary activities

Suitable monitoring sites must be selected for the surveillance and operational monitoring programmes from the existing sites. Taking into account the heterogeneity of the groundwater body and the distribution of the monitoring sites, a judgement must be made as to how reliable the quality of the groundwater body can be assessed by means of the existing monitoring network. Where necessary, the network is to be optimised. In areas with an insufficient information density, further monitoring sites are to be set up. The facilities must be shown to be in proper working order in accordance with the regulations referred to above.

Monitoring sites should be clearly allocated to particular hydrogeological entities and aquifers (cf. chapters 1.2.1.1 and 1.2.1.2). In most cases this requires that use of information on monitoring site development and on the geological strata profile.

An account of monitoring site characteristics shall be made for those sites that meet the above-mentioned requirements. This should contain all the important information, such as the geohydraulic position in the flow system, monitoring site development, land use in the catchment areas, quality developments, etc..

The monitoring sites for the surveillance monitoring and operational monitoring programme shall be sampled regularly. The quality data are to be gathered by river basin district and their validity checked without delay. The data shall be collated and kept for the purpose of assessment (cf. chap. 2.2.3 and 2.2.4).

The monitoring programme shall undergo analytical quality assurance. The soundness and accuracy of the quality data must be specified and documented in the management plan for the river basin district.

Points to note

The assessment procedure for good chemical status will be elaborated by the daughter directive pursuant to Art. 17 of the WFD. The above remarks shall be reviewed in the light of this specification.

2.2.3 Trend analysis

To be filled in after Article 17 has been elaborated.

2.2.4 Assessment and presentation of results (groundwater quantities)

1) Reference to the Directive

Article 4 (1) b ii

Article 11 (3) e, f

Annex II, 2.1 to 2.4

Annex IV, 1

Annex V, 2.1 to 2.2, 2.5

Annex VII, A 2, A 4.2, A 5

2) Technical background

Under Annex II, section 2.1.2 a groundwater body has a good quantitative status if the available groundwater resources are not excessively exploited. In addition, there may be no failure to achieve ecological and chemical quality objectives of the surface waters linked hydraulically with the groundwater, nor may the terrestrial ecosystems directly dependent on groundwater be significantly impaired. Another requirement is that no anthropogenic hydrodynamic condition may occur in the groundwater body that results in saline intrusion or inflows of other groundwater-threatening substances.

The groundwater body has a bad status only if the suspicion of a risk expressed in the further characterisation leads to confirmation that more groundwater is being taken from the groundwater body than is available, or if the monitoring results confirm this suspicion or if terrestrial ecosystems are being significantly damaged. Not every groundwater body at risk is therefore necessarily in bad condition. The classification in good or bad status is made after the monitoring programme, i.e. from 2007, has commenced and before the management plan for 2009 has been adopted.

The parameter for testing and assessment is, in all cases, the groundwater level (for confined groundwater this means the groundwater pressure surfaces, for unconfined groundwater the groundwater surface) in the respective groundwater bodies; by analogy, we shall take this to be the spring discharge especially in areas of hard rock (crevice and cavern aquifers).

Over-exploitation of groundwater occurs if, in large parts of a groundwater body, the groundwater levels (or spring discharge) shows a sustained negative tendency which cannot be explained by climatic conditions. Such tendencies generally indicate poor quantitative status, even if the above-mentioned impacts cannot at first be observed.

In many cases, these impacts only become apparent after a certain time lag or occur with spatial shifts.

With regard to ecological concerns, a local or regional change in groundwater table may also be relevant within the meaning of the Directive. A localised lowering of the groundwater table that has no ecological consequences, e.g. in the vicinity of water extraction facilities, is not a matter for the Directive.

A terrestrial ecosystem directly dependent on groundwater is damaged (sometimes irreversibly) if, due to human interference in the groundwater cycle, the depth to the groundwater table is critically altered, so that at a certain point the flora and fauna is significantly impaired. As a rule, the reduced volume of discharge or the drying-up of springs in areas where groundwater is extracted also has a negative impact on ecological systems.

The assessment parameter here is the site-relevant groundwater level (depth to the groundwater table) either oriented to plant sociology or related to the bed elevation of a running water body. Taking into account the terrestrial ecosystems and existing uses, it makes sense to set threshold values for the groundwater level at reference monitoring points. Spring discharges can also be very useful indicators, especially with regard to terrestrial ecosystems.

If a reduction of hydrodynamic potential in the groundwater body comes about in connection with an anthropogenic lowering of the groundwater table (it need not be a negative trend), there may, in coastal regions, be an unexpected intrusion of sea water (saline intrusion) with the upward surge of highly mineralised deep groundwater inland. Moreover, the artificial alteration of groundwater potential can cause an inflow of polluted groundwater from a neighbouring aquifer or lead to a contaminated surface water body infiltrating the lower strata. This can be assessed on the basis of both the groundwater level and chemical parameters with which saline intrusions and pollutant imports into a groundwater body can be recognised.

3) National provisions

What constitutes significant damage to a terrestrial ecosystem is to be clarified by the R&D project conducted by the Erftverband. The results are expected in the first half of 2003.

4) Source material

Material must be supplied which allows us to derive and evaluate the hydrodynamic potential and any negative trend in groundwater levels in a groundwater body or in the spring discharge or depths of groundwater table. Furthermore, longitudinal sections should be available for ecologically vulnerable surface waters along with maps of terrestrial ecosystems directly dependent on groundwater. Finally, it is also important to have hydrochemical monitoring values, which are to be analysed in accordance with chap. 2.2.2. In particular, the following maps are required:

Map 7: Ecological water quality

Map 10: Monitoring networks in surface waters

Map 14: Monitoring networks in groundwater

Map 15: Protected areas

5)Necessary activities

a) Wide-scale overexploitation of a groundwater body

If the groundwater level hydrograph lines related to groundwater monitoring sites positioned at a large distance from extraction installations visually demonstrate that the groundwater levels have been falling over a long period of at least ten years, we need to find out using statistical methods how far climatic or anthropogenic factors are primarily responsible for the negative trend. In areas with crevice or cavern groundwater aquifers, the findings of spring discharge monitoring can also be brought into the calculation.

If a large number of monitoring sites in a groundwater body that are situated away from the immediate impact zone of groundwater extraction installations produce results that demonstrate an anthropogenic negative tendency, the quantitative status of the groundwater body must be defined as “bad” and mapped with the colour “red”.

b) Impairment of hydraulically connected surface water ecosystems or groundwater-dependent terrestrial ecosystems

If terrestrial ecosystems are significantly damaged, the status of the groundwater body is bad. The decisive parameter for significant damage is the groundwater level. If, over a long period (set according to the type of terrestrial ecosystem), values fall consistently short of the lower thresholds (cf. 1.2.2), the ecosystems must be considered at risk and the status of the groundwater body shall be identified as bad.

Bad status also occurs where, as a result of anthropogenic changes in the groundwater level, the ecological quality objectives for groundwater-dependent surface waters are threatened or the quality of these waters is significantly reduced. The extent to which impairments are dependent on groundwater is to be determined in each case.

c) Influx of salt water or other undesirable constituent substances as a consequence of anthropogenically modified hydrodynamic potentials

Using groundwater hydrograph lines, we must find out whether the natural hydrodynamic potentials in the relevant groundwater aquifers have been modified so significantly that saline intrusions or the influx of other pollutants cannot be rule out. In addition, we must establish the fresh/salt water boundary by measuring conductivity at different depths (alternatively: depth-differentiated sampling of the groundwater with measurement of saline concentrations) and derive from these findings a possible saline intrusion. If, on the basis of current hydrodynamic potentials in the groundwater area, an influx of polluted groundwater cannot be rule out, this must be confirmed by applying chemical parameters.

If, in parts of a groundwater body to be identified by hydrogeological or geohydraulic delineation, saline intrusions or the influx of polluted groundwater are demonstrated, the quantitative status of the groundwater body or a part thereof shall be classified as “bad” and marked with “red”.

Points to note

The threshold values set at reference monitoring sites for the groundwater level (or for spring discharge) are intended to ensure that the current status is maintained. The intention is not to re-establish an original status. The key parameter for the evaluation of the quantitative status of the groundwater body is therefore the status quo. Where an existing water-dependent ecosystem is currently being damaged by anthropogenic impacts, it shall be subject to the provisions of the WFD, i.e. measures are to be developed to counter the significant impairment.

2.2.5 Assessment and presentation of results (chemical status)

To be filled in after Article 17 has been elaborated.

2.3 Supplementary monitoring requirements for bodies of groundwater in protected areas, drinking water abstraction points, and in habitat and species protection areas

1) Reference to the Directive

Article 6

Article 7

Annex IV

Annex V

2) Technical background

(Add texts on other protected areas, e.g. drinking water protection zones for surface waters)

Under Article 7 all groundwater bodies from which more than 100 m^3/d of drinking water is abstracted are to be monitored. Although the WFD does not specify the requirements for the monitoring programme, it should reflect the requirements in Annex V. Since the groundwater monitoring in these groundwater bodies does meet these standards, the monitoring of the groundwater bodies used for drinking water production may therefore be carried out in the same way as the monitoring of the chemical status of other groundwater bodies (cf. 2.2.2). The recorded pollutant concentration and its progress over time are, however, to be appraised in terms of their consequences for the use of technical processes for conditioning drinking water and the scale of these processes.

3) National provisions

Still to be added

4) Source material

Still to be added

5) Necessary activities

Points to note

If a special groundwater monitoring programme is established in the Natura 2000 areas, it should be integrated in the monitoring required under the WFD.

Are there parameters in the Drinking-Water Directive that are not specified in the groundwater annex of the Federation/Länder Administrative Agreement? If so, these parameters would have to be added as an additional monitoring requirement for groundwater bodies used for drinking-water abstraction.

2.4 Interim report to the Commission 03/2007 (monitoring programme)

1) Reference to the Directive

Art. 15 para. 2

2) Technical background

3) National provisions

4) Source material

5) Necessary activities

Points to note

2.5 Public information and consultation

1) Reference to Directive

Article 14 para. 1 sentence 1 WFD

Article 14 para. 1 sentence 2 letter a, para. 2 WFD

Annex VII A. 9 WFD

2) Technical background

First of all we may refer to the comments made under 1.7.

Moreover, , the first step consultations on the management plan must be prepared by the end of 2006: a timetable and a work programme for producing the plan, including a statement of the consultation measures to be taken, (Art. 14 para 1 sentence 2 letter a WFD).

Under Art. 14 para. 2 WFD, the public must be granted a period of 6 months in which to comment in writing. Subsequently, changes to the documents and/or to the further methods of procedure must be made where necessary based on the comments.

The WFD does not contain any further regulations as to how this first step in consultations on the management plan is to be structured at the national or international level.

3) National provisions

Section 36b para. 5 Federal Water Act (WHG)

4) Source material

EU paper entitled “Guidance on public participation in the implementation of the Water Framework Directive” of 11 December 2002. Cf. section 1.7.4 above.

The guidance paper (without annexes) is available in German translation from March 2003. This translation and the full English version appear in WasserBLIcK (*www.wasserblick.net)*. Chapter 2 and 3 of the guidance paper is particularly relevant to the issues of early active public participation.

Chapter 4 of the guidance paper is particularly useful on the question of public consultation.

5) Necessary activities

With regard to the general requirements for active participation of the public, we refer to the comments under 1.7. The forms of active public participation in the WFD implementation presented there are to be continued after 2004 with regard to the subsequent activities.
The three-step consultation stipulated in Article 14 para. 1 of the WFD for the production of the management plan applies to the entire public sphere in the river basin district for which a management plan is drawn up, i.e. also to the general public. Appropriate preparations must be made in order to motivate the unorganised public, in particular, to play an active role. No conclusive stipulations have yet been made regarding preparation of the first step in consultation on the management plan,

as the discussion has not yet been concluded at national and international level. The following aspects must, however, be taken into consideration:

- At which level should the consultation take place (*Land*, regional, local)?
- Who should develop the necessary papers (for international river basin districts, uniform papers which must be translated or papers developed nationally by the countries concerned)?
- What publication medium (mixture of paper copies put out on display and announcements in the usual media and internet, access to authority computers for members of the public without PCs, assistance by trained staff)?
- Written opinions also by email, possibly as a formal record (not demanded by the WFD), in which case - where? Possibly consider spoken deliberations at regional level where this is possible (not demanded by the WFD)?
- Who collects and evaluates the comments (national or international, centralised or decentralised collection)?
- How can the public be informed of the outcomes of consultation and of how these outcomes are being taken into account (feedback), not least to motivate the public to stay involved in the following two consultation steps?
- How can the consultation be coordinated and harmonised internationally?

3. Activities to be completed between 2006 and 2009 and integrated in the management plan

3.1 Definition of environmental objectives under Article 4 for surface waters, groundwater and protected areas, especially for cases pursuant to Article 4, para. 3, 4, 5 and 6

to be added (around 2003)

3.2 Information and public participation

1) Reference to the Directive

Article 14 para. 1 sentence 1 WFD

Article 14 para. 1 sentences a to c, para. 1 sentence 3 and para. 2 WFD

Annex VII A.9 and A.11 WFD

2) Technical background

We can refer first of all to the comments under 1.7

By the end of 2006 at the latest, the public consultation on the timetable and work programme for producing the management plan will begin (see comments the first step of consultations in 2.5). By mid 2007 there will be an opportunity to submit comments in writing. The comments must be evaluated and papers adapted where necessary.

Parallel to this, the public consultation must be prepared in the framework of the second consultation step (Art. 14 para. 1 sentence 2 letter b WFD): interim overview of the significant water management issues established for the basin district. This consultation must be commenced by the end of 2007 at the latest. Here too, a period of 6 months must be granted for submission of comments in writing (Article 14 para. 2 WFD). On the basis of the comments, the findings on the important water management issues must be revised where necessary.

By the end of 2008 at the latest, the third step of the consultation on the management plan must be commenced (article 14 para. 1 sentence 2 letter c) WFD): the draft management plan for the river basins.

In accordance with Article 14 para. 2 WFD, six months are to be granted here, too, for the submission of comments in writing. The draft plan must be revised where necessary in response to the consultation experience.

Access to background documents and information used in producing the draft must be granted on application (Article 14 para. 1 sentence 3 WFD).

In addition to the WFD, the SEA Directive (Directive 2001/43/EC of the European Parliament and the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes). additionally requires at least one public consultation on the complete programme of measures and not simply on the summary of the programme of measures in the management plan. Discussions are underway at national and EU level as to how the two consultations can be connected and where the specific differences in content lie.

3) National provisions

none

4) Source material

EU paper entitled “Guidance on public participation in the implementation of the Water Framework Directive” of 11 December 2002. Cf. section 1.7.4 above.

The guidance paper (without annexes) is available in German translation from March 2003. This translation and the full English version appear in WasserBLIcK (*www.wasserblick.net)*. Chapter 2 and 3 of the guidance paper is particularly relevant to the issues of early active public participation.

Chapter 4 of the guidance paper is particularly useful on the question of public consultation.

5) Necessary activities

Reference is made in the first place to the comments under 1.7. The opportunities for involving the public indicated there must be continued and where necessary intensified

With regard to the consultation and comments at the two later steps of the consultation, the same requirements and questions arise as indicated in 2.5.

In the third consultation step (draft of the management plan) it is doubtful whether the consultation will be do justice to what is a relatively abstract draft planning for a river basin district, and in some cases might even entail international draft planning. In order to interest the public for this plan, it will be necessary to give people at local level access to the consequences of a management plan, i.e. to break down the management plan to regional or local levels. Appropriate information and data, which must be collected in any event in order to produce the plan, could therefore also (voluntarily) be made available (practical would be via the internet, with links to other databases or similar).

This would also, in part, provide the access to background documentation and information required by the WFD. This right to access might also be secured with reference to the Environmental Information Act, as it deals with the same type of information and already prescribes an established procedure (applications etc). A decision must be taken as to which contact partner at national or international level, in the form of a central or local offices should be given for incoming enquiries. It must be possible to provide the requested information and documentation relatively quickly to allow the public time to present comments within the six month timeframe.

4 Necessary activities to be completed by 12/2009

4.1 Evaluation and presentation of the results of the monitoring programmes under Article 8 for surface waters, groundwater and protected areas

4.2 Deficit analysis for target performance comparison

4.3 Programme of measures

4.4 Register of all detailed programmes and management plans for river basin districts

4.5 Summary of measures to facilitate public information and consultation, its outcomes and the modifications of the plan made in response (Annex VII A.9 and 11)

4.6 Evidence of cost-recovery for water services as required under Article 9 (planned steps for implementation, cf. Article 9 (2))

4.7 Summary of all activities and results in the management plan for the river basin district

Annex 3.1 (see below)

River Basin Districts in the Federal Republic of Germany
(Directive 2000/60/EC - Water Framework Directive)

The marking and designation of elements of international river basin districts situated outside the borders of the Federal Republic of Germany are merely illustrative and are not intended to represent boundaries determined by other States or international agreements.

Source: Federal Environment Agency (UBA), February 2002

List of the maps to be produced for the reports required under EC Water Framework Directive **Annex 3.2**
Status: 10.03.2003

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
1	**River Basin District - overview - 1: 4 million**					(a) Annex I, ii (b) Part 3, no.1.1.1 (c) Geographical coverage of the River Basin Districts with names of main rivers and a precise description of the boundaries	(a) 12/2004
		OW 1	River Basin District		Name MS Code District Code Area km^2	Art. 2, Annex I,ii Management unit made up of one or more neighbouring river basins and their associated groundwaters and coastal waters	(b) UBA[1]/competent authority[2] (c) 12/2003
		OW2	River basins Sub-basins		Name Competent authorities MS Code	Art. 2, Annex I,ii Areas from which all surface run-off flows into the sea at a single point (river basin) or into a water course (sub-basin).	(b) comp. authority (c) 12/2003
		OW3	large waters		Selection of waters	Main rivers under Annex to the Federal Water Act	(b) UBA (c) 12/2003
2	**List of competent authorities 1: 4 million**			**OW1, OW3,**		(a) Art. 3, Annex I (b) Part 1 , no.1, Part 3, no. 2.1 (c) Area covered by the competent authority for the River Basin District or parts thereof	(a) 06/2004 (b) comp. authority. (c) 2003 (available)
		H7	Territory of the competent authorities		Name Address Authority Code		

[1] UBA – Umweltbundesamt: Federal Environment Agency
[2] competent authority under Article 3 (the *Länder* or *Bundesländer* – state governments)

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
	Location and boundaries surface water bodies					(a) Annex II, no. 1.1 u. 1.2	(a) 2004
		OW4	Surface water body categories		MS Code Name River Basin Code EcoRegion Code Heavily modified Artificial System-type A/B Categories. DLM1000W		
4	**Location and boundaries of** surface water bodies - Types - 1: 500 000			OW4		(a) Annex II, no. 1.1 u. 1.2 Annex VII, no. A 1.1 (b) Part 3, no. 1.1.2 (c) see above	(a) 12/2004/2009 (b) comp. authority (c) 6/2004/2009
		OW4a	Types of surface water bodies		MS Code Name Geology typology Size typology Typology	Differentiation according to type of waters under System B, Annex II no. 1.2 building on the geomorphologic maps of the river landscapes based on Briem. cf. also table of biocenosis-relevant types of running waters AH p. 10	

[3] BKG - Bundesanstalt für Kartographie und Geodäsie: Federal Office of Cartography and Geodesy

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
5	**Location and boundaries of** groundwater bodies/groups of bodies			OW1, OW3, (OW2),		(a) Article 5 (1)	a) 12/2004
		GW1	Groundwater bodies		MS Code Name EcoRegion-Code River Basin Code	Location and boundaries of groundwater bodies /groups inter alia for initial characterisation	
6	**Monitoring network for surface water bodies** 1: 500 000			OW4,	MS Code Name Water Body Code	(a) Article 8, no. 1 and 2 Annex V no. 1.3 Annex VII, no. A 4.1 and A 4.3 (b) Part 3, no. 2.1.3 (c) Location of monitoring sites on surface waters	a) 12/2009 (b) comp. authority (c) 12/2006
		OW5a	Monitoring sites for surveillance monitoring, incl. for Habitat Directive areas and bird protection areas		Surveillance	Annex V, 1.3.2 - 1.3.5	
		OW5b	Monitoring sites for operational monitoring		Operational	Annex V, 1.3.1	
		OW5c	Monitoring sites for drinking-water abstraction from surface waters		Drinking	Annex V, 1.3. 5	
		OW5d	Monitoring sites for investigative monitoring		Investigative	Annex V, 1.3. 3	
		OW5e	Reference monitoring sites		Reference	Annex II - 1.3 (iv)	
7	**Ecological quality, ecological potential of surface water bodies** **1 : 500 000**			OW4,		(a) Article 8, no. 1 Annex V, no. 1.4.2 Annex VII, no. A 4.1 (b) Part 3, no. 2.1.4 and 2.1.5 (c) Presentation of surveillance results and classification of ecological status and of ecological potential	a) 12/2009 (b) comp. authority (c) 06/2009

[4] SGD - Staatl. Geologische Dienste: State Geological Services

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
		OW4 b	Ecological quality		European Code Ecological Status Status date	see above	
		OW4 c	Ecological Potential		European Code Ecological potential Status date	see above Classification of ecological potential for each surface water body of the category artificial or heavily modified.	
		OW4d	Bad status or bad potential due to (non) synthetic pollutants		European Code Non-compliant Status date	Annex V, 1.4.2 iii	
8	**Chemical quality of surface water bodies** **1 : 500 000**			OW4		(a) Article 8 (1) Annex V, no. 1.4.3 Annex VII, no. A 4.1 (b) Part 3, no. 2.1.4 and 2.1.5 (c) Presentation of monitoring results and classification of the chemical status	a) 12/2006 (b) comp. authority (c) 06/2006
		OW4 e	Chemical quality		European Code Chemical status Status date	see above	
9	**Quality of groundwater bodies** **1 : 500 000**			GW1 OW1 OW3		(a) Annex V, 2.5 Annex VII, A 4.2 (b) Part 3, sections 2.2.4 and 2.2.5 (c) Member States shall provide in the River Basin Management Plan a map showing for each groundwater body or groups of groundwater bodies both the quantitative status and the chemical status of that body or group of bodies, colour coded in accordance with the requirements of sections 2.2.4 and 2.4.5. Member States may choose not to provide separate maps under sections 2.2.4 and 2.4.5 but shall in that case also provide an indication, as specified in 2.4.5, on the map required under this section of those bodies which are subject to a significant and sustained upward trend in the concentration of any pollutant or any reversal in such a trend.	a) 12/2006 (b) SGD/ comp. authority (c) 06/2006

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
		GW1 a	Quantitative status of groundwater bodies		European Code Quantitative status Status date	(a) Annex V, 2.2.4 and 2.5 Annex VII, no. 4.2 Quantitative status of groundwater bodies	
		GW1 b	Chemical status of groundwater bodies		European Code Chemical status Status date	(a) Annex V, 2.4.5 and 2.5 Annex VII, no. 4.2 Chemical status of groundwater bodies	
		GW1 c	Trend of pollution of groundwater bodies		European Code Pollutant trend Status date	Those groundwater bodies which are found to show a significant and sustained trend towards increased pollutant concentrations due to anthropogenic influences or any reversal in such a trend shall be marked as required in section 2.4.5.	

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
	Monitoring network for			GW1,		(a) Annex V, no. 2.2 and 2.3	a) 12/2009
		GW2 a	Groundwater table monitoring network		European Code MS Code Level	(a) Annex V. no. 2.2	
		GW2 b	Monitoring sites for surveillance monitoring - chemistry -		European Code MS Code Surveillance	(a) Annex V. no. 2.4	
		GW2 c	Monitoring sites for operational monitoring - chemistry -		European Code MS Code Operational	(a) Annex V. no. 2.4	
11	**Protected areas**					(a) Article 6 Annex IV, Annex VII, no. A 3 (b) Part 3, no. 1.3.1 (c) Maps for the following areas designated under Community regulations	a) 12/2009 (b) see below (c) 06/2009
		S1	Drinking-water protection zones (outer zones)	GW1, OW1, OW3	Name European Code	Areas that have been designated under Art. 7 for the abstraction of water for human use or are to be so designated.	(b) comp. authority
		S2	Designated shellfish waters	OW1, OW4	Name European Code	Areas that have been designated for the protection of economically significant aquatic species	(b) comp. authority
		S3	Recreational and bathing waters	OW1, OW4	Name European Code	Waters that have been designated as recreational and bathing waters	(b) comp. authority
		S4	Nutrient-sensitive areas	OW1, OW4	Name European Code	Nutrient sensitive areas including areas designated as Vulnerable Zones under Directive 91/676/EEC and areas designated as Sensitive Areas under Directive 91/271/EEC	(b) comp. authority

Map number	Map name Reporting scale	Layer code	Name of layer	Other layers	Attributes*	(a) Reference to EC – WFD, (b) Reference to this Guidance Document (c) Description of the map / layer	(a) Report to Comm (b) Compiler (c) Submit to WB
		S5	Habitat areas (water-dependent)	OW1, OW4	Name European Code	Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites designated under Directive 92/43/EEC and Directive 79/409/EEC	(b) comp. authority
		S6	Bird protection areas (water-dependent)	OW1, OW4	Name European Code		(b) comp. authority
		S7	Fish waters	OW1, OW4	Name European Code		(b) comp. authority
0	**Background**						Compiler
		H1	International borders (NUTS 0)				BKG Data set EGM
		H2	Land cover (Corine Landcover)			in necessary, hydrological reclassification	UBA
		H3	Relief			for presentation purposes	BKG Data set EGM
		H4	Settlements (selection from NUTS 4)				BKG Data set EGM
		H5	Transport network (only motorways)				BKG Data set EGM
		H6	Ecoregions		Name EcoRegion Code		European Commission
		H7	Boundaries of competent authorities		Name Address Authority Code		competent authority
		H8	Boundaries of *Bundesländer* (NUTS 1)				BKG Data set EGM

* The “Attributes“ column shows the obligatory information to be reported by the competent authorities (without claiming to be compete at present time).

Annex

Draft

Handling the mapping data on different scales

Present situation

The basic map material for reporting purposes is supplied by digital landscape model DLM1000W for scales from 1:500 upwards. The scales used for reporting under the Water Framework Directive are generally unsuitable for providing a useful water resource planning overview for sub-basin areas at the local-area level. In many *Länder*, operational level digital maps for the river drainage network are available, often with comprehensive territorial coverage, from the ATKIS database. These are on a scale 1:25,000 or on even smaller scales as required for the technical operations on site.

For many aspects of the presentation, the technical challenge is therefore to generate large-scale maps from small-scale maps, with all the problems of generalisation and the aggregation steps needed for parts of this process. For national reporting purposes, the Federal Republic of Germany uses WasserBLIcK, a system into which the *Länder* file their aggregated data. WasserBLIcK transforms this data into reporting-scale maps, and the reporting-level layers taken from Table 3.2 form the basis of the presentation.

To minimise the work required at all levels in transferring mapping data from the technical working level to the reporting level and to avoid duplication of this work, it is essential that everyone concerned, starting from those at the lowest operational level, adopt a concerted approach.

Concerted approach

Since the transformation of small-scale maps into large-scale maps can often involve a great deal of manual input due to the problems of generalisation, the recommended approach is to make a straight transfer of data up to the next map scale level without regard to maps and co-ordinates. Maps can then be produced at the higher scale by marking the relevant data with an ordering criterion that appears on all map-scales.

The mapping elements generally required for the presentation under the Water Framework Directive are point and line information on watercourses and spatial presentations for river basins and groundwater bodies. In Germany, these elements do not appear on centrally provided layers but emerge from local cartographic work, or through aggregation. This applies to most of the required mapping information required at the reporting level (exceptions include the data for protected areas).

The following elements, which are already used by most *Länder*, can be used as ordering criteria:

Points and lines	Water identification number in connection with river stationing (kilometration)
Sub-basin areas	Area identification code
Groundwater aquifers	Area identification code *(we must consider here whether the river basin number can also be used.)*

Having established these definitions, it is possible to transfer data of geographical relevance to a water body or to river basin area from the cartographic level to the reporting level without having to deal with all the presentational problems that occur at different map scales. Since only data with a hierarchical key (without co-ordinates) is sent from one level to another, aggregations can largely be carried out mechanically. This aggregated data can, if required for imaging purposes, be transported to the next higher level by the same mechanism.

Prerequisites

To ensure that the approach presented here will be adopted at all levels, certain requirements must be fulfilled:

1. At the highest level, i.e. the Federal Republic of Germany, which has the WasserBLIcK data system as the technical interface to the *Länder*, layers for the river drainage network, the river basin areas and the groundwater bodies must be submitted with uniform ordering criteria.

2. The WasserBLIcK system has set tables for all the report data to be supplied, and these tables can be filled by the *Länder* systems or exported into the *Länder* systems.

3. Those *Länder* that do not have digital river stationing maps ("*Gewässerstationierungskarte*" showing kilometration) can make use of most GIS systems for automated plotting of the watercourse stations for the DLM1000W waters layer.

4. *Following text to be checked:* If the stations of a watercourse cannot be plotted by *Länder* for the DLM1000W layer, an automated generation of stations shall be filed in WasserBLIcK as an ordering criterion.

5. To achieve approximation of the river stationing values between the generalised report map DLM1000W and the cartographic level, the generally higher positioning values of the cartographic level shall be transposed into the generalisation level via an algorithm in the GIS system. *A decision must be made here as to whether this conversion is to take place within the WasserBLIcK system or be performed in advance by the Länder, or whether merely the exceedance of values should be reduced in WasserBLIcK to a maximum value.* The *Länder* must also carry out this conversion if other maps showing river stations are used, because the higher-scale lines are as a rule larger than the generalised lines.

6. The conversion of co-ordinate point information into watercourse stations (kilometration) can be done with most GIS systems at the cartographic level by using an algorithm that has a high accuracy, so that manual adjustments are largely unnecessary. This procedure is needed for the transfer of those data sets in which only co-ordinates are known without any knowledge of station values (e.g. data on contaminated sites).

The approach described here, along with the prerequisites for its adoption, enables data to be transferred over several map-scale levels with relatively little effort, and intermediate aggregations can be carried out within the database. In terms of graphic visualisation, however, the procedure is a one-way street, since reverse enlargements from a higher scale to a smaller scale would not be acceptable.

German Guidance Document for the implementation of the EC Water Framework Directive

Part 4
Thematic working papers

1) Register of R&D projects to prepare for WFD implementation in the water sector (as of: 15.04.2002)

2) Working groups to develop EU guidance documents

3) Criteria for recording anthropogenic pressures and assessment of their impacts to ensure timely and meaningful reporting to the European Commission; as of: 31.03.

4) Identification and designation of heavily modified or artificial bodies of surface water

5) Requirements for sustainable agriculture from the perspective of protecting water resources

6) Rules for structural and civil engineering under the Water Framework Directive

7) Functions of WasserBLIcK

8) Agreements on electronic data exchange for reporting purposes

9) Internet addresses of the *Länder*, LAWA, and Federal Government that are relevant to the implementation of the EC Water Framework Directive