Umwelt Bundes Amt
Für Mensch und Umwelt

Bundesministerium
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Implementation of the European Water Framework Directive in Bulgaria

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- Operational Manual -

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List of abbreviations

AWB	Artificial Water Bodies
CIS	Common Implementation Strategy for the Water Framework Directive
DRBD	Danube River Basin Directorate
GWB	Groundwater bodies
HMWB	Heavily Modified Water Bodies
ICPDR	International Commission for Protection of the Danube River
SWB	Surface water bodies
RBD	River Basin Directorate
WFD	European Water Framework Directive
WMA	Water Management Act (Bulgaria)

1. Introduction

The Directive 2000/60/EG (European Water Framework Directive - WFD) of 23 October 2000 of the European Parliament and of the Council for establishing a framework for Community actions in the field of water policy was put into force on 22 December 2000 in the Official Journal of the European Communities.

The European Water Framework Directive (WFD) refers to all water throughout the territory of the EU and is relevant to inland surface waters, transitional waters, coastal waters and groundwater irrespective of their use. The WFD establishes the framework for the protection of all water resources which are vital for both human and nature by steering substantial processes in the ecosystems. The Directive focuses on an integrated resource management, looking at the water courses, their floodplains and their catchment areas as a unit. At the same time, the interactions between surface waters and groundwater are included. The Directive takes into consideration the ecological function of water as part of the natural habitat and integrates the objectives of nature conservation.

The objective of the WFD is to achieve a good status of all surface waters and groundwater, and a good ecological potential of those waters within 15 years. To meet this objective, River Basin Management Plans have to be prepared in all River Basin Districts to cover all elements of water protection. The environmental objectives to be achieved by the Member States are listed in Art. 4 WFD.

Flood protection is not part of the WFD. However, flood protection will be considered in interrelationship with morphological issues as this is relevant for the elaboration and evaluation of measures.

The WFD is one of the first Directives of the EU in the field of environmental policies that uses economic instruments to establish the sustainable management of natural resources. The economic instruments are used to identify the most efficient use of limited water resources.

According to Art. 2 Nr. 15 WFD, the River Basin Districts are the main unit for the management of river basins.

Art. 14 WFD requires early and comprehensive information as well as consultation of the public (Public participation). This policy serves to ensure the active participation of all parties interested in the process of the Directive's implementation.

This Manual aims to provide comprehensive information to all institutions participating in the implementation of the Directive in Bulgaria and to the general public in Bulgaria. A summary of the following issues are presented:

- Objectives, instruments, tasks and time-schedule of the European Water Framework Directive ,
- Legal and administrative implementation of the WFD,
- Instruments of national and international co-operation and co-ordination in the technical implementation of the Directive,
- Establishing the specific and technical requirements, processes and objectives to be achieved,
- The current state of the legal, organizational and technical implementation,

In the course of the Directive's further implementation, this Manual is to be continuously updated.

2. Objectives of the European Water Framework Directive (WFD)

The purpose of the WFD is the improvement or the conservation of the good status of surface waters and groundwater until the end of the year 2015. This means:

- for surface waters at least a good ecological and chemical status;
- for groundwater at least a good chemical status and a good quantitative status, and
- for artificial waters and heavily modified water bodies a good ecological potential and a good chemical status.

Surface waters and groundwater must be protected, improved and rehabilitated. Any deterioration in the status of surface waters and groundwater has to be prevented.

The discharge of harmful substances into groundwater must be prevented or restricted. Additionally, trends of increasing in the concentration of harmful substances are to be reversed.

The main objectives of the WFD and the instruments for attaining them are presented in Figure 1. These objectives are to be reached within specified deadlines (cf. Section 3).

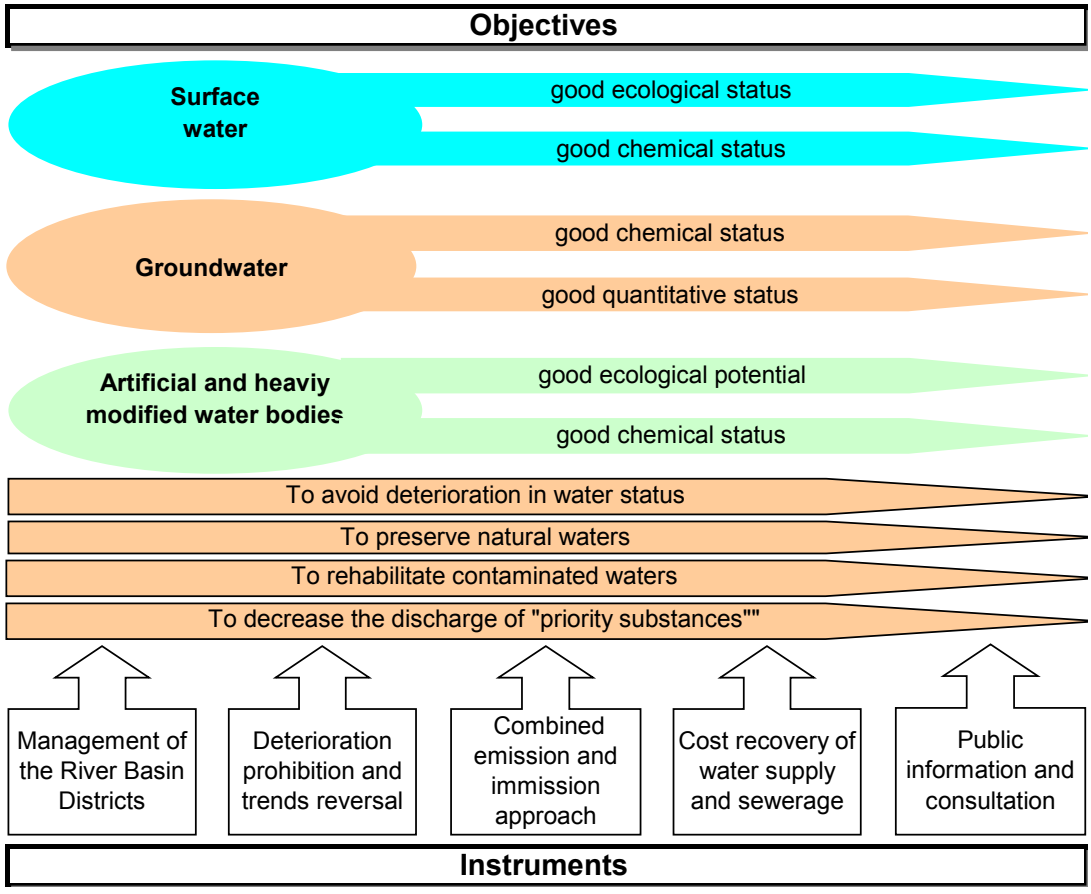


Figure 1: Objectives and Instruments of the WFD

3. Tasks and time schedule for implementation of the WFD

The WFD sets up binding environmental objectives which the Member States have to achieve coordinated within River Basin Districts defined by natural characteristics. With the adoption of the WFD the set requirements in the River Basin Districts must be fulfilled within obligatory deadlines.

3.1 Tasks for implementation

The coordinated approach within the River Basin Districts is a central element of the WFD. It requires extensive coordination between all actors and involved participants. Crucial for the success of the WFD is the willingness for transboundary co-operation across administrative and state borders.

The tasks for implementation of the WFD are divided into the following groups that have to be realized in consecutive steps within the next fifteen years.

- Implementation of the WFD in the national legislation.
- Inventory of waters in the River Basin Districts in relation to water management, ecology and economy, including a risk assessment of the water status;
- Elaboration and implementation of the monitoring programme with the aim of monitoring the water status;
- Definition of the objectives to be achieved in the River Basin Districts in relation to water status;
- Determination of the necessary measures for achievement of these objectives.
- Performance and implementation of the measures.

The implementation of the WFD in national legislation is completed (cf. Section 4).

The main part of the work concerning the inventory of waters is the identification of the pressures and impacts on groundwater and surface water bodies. For this purpose, all available relevant information and data on significant pressures have to be collected, e.g. point sources from the industrial sector and the municipalities, diffuse sources, impoundments, strengthening, water abstractions or the discharge of cooling water. The collected data must be assessed taking into consideration all the monitoring results and data from analysis and measurements be conducted within the respective river basin.

In line with the integrated approach to manage water resources, it has to be assessed, taking into account the local expertise, whether the water body under review is likely to achieve the environmental objectives of “good ecological” and “good chemical” status for surface waters and “good chemical status” and “good quantitative status” for groundwater, or whether the achievement of these objectives is endangered (“at risk”).

The non-endangered water (water bodies not at risk) does not need to be examined further as they meet the requirements of the WFD.

Further action has to be taken concerning those water bodies which are seen as unlikely to achieve the environmental objectives. This comprises surveillance monitoring and operational monitoring based thereon. (Art. 8; 2004 – 2006). To this end, the chemical and biological parameters are to be checked at representative sites of surface waters and groundwater on the basis of the data collected for the inventory. If the operational monitoring reveals that neither the good chemical status (qualitative objectives) nor the good ecological status can be reached, the reasons for this have to be identified and a Programme of Meas-

ures has to be adopted to achieve the predefined specific “good status” of the respective body of water.

The approach of the risk assessment referring to chemical status and quantitative status of groundwater corresponds to the approach applied to surface water.

According to Art. 4 WFD, the Members States may claim exceptions to the pursuit of the objectives if conditions set up in Art. 4 WFD are fulfilled. Art. 4 WFD also provides, that these exceptions must not threaten the achievement of the objectives as a whole.

For artificial and heavily modified water bodies the WFD provides a possibility for the development of a “good ecological potential” and of a “good chemical status” only, if changes in the morphology of water will significantly affect other public interest issues such as navigation, power generation, drinking water reservoirs or agricultural land drainage, or on grounds of consideration of technical or economic feasibility and subject to the fulfilment of further conditions.

The implementation of WFD is envisaged to be accompanied by early and comprehensive information and consultation of the public (Art. 14 WFD). It is necessary for the Member States to provide for the “active involvement of the interested parties in the implementation of this Directive, in particular in production, review and updating of the River Basin Management Plans”. This means the active involvement of affected and interested parties, such as agriculture, environmental protection as well as authorities, municipalities and districts (counties) in the planning process.

3.2 Deadlines for implementation

The WFD sets the year 2015 as a deadline for the realization of the objectives therein determined. (cf. Table 1). The main steps in this implementation are:

- Harmonization of the legislation of the Member States necessary for the implementation of the WFD within 3 years (December 2003)
- Initial characterization and risk assessment for all River Basin Districts within 4 years (December 2004)
- Preparation and implementation of a monitoring programme within 6 years (December 2006)
- Preparation of a Programme of Measures for the River Basin Districts to achieve the environmental objectives of the WFD and the publication of the River Basin Management Plans within 9 years (December 2009)
- Implementation of the Programme of Measures in the River Basin Districts to achieve the environmental objectives of the WFD within 12 years (December 2012)
- Achievement of a “good status” for surface waters, groundwater and of protected areas within 15 years (December 2015).

Under certain narrow conditions the deadline for the achievement of “good status” may be extended by two 6-year periods so the maximum time-limit for the achievement of a “good status” can be 27 years.

Table 1: Deadlines for Implementation of the WFD

Position	Acc. to art… of WFD	Deadlines
Entry into force	**25**	**December 2000**
Harmonization of the legislation		
- adoption of legal provisions	24	December 2003
- determination of competent bodies	3 (7)	December 2003
- determination of comppetent bodies in relation to EU	3 (8)	June 2004
Initial characterization and risk assessment		
- analysis of the river basin characteristics	5 (1)	December 2004
- list of protected territories	6 (1)	December 2004
- determination and assessment of significant burdens	5 (1)	December 2004
- economic analysis of water use	5 (1)	December 2004
Continuation of data collection for initial chacraterization	5 (2)	December 2013/2019
EU provisions for groundwater		
- setting of measures on the part of the EU for groundwater protection	17(1)	December 2002
- EU criteria for chemical status and trends reversal	17(2)	December 2002
- nationally based criteria - if necessary	17 (4)	December 2005
Monitoring programme		
- preparation and implementation	8	December 2006
Public information and consultation		
- publication of the timetable and work programme	14 (1a)	December 2006
- publication of the most important issues concerning water capacity	14 (1b)	December 2007
- publication of draft copies of the River Basin Management Plan	14 (1c)	December 2008
River Basin Management Plan and Programme of Measures		
- preparation and publication of the River Basin Management Plan	13 (6)	December 2009
- preparation of programme of measures	11 (7)	December 2009
- cost recovery of water supply and sewerage	9 (1)	December 2010
- implementation of measures	11 (7)	December 2012
-(additional development) updating of the River Basin Management Plan	13 (7)	December 2015
- (additional development) updating of the programme of measures	11 (8)	December 2015
Achievement of the objectives		
- good status of surface waters	4 (1a)	December 2015
- good status of groundwater	4 (1b)	December 2015
- achievement of the objectives in protected territories	4 (1c)	December 2015
- extension of the terms for objectives achievement	4 (4)	December 2021/2027
List of the priority "Hazardous Substances"		
- proposal for graphic values of the emissions and immissions	16 (8)	Oct./Nov 2003
- further development/updating of the list	16 (4)	December 2004
- cessation of discharges of priority hazardous substances	16 (6)	20 years

4. Implementation of the WFD in the national legislation

The implementation is carried out in accordance with Art. 24 (1) WFD immediately after accession to the EU. The European Commission is notified of the exact text of the national legal provisions referring to the WFD.

4.1 Draft of Water Management Act – Bulgaria

The Draft of Water Management Act (WMA) regulates the water management in the Republic of Bulgaria. The purpose of the Act is the achievement of sustainable good quality of water through instructions to the responsible parties and set approximate values for the water bodies.

The act is divided into 12 chapters.

Chapter 1 (General Provisions) covers the objectives of water management and indicates via provisions the concerned fields and institutions. According to Art. 7 (1) WMA water management is carried out at national level and at River Basin District level. The division into 4 River Basin Districts is clarified in Art. 7 (4) WMA. The relation to groundwater bodies that do not directly belong to the respective region is clarified in Art. 7 (5) WMA. The relation to trans-border river basins is determined in Art.7 (7) WMA.

Chapter 2 (Water Management) Section I and Section II determine the areas of competence and the tasks of the participating institutions. Art. 15 (1) WMA lists the tasks of water management. According to Art. 16 WMA water management at a national level is carried out by the Ministry of Environment and Water and at the regional level of river basin management by the Basin Directorate within the respective River Basin District. As to trans-border River Basin Districts the functions are taken over by an international commission for basin management (Art. 17 WMA). Art. 18 and 19 WMA set out the tasks of the National Water Council and of the Basin Councils. In section II, Art. 20 to 36 WMA regulate the areas of responsibility and the tasks of the ministries and of the assistants to the competent authorities. Section III of Chapter 2 “Water Management Planning” provides for the information on the contents of the National Management Plan, (Art. 39 WMA) and of the River Basin Management Plan (Art. 40 WMA). This section also contains all deadlines at which the plan has to be checked.

4.2 Regulations for the Activity, Structure, Organization of Work and Staff of the Basin Directorates

The Member States are required by the WFD to determine the hydrological borders of the River Basin Districts.

The Member States are to determine the river basins within their territories and assign them to a River Basin District for the purposes of the Directive. A river basin located on the territory of several Member States has to be assigned to a corresponding international River Basin District.

Regulations for the Activity, Structure, Organization of Work and Staff of the Basin Directorates of January 2002 lay down the structure, tasks and responsibilities of the authorities in River Basin Districts (State Gazette No. 10).

Chapter 1 (General Provision) determines from a legal point of view the position of the authorities of River Basin Districts and their main tasks. Chapter 2 (Director of a Basin Directorate) determines the tasks and powers of the head of the body managing a River Basin District. Chapter 4 (Organization of work of the Basin Directorates) sets out the framework conditions under which the bodies are to perform their tasks. The Basin Directorates are collated to the River Basin District by the provisions of the Water Act. According to Chapter 3

(Staff, Structure and functions of the Basin Directorates) Art. 7 of this Act, they have planning, information and controlling functions within the territory of their respective region. The Basin Directorates consist of six divisions. (Chapter 3 Article 9 Water Act):

1) Administrative-Economic Department
2) Department of “Planning and Management“
3) Department of „ Monitoring, Prognosis and Information“
4) Department of „Permissions and Registration”
5) Department of „ Water and Water Economy, Cadastre“
6) Department of „Control, Cooperation with Other Institutions and Public Information”

Their functions are described in Chapter 3 Article 10 ff. Water Act.

The River Basin Directorate is managed by a Director (Chapter 2 Art. 4 Water Act). The activities are coordinated by the top-level Water Agency with the Minister of Environment and Water (Chapter 1 Art. 3 Water Act).

4.3 Regulations for the Activity, Structure, Organization of Work and Staff of the Basin Councils

The regulations determine the staff composition, the tasks and rights. They have been issued by the Bulgarian Ministry of Environment and Water and were published on 18th March 2003 (State Gazetteer No. 25).

The regulations contains six sections.

Section I (General Provisions) describes the legal status of the council and its main tasks. A Basin Council is established for each River Basin District (Section I Art. 2).

Section II (Basin Directorates) regulates the cooperation of the River Basin Directorates and the Basin Councils. The Basin Councils are commissions performing consultative functions for the state and the public set up with the aim of supporting the activity of the River Basin Directorates (Section II Art. 5).

Section III (Structure and staff of the Basin Council) determines the staff composition of the Basin Councils (see Figure 2 and Figure 3).

Section IV (Organization of activity) describes the rules of conducting the sessions of the council.

Section V (Technical and expert servicing) provides information about the tasks of the secretary of the Basin Council.

Section VI (Financing) presents the financing of the Basin Council outside the financial framework of the River Basin Directorate.

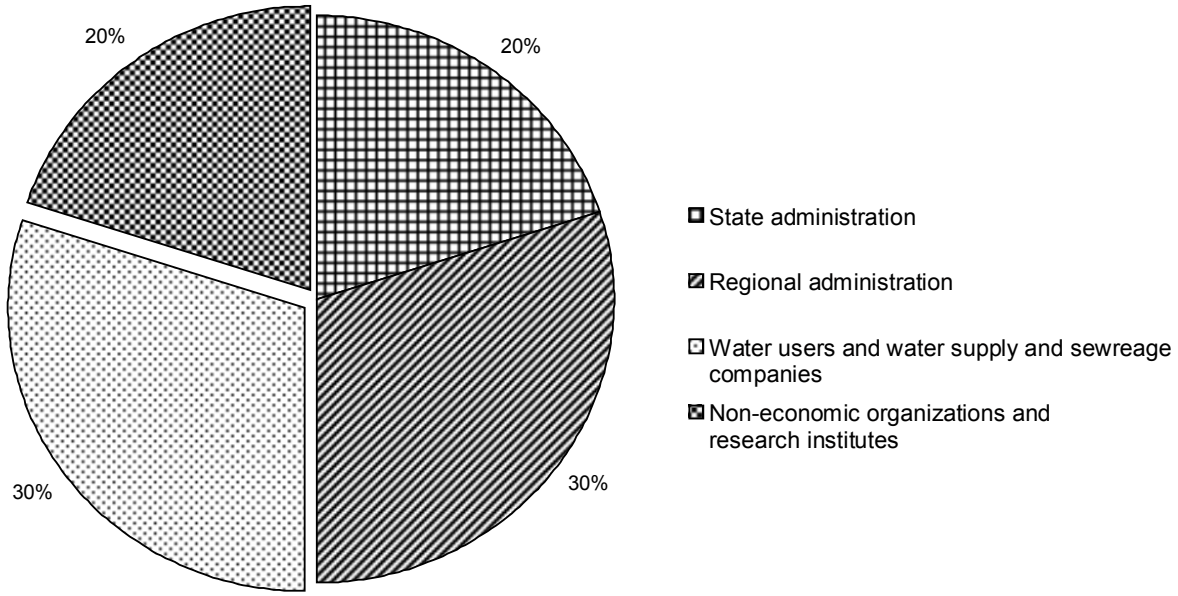


Figure 2: Composition of the Basin Councils as institutions

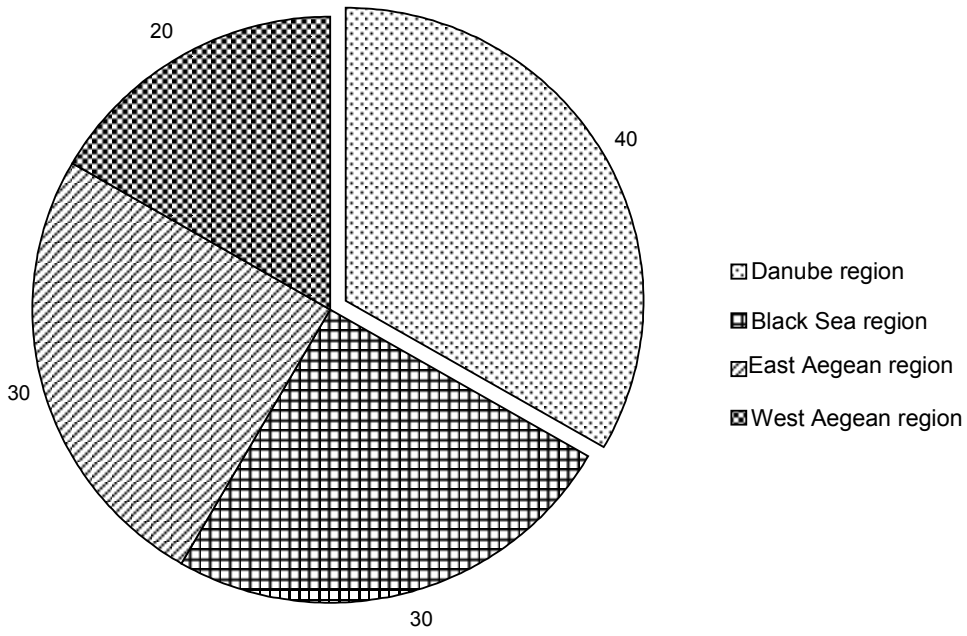


Figure 3: Number of members in the Basin Councils

5. Organization of the implementation of the WFD

5.1 Competence and coordination

Responsible for the implementation of the WFD in Bulgaria are the River Basin Directorates (see Figure 4):

1. Danube: Pleven (Russe; Sofia; Veliko Tarnovo; Vraza)
2. Black Sea: Varna (Bourgas; Shoumen)
3. East Aegean Sea: Plovdiv (Pazardjik; Smoljan; Stara Zagora)
4. West Aegean Sea: Blagoevgrad

Figure 4: Boundaries of the River Basin Districts and of the counties in Bulgaria

The following sub-basins are part of the river basin of the Danube(see Figure 5):

- Erma
- Iskar
- Nischava
- Ogosta and the rivers to the west of Ogosta
- Vit
- Ossum
- Yantra
- Russenski Lom
- The rivers in the Dobrudja plain to the west of the watershed of the Malm-Valalangian aquifer

5.2 Data Management and IT-Structure

Responsible for the IT technology management is the IT Department at the Danube River Basin Directorate in the city of Pleven (department head: Rumelija Petrova)

The maintenance and storage of the data is carried out centrally in Pleven. Local specialized databases are maintained at the four regional bureaus of the Directorate. Any important information and data that are necessary for the preparation of WFD products and the management plan are transferred to the IT department at Pleven. The data blocks concerning Bulgaria as a whole are at the disposal of other state institutions.

The IT department in Pleven works with the ESRI ArcGIS 9 software. The file formats Shapefile and Personal Geodatabase are used for processing of GIS.

5.3 Web-based communication - informational portal

At the beginning of the European Twinning Project „WFD-Danube-Bulgaria“ in January 2005 the web page

http://www.hlug.de/twinning/water/index.htm

was launched. The majority of the texts presented on it are in German, English and Bulgarian. The purpose of the page is to provide a quick exchange of data between the competent bodies and other participants and free access to information for the public.

The subjects are arranged by

- Activities (mission-agendas; mission-presentations; mission-reports)
- Documents (CIS-documents ; literature)
- Norms/Rules (WFD; Water Management Act; Regulations; etc.)
- Reports (ICPDR-Roof Report; National Reports)
- Project planning (Documents Project Management)

With the exception of the section „Project Planning“, all information is freely accessible. The section “Project Planning“ can only be accessed by entering a password. Data for internal use and intermediate results are stored in this section.

5.4 Technical specifications of the hardware and software

Figure 5 shows the IT structure. Later on the existing hardware elements are to be supplemented by new ones.

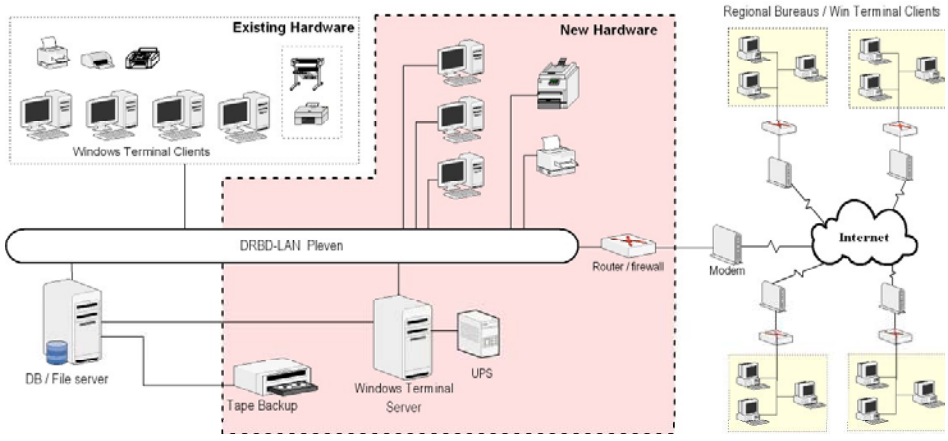


Figure 5: Hardware infrastructure of River Basin Directorates (example: Pleven)

5.5 Implementation schedule

5.6 Reporting

The CIS-Document „Towards a Guidance on Reporting under the WFD“ of 20th November 2004 outlines the main requirements for reports under the WFD (see Table 2).

Table 2: Reporting under the WFD

Art. 3(8) with annex I	River Basin Districts and competent authorities	22 June 2004.
Art. 15(2)	Summary of the inventory	22 March 2005
Art 15(2)	Summary of the monitoring programme	22 March 2007
Art, 15(1)	River Basin Management Plans	22 March 2010
Art. 15(3)	Progress reports	22 December 2013

Three levels of processing and reporting have to be differentiated (see Table 3).

Table 3: Levels of processing and reporting of WFD

1.	International level	Roof Report (A)	(international) River Basin District
2.	National level	National report	River Basin District (national)
3.	Operational level	Regional report	sub-basin (processed region)

Figure 6 presents schematically the levels of processing and reporting in the Danube River Basin and the Danube River Sub Basins Bulgaria.

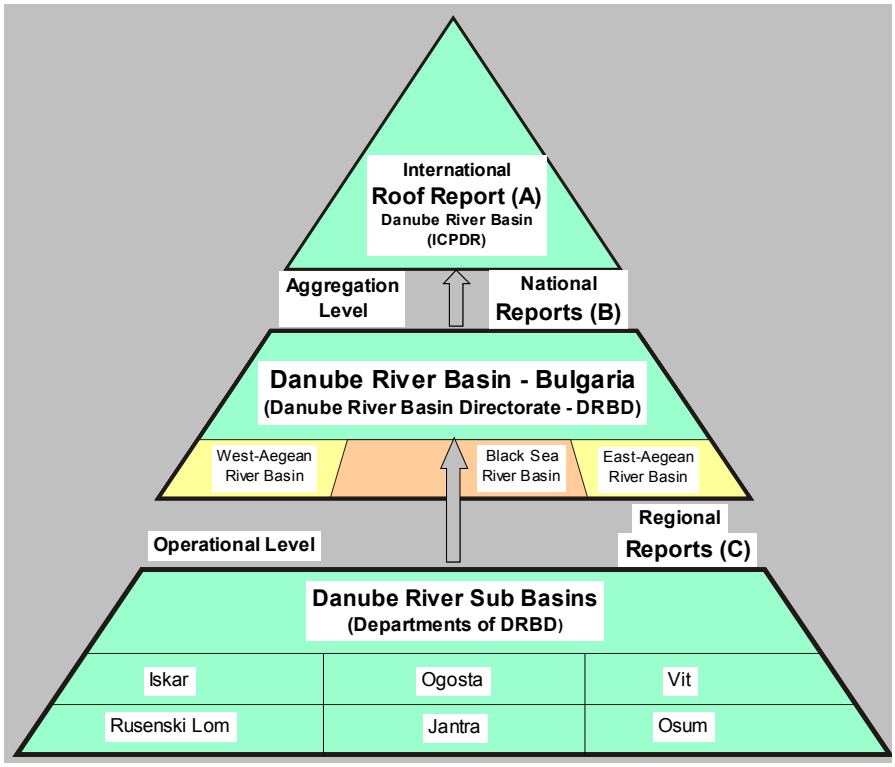


Figure 6: Levels of processing and reporting of the WFD in Bulgaria

5.6.1 ICPDR: Danube River Basin Analysis (WFD Roof Report 2004)

The International Commission for the Protection of the Danube River - ICPDR) presented a report on the inventory. (WFD Roof Report 2004 (A). Vienna, 18th March 2005) of the Danube River Basin

(www.icpdr.org/pls/danubis/danubis_db.dyn_navigator.show).

5.6.2 National report

The Bulgarian Ministry of Environment and Water and the River Basin Directorates prepare summary national reports (B) for the 4 River Basin Districts and present them to the European Commission.

5.6.3 Regional report

For the sub-basins (work areas) the River Basin Directorates prepare application-oriented regional reports (C) which form the basis for preparation and implementation of the programmes of measures and the management plans.

6. Technical Implementation

6.1 Inventory - Pressures

As per the CIS Guidance „Analysis of pressures and impacts“ the inventory has the task to cover activities connected with environment (driving forces), the pressures and their impacts. Significant pressures exist when they entail non-negligible impact on water. The impact of such pressures has to be checked whether it endangers the achievement of the objectives.

A main result of the inventory is the “Assessment of the achievement of objectives” for all water bodies.

The inventory of water for the purposes of the WFD covers running waters with river basins >=10 km², lakes with water surface $\geq$ 50 ha and the complete groundwater.

The inventory has to cover the boundaries and description of the catchment areas (Art. 5 WFD). It needs to include:

- The description of the characteristics and structure of water;
- The review of the impact of human activity on the status of surface waters and on groundwater;
- The economic analysis of water use.

Additionally, the areas which have been designated as requiring special protection under specific Community legislation have to be registered (Art. 6 WFD).

The recovery of the costs of water services, including environmental and resource costs, have to be shown, having regard to the economic analysis (Art. 9 WFD).

6.1.1 Surface water

6.1.1.1 Reference to WFD

According to Art 2 Nr. 10 WFD a surface water body is a „discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of stream, river or canal, a transitional water or a stretch of coastal water“.

6.1.1.2 Surface waters categorization

Surface water bodies are divided into the following types of surface water (see Annex II Nr. 1.1 (i) WFD):

- rivers
- lakes
- transitional waters and
- coastal waters

or

- Artificial Water Bodies = AWB respectively
- Heavily Modified Water Bodies = HMWB.

6.1.1.3 Characterization of River Basins

The characterization of river basins includes a typology of the surface waters. Typology offers the possibility for the differentiation of water bodies according to their relevant abiotic characteristics for their ecological functionality and their specific biocenoses. They serve as

the basis for obtaining and describing the specific reference conditions for specific types which are the point of reference for a later assessment of the status.

6.1.1.4 Surface waters typology

For the characterization and typology of surface waters in Bulgaria system A was up to now was applied. In future it will be replaced by system B, in order to obtain a more realistic picture of the water status.

For the typology a “top-down” method is used. The following steps need to be carried out:

- The application of the criteria of system A (for rivers: altitude, catchment size, geology and ecological region; for lakes: altitude, surface area size, depth, geology and ecological region)
- The selection of substantial biological parameters (different parameters in the various eco-regions)
- The selection of other parameters available in maps and databases (e.g., topographic maps, geology, soils, sediments, potential natural vegetation)
- The definition of types for the selected parameters
- Recommended: water landscape maps (sub eco-regions) to summarize the important and biologically significant parameters in “super parameters”
- The extension of the existing typology via the biologically significant parameters
- The definition of types, mainly for all components for water quality (partially with the necessary sub-classes for the description of referential conditions of the separate components)
- The first check of the existence of the types through expert judgment (if necessary, visit to the water bodies on spot)
- If necessary, the first modification of the typology
- The completion of system B
- Recommended: the making of maps for the types and the lakes

Further validation of the typology can be already carried out during the preparation of the database or during the monitoring (bottom down method). The development of System B by use of the “top down” method will take approximately 6 months. Validation using the “bottom up” method will approximately take between 1 and 2 years. For the transition period from system A to system B an expert team for technical and administrative tasks should be established.

6.1.1.4.1 Typology

The products following below have to be developed in the typology. They serve as a description of the water bodies, of the establishment of a monitoring network and for the development of the River Basin Management Plan.

1) System of the surface water types

   Systematic overview of all types of surface waters and description of the parameters and their class.

2) Nomenclature of the surface water types:

   The names serve for better understanding and acceptance of the types defined. They reflect their main characteristics. Additionally, individualized codes are applied.

3) Type description (Passport of the type)

   These “Passports” contribute to the description of the reference conditions. They contain the following characteristics:

   - Distribution and quantity of the types
   - Morphological aspects
   - Chemical composition of water
   - Hydrology
   - Biocenosis

4) Map of the water landscape

   By “water landscape” are meant homogenous regions with respect to topographic, geological, geomorphologic and pedologic characteristics. They represent the main appearance of a type. The maps can be digital or analogous. Expert opinions can also be of help. The maps are especially useful for differentiation of the types.

5) Maps of the types

   GIS technology can be applied for the preparation of maps relating types of surface water to WFD-relevant waters.

6.1.1.4.2 Reference conditions (type description)

According to Annex II WFD the type-specific hydro morphological and physico-chemical, as well as biocenosis - related reference conditions for very good ecological status shall be established for all types of running water and their respective reference sites shall be determined. The initial description of reference conditions is provided in the “passports”.

6.1.1.4.3 Criteria for delineation of the surface water bodies

The delineation of the surface water bodies (SWB) refers to the provisions of the CIS-Guidance Document „Identification of water bodies“ (EU-Commission 2003). The main criteria for the delineation of the SWB are listed in Table 4.

Table 4: Criteria for delineation of surface water bodies

(K1)	Water category (river, lake) resp.classifying (heavy modified, artificial)
(K2)	Specific water type
(K3)	River Basin District: Danube . . .
as per expert knowledge in case of necessity of substantial changes in the various pressure types, resp. their impact	
(E1)	physical characteristics (significant tributary)
(E2)	different pressures, respective their impact
as per organizational reasons	
(O1)	Water Bodies from part A of the report and the rest waters which are observed exclusively in part B of the report

The criteria do not depend on the classification of a water body as a river, lake or an artificial or heavily modified water body. They have to be applied in a way that avoids unjustifiable non-homogeneity of the characteristics and pressures on the SWB.

The first delineation of SWB is carried out in two steps. The first step consists in delineation according to the characteristics of water as per (K1) – (K3) as (E1) and (O1). In a second

step, these water bodies have to be differentiated again as to the types of pressure and their impact. (E2). In further planning stages the surface water bodies may be iteratively modified in their boundaries. The delineation of border waters or trans-boundary waters is performed after reaching inter-province or inter-state agreement.

Another principle of SWB delineation is that it shall not result in an ungovernably large number of SWB. The length of SWB in running waters should not exceed 5 km as a rule.

The possibility of unification of initially differentiated waterways into a single SWB should be checked. Even waterways of different rivers can be united in a single SWB, if they adhere to the following criteria:

- The division criteria (K1) to (K3) and (O1) do not allow for unification of multiple parts of a river into a single SWB
- The criteria (E1) and (E2) depend on the expert judgment and should be applied only in cases of “substantial changes”. Conversely, differentiated parts of a river can only be incorporated into a single SWB if a sufficient homogeneity of the SWB is preserved.
- Unification into a single SWB is only possible in short parts or tributaries of a river.

Additional unification of water types must not be undertaken, if:

- Large deviations in the grade of the saprobic index does not occur or occurs only in small amounts (a deviation by two or more grades is seen as large)
- The assessment of the achievement of eutrophy potential objective is largely identical in the unified water body.

No unification shall be carried out in the following cases:

- Where unification leads to non-homogenity in the use of water power in the SWB (leading to a significant change in the classification). In this case further differentiation into SWB has to be made, if necessary.
- Non-homogenic combination of areas of a different factual status relating to significant hydro morphological alterations.

In a single SWB several parts of a river can be unified which:

- Consecutively (possibly from different sides) flow into a larger water body;
- Are interrupted by water bodies from another category or class, such as:
  - ⇒ Elements of flowing water before or after a lake or
  - ⇒ Parts of waterways interrupted by a heavily modified water body.

6.1.1.5 Principles in the assessment of the achievement of the objectives

6.1.1.5.1 Approach

Several steps are needed to conclude the assessment of the achievement of the objectives:

Information collection:

1. Covering of the pressures (emissions) and their significance; it serves as additional information
2. Covering of the impact (imissions) in surface waters

6.1.1.5.2 Assessment

1. Assessment of the impact/s in relation to the water elements
2. Summary assessment in relation to surface water bodies.

The result of the information collection and the assessment is the assessment of the achievement of the objectives for flowing water in 4 assessment categories. According to the CIS-Guidance Document „Principles and Communication of Results of the first Analysis" it is not necessary to present an integral result for each separate water body.

It is sufficient to make an integral assessment of the achievement of the objectives with respect to the ecological status. The achievement is differentiated in four assessment categories to clarify the various problems and the reasons for them, but is also due to the different meaningfulness of the categories.

Of the four assessment categories two are indicators of biological changes, one evaluates the water chemistry, and the fourth shows the changes in the habitat. For classification as a "good status" water body, the biological and chemical quality components are crucial according to Annex V WFD. The hydro-morphological quality components are used additionally in the assessment if "good status" will (likely) not be achieved.

The combination of four incompatible categories in a summary assessment category is not seen as sensible.

The two assessment steps for evaluating the achievement of the objectives are conducted as follows:

1. Assessment of the achievement of the objectives in relation to the water elements

   For each part of the water body (about 500 m. to 1 km. as a rule, depending on the data situation) an assessment of objectives achievement in the four assessment categories is to be made

2. Assessment of the achievement of the objectives in relation to the surface water bodies

   The assessments for each part of the water body in the four assessment categories are integrated into an assessment of the achievement of the objectives for the entire SWB.

3. Assessment of the achievement of the objectives in relation to heavily modified water bodies

   The approach described above is applied in the same way for heavily modified water bodies.

The assessment of the achievement of the objectives so far does not differentiate according to whether the ecologic objective for the water body under Art. 4 WFD is a "good ecological status" or a "good ecological potential".

6.1.1.5.3 Assessment categories

The assessment of the achievement of the objectives of flowing water uses four assessment categories:

- (OGB) organic pressure (from substances that absorb oxygen)
- (PNS) biogenic substances
- (HMV) hydro-morphological alterations
- (SCS) specific chemical hazardous substances

The presence of migration barriers is included in the assessment of water by means of mapmaking of the structure and the additional data collection.

The relevant substances for assessing the chemical status in accordance with Annexes IX and X WFD are united with the relevant substances for assessing the ecological status in

accordance with Annex VIII in a single assessment category “specific chemical hazardous substances”.

The assessment for achievement of the objectives in each assessment category has to be made for all flowing waters (i.e., also for flowing waters classified as artificial or heavily modified).

Artificial flowing waters are often classified as “not likely to achieve the objectives” within the assessment category “hydro-moprohological alterations”.

6.1.1.6 Determination of pressures

6.1.1.6.1 Reference to WFD

It is necessary according to Art. 5 (1) WFD to conduct an analysis of the characteristics and the impact of human activities on the status of surface waters. The details of this inventory are given in Annex II of the WFD. The Guidance-Document of the European project 2.1 “Guidance on the Analysis of Pressures and Impacts” provides practical directions.

In principle, the substances leading to “significant pollutions” (Annex II No 1.4 of the WFD) have to be taken into account. Apart from the substances listed in Annex VIII (a list that does not cover all most important harmful substances), other substances have to be considered, if they lead to pollution. The definitions of Art. 2 No. 29 WFD “Hazardous substances” and Art. 2 No. 33 WFD “Pollution” have to be applied.

The Bulgarian institutions have prepared an inventory “Report on the implementation of the WFD in the field of water policy 2000/60/EG for the year 2004”; the manual includes these results. Necessary supplements to this report have to take into account:

- The next step after the inventory is the monitoring;
- The improvement of the inventory or the increase in data serves by way of intermediate assessment according to Annex II No. 1.5 WFD mainly an optimization of the monitoring.
- Each increase in data has to be optimized with regard to the conflict of present objective and the problems of work economy related with a step-by-step approach.

Art. 5 WFD requires the check of the impact of human activity on the surface water status, i.e. the substance and hydro-morphological pressures on flowing waters. According to Annex II 1.4 WFD substances pressure are the influxes from point sources and diffuse sources as well as the hydro-morphological pressure (water abstraction, morphological alterations and flow regulation). Any other kind of significant pressure is to be separately presented. The examination of emissions provides additional information for the assessment of the achievement of the objectives with respect to the substance pressure on flowing waters.

An important basis for the determination of significant pressures from point sources and diffuse sources are the existing Directives and the EU reports referring to pressures from point sources:

- The Urban Waste-water Treatment Directive (91/271/EEC),
- The Integrated Pollution Prevention Control Member States Directive (IPPC Directive.) (96/61/EC),

For the pressure from diffuse sources:

- The Nitrates Directive (91/676/EEC), The Plant Protection Products Directive (91/414/EEC), and the Biocides Directive(98/8/EC),

For the first River Basin Management Plan in both these areas:

- The Directive for Discharge of Certain Dangerous Substances (76/464/EEC),
- The Drinking Water Directive (75/440/EEC),
- The Directives for Fish Water (78/659/EEC) and Shellfish Water (79/923/EEC),
- The Bathing Water Directive (76/160/EEC).

6.1.1.6.2 Point Sources

6.1.1.6.2.1 Reference to WFD

Annex II 1.4 WFD requires covering of urban, industrial, agricultural and other discharges.

6.1.1.6.2.2 Methodical approach

Point sources of pollution from municipal and industrial discharges have been listed in the initial characterization of sites of above 2.000 equv. inhabitants. If discharges are not carried out through treatment plants or centrally, comprehensive quantitative data of pressure are not available. A large part of waste water is not directly discharged into surface water, but injected into the ground. If all waste water was actually discharged into surface water, the quality of surface water would be much poorer. If waste water is not discharged into surface water, it is a problable cause for the pollution of groundwater. In this case it is considered either a diffuse source pressure or a pollutant for „groundwater" according to chapter 6.1.2.

6.1.1.6.2.3 Required Reporting and Summary Actions

It is not expedient under the present conditions to precisely specify the existing emissions, because of the great costs associated with sampling. According to the guidelines to the WFD, the initial characterization shall use the available information, and if such information is not available, it should be collected at a later stage. To comply with the WFD requirements, the present sewerage systems and treatment plants will have to be extended according to the plans in the next years. This can lead to the definition of additional pressure on the surface water which has to be countered by the application of new prevention and treatment methods with regard to the „combined approach". The emphasis has therefore to be laid on the preparation and implementation of actual measures due to the pressing need for action rather than on an analysis of existing pressures. With regard to measures, a precise registration of emissions including significant discharges at less than 2.000 equiv. inhabitants and strategic thoughts on fulfilling of ecological quality standards of surface waters are indispensable.

Rainwater discharge problems are not treated in the initial characterization. The focus sould be on the planning of measures, especially the planning of the necessary facilities (i.e. the option of separated sewerage systems shall be considered for some smaller urban areas where such separation is economically justified).

Within the frame of the extension and/or completion of sewerage systems and treatment plants the development of a consumer software is indispensable to systematically collect and maintain important data for planning, operation parameters and waste water chemical characteristics. This product shall be used for storing and processing information regarding rainwater discharges. At a later stage it can be used for the next Programme of measures.

In further work steps the urban areas of below 2.000 equiv. inhabitants will have to be taken into account. The necessary structural data will therefore have to be collected (location, water use, inhabitants, industrial water consumption etc). This activity will involve cooperation with local municipalities, regional government, industrial enterprises and small businesses, who operate in the catchment areas of the respective body of water.

Table 5: Significant Pressures – Surface Water

Significant Pressure		Bulgarian Approach and Actions	Suggestions for changes		Notes	
	2	3	5		6	
1	Point Sources	urban areas with waste water treatment plant urban areas without waste water treatment plant, but having sewerage system (> 2.000 equiv. inhab.) Industrial waste water with and without treatment	Parameters/data examination of annexes V, VIII, IX, X as regards their significance/ sustainability (under Regulation No 6 of 2000).		Model methods to be applied in the future for pressure analisys, for ex. MONERIS Urban areas with < 2.000 equiv.inhab. shall be taken into consideration if necessary if data are available	
2	Diffuse Sources	Industrial areas without waste water treatment plant and sewerage (> 2.000 equiv.inhab.) Industrial areas without sewerage Non insulated dung-hills (> 2.000 equiv. inhab.)	Registration and identification of abandoned dung-hills Abandoned industrial areas, closed down industrial polluted fields Closed down military areas, factories and explosive production sites	Parameters examination in accordance with Annexes V, VIII, IX, X as regards their significance		Abandoned dunghills, closed down industrial areas, non-insulated dunghills and promiscuous/ unregulated dunghills are point sources of pollution of groundwater
3	Water Use	Map of available water use Water use permits register Environmental impact assessment – EIA if necessary Compliance with Order РД-1383 for the minimal river water flow	Systematic researches and inventory of water use according to criteria in Order РД-1383 Water use for small Water Power Plants, water mills etc			
4	Flow regulation	Up to now: no data for barriers (dam walls, Water Power Plant) and their importance for the river water flow	Weirs (facilities for regulation of water flow for Water Power Plants) Waterfalls (facilities supporting riverbeds) Drainpipes		Information can be obtained in the form of secondary data (maps, riverbed maintenance, flood protection etc)	
5	Morpho-logical Modifi-cations	Up to now: no data available for morphological modifications	Evaporation of river section > 70 % of the length of the body of water Conserved bank > 70 % of the length of the body of water Bails/draining with or without sediment removal			

Table 6: Basic data for rainwater overflow facilities

Nr.	Necessary information	Note
1	Name of the installation	
2	Installation operator	
3	Identification number	
4	County, municipality, residential area	
5	Used water	
6	Water code	
7	County code	Water body number
8	MNQ (mean low quantity) of water above the discharge point	The data should be separately collected
9	Coordinates of the discharge point	
10	Treatment (e.g., filtering installation)	For instance, soil filter
11	Type of installation	Through-flowing basin, over-flow facility for rainwater, etc..
12	Drained surface of the catchment area [ha]	
13	Settlement area of the river basin (Ared,)	Sealed areas (ha)
14	Basin of the river above the discharge point (Aeo)	ha
15	Number of inhabitants in the catchment area	E
16	Number of population equivalent (p.e.) in the catchment area	EW
17	Waste water outflow (QS)	l/s
18	inflow in drying-up periods (Qt)	l/s
19	Throttled-down outflow (behind the overflow structure) to the waste water treatment structure (Qab)	l/s
20	longest time of flowing in a canal (tf)	min
21	Retention basin volume	m^3
22	Discharging load	CSB or similar, (kg/(ha*Year))
23	Duration of discharging	Hours/Year
24	Discharging frequency	1/Year

Table 7: Necessary activities at working level – Point sources

Nr.	Working step	Who?	(Intermediate) product (map, table, text/graphics)	Data location, notes
1	Determination of unit to which the information for electronic processing is to be sent, for municipal and industrial plants for waste water treatment and discharge of rainwater	MoEW	Concept for realization of the system for electronic processing	
2	Development of electronic information system "Municipal waste water treatment structures"	unknown	Table of the existing waste water treatment structures and cartographic presentation, available	Basin directorates
3	Development of electronic information system „Industrial waste water treatment structures"	unknown	Table of the existing waste water treatment structures and cartographic presentation, available	Basin directorates
4	Development of electronic information system„Discharge of rainwater "	unknown	Tables and maps	If necessary this electronic information system may be integrated within the system of the municipal and industrial structures
5	Input of the information and maintenance of the information system by the competent bodies	unknown	Complete and up-to-date information	Covering of all discharges
6	Data assessment, preparation of working documentation for further implementation of the WFD	MoEW	End product	
7	Text documentation for the results, products	MoEW	Text	
8	New mode for collection and treatment of waste waters, it is necessary to cover municipalities with < 2.000 equivalent inhabitants	Basin directorates		Data input in the IT processing system

6.1.1.6.3 Diffuse sources

6.1.1.6.3.1 Reference to WFD

Annex II 1.4 WFD requires identification of diffuse source pollutants coming from domestic, industrial, agriculture and other facilities and activities.

6.1.1.6.3.2 Methodical approach

For the purposes of the initial characterization urban areas and industrial facilities without sewerage, domestic and construction solid waste landfills are defined as diffuse sources. The pressure quality however is not given a definition. The pressure on surface water by such sources cannot be excluded, but, as a rule, it has to be identified first at this point since the pressure is exerted through groundwater.

Diffuse pressure can be described as follows:

- For substances introduced by diffusion the crucial factor are biogenetic substances, pesticides (plant protection preparations) and heavy metals
- Diffuse nitrogen pressure of surface water is mainly influenced by the groundwater flow (dissolved substances)
- Diffuse phosphorus pressure of surface water is mainly caused by erosion (particle-based introduction)

- Biogenetic loads caused by diffuse pressure can provoke eutrofication of coastal waters, even if inland water is not affected
- Remote pressures/pollutants can cause a diffuse pressure

On the basis of various research programmes the following groups of substances have been identified as possible causes of a reduction in water quality:

(1) disoxygenating substances
(2) biogenetic substances
(3) metals
(4) high-volatile haloid hydrocarbons
(5) high-volatile aromatic hydrocarbons (benzene, thulol, …)
(6) polycyclic aromatic hydrocarbons
(7) polychlorinated biphenyls
(8) plant protection preparations - pesticides
(9) acid producing substances
(10) salts

Table 8: Model List of other diffuse sources of regional importance

A quantitative representation of these connections is difficult. The approach suggested here should be considered as a proposal as there are other methods and models for identification, modeling and forecasting of loads and impacts.

Designation	Important substances	Importance for the Region	Note
1	2	3	4
drains	plant protection preparations, biogenetic substances, metals		insufficient data, as a rule
raise in acidity through the impact of substances in the air?		e.g. in the source area	cartographic coverage of areas threatened with acidity raise
remote pollutants		immediate vicinity of water	Non operational enterprises
mining	respective substances and typical values		distinguishment between natural load and anthropogenetic pressure
Shooting galleries, military bases or ranges	Sb, As, Pb, ...	immediate vicinity of water	

1. Calculation of diffuse loads based on collected immission data subtracting point loads. This allows at least an approximation of the extent of the diffuse load.

2. The application of a load model for nitrogen and phosphorus. The MONERIS model has already been applied in the Danube River Basin. It seems appropriate to apply MONERIS to the two parameters for a further differentiation of surface waters. The use of MONERIS does not replace the problem of data availability. Data availability, data collection and the expediency of assumptions should be discussed in detail using the MONERIS input data list. The need of MONERIS data marks the minimum quantity of data required for implementing the WFD.

Other diffuse pressure potentials have to be identified by expert judgment if necessary. The emission method referred to in item 1 should be applied wherever possible for a quantitative assessment including the validation of MONERIS data.

Table 9: Operational steps – Diffuse Sources

No	Action Step	Executor	Output	Remark
1	Application of the immission method	EEA, Basin Directorate	quantitative information for diffuse pressure	Processing related to row 1
2	Collecting data as regards MONERIS or another model	EEA, Basin Directorate	tables of current pressure, description of river basins and hydrological data	EEA, Basin Directorate and other units
3	Assessment of pressure resulting potential on the basis of expert judgement	Basin Directorate		Processing related to row 2
4	Application of MONERIS	IGB Berlin	N and P substances flow	Basin Directorate
5	Independent continuation and particularization with MONERIS implementation by a Bulgarian institution	decision by the MoEW		

6.1.1.6.3.3 Required Reporting and Summary Actions

Table 10 lists the necessary activities for covering the diffuse sources:

Table 10: Necessary activities at working level – diffuse sources

No	Working step	Who?	(Intermediate) product (map, table, text/graphics)	Data location, notes
1	Expert resolutions for significant parameters	Basin directorates		Processing in connection with line 2
2	Application of the immission method	EEA, Basin directorates	Quantitative information for diffuse loadings	Processing in connection with line 1
3	Collection of data for MONERIS	EEA, Basin directorates	Table of existing loadings, description of the river basin, hydrological data	EEA, Basin directorates and other units
4	Application of MONERIS	IGB Berlin	Movement of the substances N and P	Basin directorates
5	Independent continuation and particularization of MONERIS application on the part of the Bulgarian institution	Resolution of MoEW		

Other substances which might be of (regional) importance are remote pollutants and/or hazardous soil pollutions (including landfills, incidents and other damages),pollutions in abandoned mining facilities or a significant dry or wet atmospheric sediment. Information on these sources has to be included in the inventory (cf. Table 11).

Table 11: Other diffuse sources of regional significance that may cause pollutions (Examples)

Indication	Determining for the following substances	Regional significance	Note
Shooting grounds	Sb, As, Pb, ...	In immediate proximity to waters	
Mines	Respective substances and parameters		Differentiation between geogenic and anthropogenic pressure
Old pollutants		In immediate proximity to water	
Acidy level increasing		For instance, in the area of the spring	Cartographic covering of the regions endangered by increased acidity levels
Drainage	Plant protection preparations, biogenic substances, metals		Generally bad situation with respect to data
.....			

6.1.1.6.4 Water abstraction

6.1.1.6.4.1 Reference to WFD

Annex II 1.4 WFD covers the revision and coverage of domestic, industrial, agricultural, hydro-energetic and other water uses. Due consideration has to be accorded to seasonal variations and water losses, if supported at this stage by sufficient data. This can be provided for in future activities and programmes.

6.1.1.6.4.2 Methodical approach

Water abstraction (all types of it) requires a permit for the whole country. Order No. 1383 of 18.11.2003 regulating the allowed minimum flow issued by the MEW provides for the minimum flow in riverbeds with regard to their ecological status. Necessary additional information on water abstraction are:

(1) „smaller" water abstractions, this term is synchronized with the WFD requirements

(2) check on the minimum flow in rivers in accordance with Order No. 1383

The significance/impact of «parts of low water» (meaning dried-up rivers) on the components of ecological status is not fully examined. It is therefore initially sufficient to examine for their fish stock only some parts which dry out on a periodic basis or which carry little water. Based on these findings a decision has to be taken about which information on «parts of low water» needs to be additionally collected. It is recommended to carry out additional data collection after such parts of rivers have been examined and the pressure and impact have been assessed. Many abstractions are related to dam facilities and the problem of passage, so collection of additional information is indispensable.

6.1.1.6.4.3 Required Reporting and Summary Actions

Additional data collection after the examination of the relevance of „parts of low water". Observance of the interdependence of conductivity and morphological alterations (see Table 12).

Table 12: Operational Steps – Water Abstraction

No	Action Step	Executor	Output
1	Registration of significant water uses Checking up the completeness of the available information	Basin Directorates	tables containing coordinates of location and description of the quantity, type of water use, limit thereof as per the water flow, use and type of impact e.g. fish stock map „Water abstractions" (GIS)/water abstractions and water use
2	A sample examination of some water poor areas river sections / WB	BD	report and recommendation maps
3	Putting collected data in compliance with the requirements of Order No 1383	BD	Comparative tables or map
4	Report drafting	BD	Report, tables

6.1.1.6.5 Flow regulation

6.1.1.6.5.1 Reference to WFD

Annex II 1.4 WFD requires to identify significant flow regulations including transfer and diversion of water from one river valley or sub-river valley to another as well as an assessment of its impact on the water balance.

6.1.1.6.5.2 Methodical approach

Construction facilities and measures causing flow are artificial lakes, flood prevention reservoirs, bottlenecks, bed construction facilities etc. Such measures are related to the alteration in morphology and hydrology and exert a strong impact on water organisms. A particular strong impact is that of barrier facilities as they interrupt the conductivity of water organisms which are unable to pass these barriers. The basic comparative figure for the significance of flow regulation is the «natural flow regime».

A summary is presented in Table 13.

Table 13: Constructed structures, flow regulation measures and their impact

Construction facility	Task	Impact
artificial lake	Storage of abstraction water (potable water, irrigation)	General: Interrupting the passage of migrating organisms, damage to the sediment, fluctuations in water levels. Bottom sluice – impact on water in the bottoms: changes in temperature balance, raise of biogenetic substances through liberation of P in the stagnation phase
artificial lake	Storage of abstraction water (potable water, irrigation)	On the bottom waters: decrease in the flow volume, problems with the sanitary minimum (importance compared to unaffected conditions)
artificial lake	compensation of low water (more maintaining irrigation and WPP use in summer time)	Bottom water: disturbance in flow and temperature regime by short term strong flow fluctuations ; combining fish fauna and invertebrates (significance as compared to unaffected conditions)
artificial lake	stem of high water, protection against high water	Bottom water: reduce the frequency of bottom formation flow, clay formation (significance as compared to unaffected conditions)
flow from draining tubes, ditches	draining agricultural plains	Increase in flow volume (significance as compared to unaffected conditions), reduce the level of groundwater
artificial lakes on rivers	„river treatment plants“ = increase in the level of self purification by an extended stay period, recreation use, fishery, stemming high water	Passage interruption, sedimentation, eutrofication
WPP with turbine in the main stream	electricity production	Passage interruption, disturbance in sedimentation, in influx operational regime combining biocenose through treatment and moving
WPP with draining channel	electricity production	see above+ sanitary minimum issue
transfer from/into another river basin	protection against high water , supply of potable and domestic water, irrigation	Dependence on the local situation (significance as compared to unaffected conditions)

6.1.1.6.5.3 Required Reports and Summary Actions

Initial characterization has so far not taken flow regulation of surface waters by barrier construction facilities (except big artificial lakes) into account which makes it necessary to collect additional information, file such information and include it into the water analysis and assessment. With regard to the assessment of flow regulation and morphological alteration the available information is heterogeneous. Construction facilities with the characteristics indicated below have to be considered as endangering the good status of a water body:

(1) smooth falls, very steep falls higher than 30 cm without effective support facilities to the conductivity of migrating organisms (fish and macrozoobents).

(2) strong bottlenecking which leads to at least 20% of the water body having no flow at average water level.

(3) barriers interrupting natural migration of organisms are always a threat to the good status of water. This also refers barriers located downriver which make the passage of migrating fish upstream impossible.

(4) smooth tubes longer than 50 m, tubes with sediment longer than 100 m are also considered significant barriers to migration. Derivations in length have to be estimated according to national particularities.

Table 14 lists the necessary activities at working level regarding flow regulation.

Table 14: Operational steps – Flow Regulation

No	Action Step	Executor	Result	Remark
1	Determination of flow regulating construction facilities	Basin Directorate		This shall be preceded by planning a decision for electronic processing
2	Drafting a List of Water flow Regulating Construction Facilities, towards the body of water. Juxtaposing each construction facility with systematization of table 4 Juxtaposing with data contained in table 4 Assessment of the passability for fishes	Basin Directorate	Table containing coordinates of location and description of some more significant data related to construction facilities Elaboration of a thematic map „Flow Regulation“ (GIS)	Contacting, coordinating and joint actions with other interested institutions, if necessary.
3	Documentation for covered construction facilities and data set out according to the abovementioned significant criteria	Basin Directorate	Report	clarification report

6.1.1.6.6 Morphological alterations

6.1.1.6.6.1 Reference to WFD

Annex II 1.4 WFD requires the identification of significant morphological alterations to water bodies.

6.1.1.6.6.2 Methodical approach

Hydro-morphological alterations are as important for many rivers with regard to their ecological status as the load caused by hazardous and biogenetic substances. They often deprive water organisms of their living environment and their access to nutrition substances, consequently their chance to survive.

Table 15: Criteria for significant morphological alterations

	Topic/Thematic map	Criteria for pressures	Comments
1. General information			
Delineation of water bodies	Water body: Surface water/rivers, includes typology, Lake Segment, Water body: Surface water/lakes		
2. Pressures			
Significant morphological alterations	Morphological alteration	straightening > 70% of water body length bank fixation > 70 % of water body length dredging with and without removal of sediments expert judgment	Up to now: no on site data on morphological alterations available. Therefore, information may be derived from secondary information (maps, river bed maintenance, flood protection works etc.)
Significant flow regulations	Flow regulation	Permanent impoundment, dam, weir and relevant installations located in respective water body backwater length > 500 m - 1 km passages and pipe installation > 300 m expert judgment	Systematical survey and inventory on water abstractions according to the criteria of Ordinance 1383 Abstractions for (small) hydroelectric power stations, mills. Identification of water bodies are not yet in accordance with Ordinance 1383.
Significant water abstractions	Water abstractions	(1) water extraction by hydropower stations, abstraction point with residual discharge < 1/3 of mean low flow) (2) water abstraction for industrial and agricultural use > 1/3 of mean low flow)	Up to now: no data on barriers (dams, hydro power) and their significance for continuity of water flow in river systems
3. Risk assessment			
1. Water bodies not at risk	“one out-all out” approach is proposed		
2. Water bodies at risk			

6.1.1.6.6.3 Necessary activities at reporting level and information collection

The subsidiary value „riverbed line“ has to be covered through the level of curve (ratio of the river length to the length of the riverbed line).

No data is available so far regarding water morphology, i.e. water structure. Where the water structure is mapped, a simplified method can be applied indirectly identifying the water structure through the “riverbed line”. Water structure data assessment indicates that many descriptive parameters of water structure (e.g. fortifications of river bottom, riverbank, pools, rapids, coast collapse) are in interdependence with the riverbed line. This is a result from the fact that waters with corrected riverbeds do not have many water structures which are formed by natural processes such as erosion or sediments (e.g. coast collapse, low-pitched coast from the inner side of a river elbow). Moreover, due to shortening flow length (=> increase in slope and flow speed), this water suffers from in-depth erosion with negative impact, such as reducing the level of groundwater or fortification of bottom and riverbanks so as to avoid side and in-depth erosions.

Therefore the riverbed line can be used as an indicator for the water structure, since rivers with a right bed, as a rule, have a poorer water structure, while rivers with naturally curved beds, as a rule, have a better water structure. Thus an assessment can be done if a river section is expected to achieve the "good ecological status" („risk assessment“), but these subsidiary values cannot be used to define the existing specific deficits and what kind of measures should be undertaken for the improvement of the environmental status. With a view to undertaking these next steps, required by the WFD („gap analysis“, „programme of measures“), the real water structure has to be mapped. It is recommended to apply one “on the spot method”, registering those parameters which are important for co-communities, such as bottom substratum or eventual pools and rapids.

For the identification of the morphological alteration with a view to the WFD objectives, different assessment criteria are introduced for the water bodies:

(1) if the share of morphological modification is below 30% for the whole water body, an assumption is to be made that there are no permanent morphological damages caused to the whole water body.
(2) if more than 70% of the length of the body of water has a heavily modified morphology, an assumption is to be made that the water body will not be able to achieve the good ecological status.
(3) if the share is between 30% and 70%, the situation is not clear and the significance of morphological alteration needs to be checked by a follow-up monitoring.

Criteria to be applied are:

(4) flow development alteration, longitudinal profile, cross profile, bottom structure and coastal structure.
(5) strong limitations of „riverbed dynamics”.

The following shall be taken into account when describing in essence the riverbed line (see Figure 7):

The riverbed line is described through a sinuosity coefficient: sinuosity coefficient = channel length / valley length („river sinuosity = channel length / valley length“, see figure, CL = channel length , VL = valley length, DD = air line).

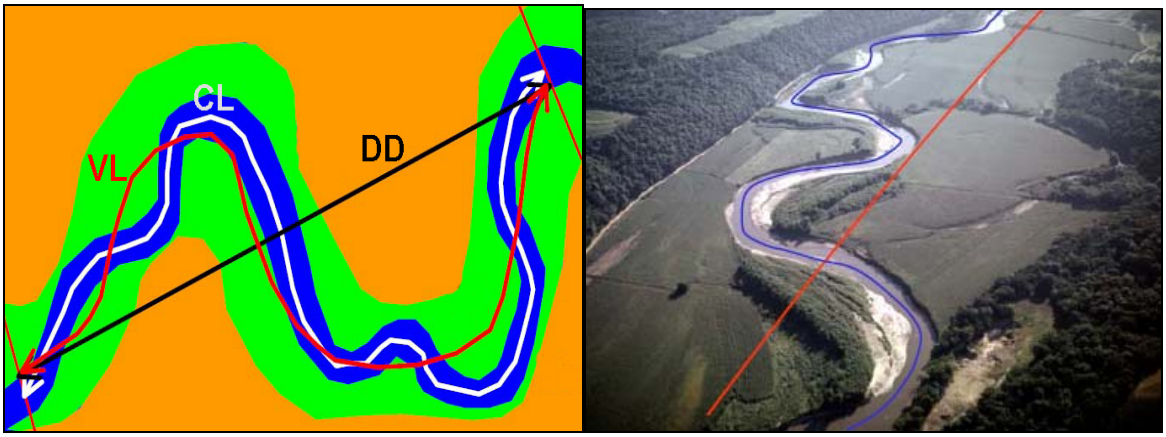


Figure 7: Sinuosity coefficient (Scheme)

Sinuosity is usually classified in Table 16.

Table 16: Sinousity

Water basin line	Sinuosity
Straight line	~ 1,0
Corrected riverbed	1,0 1- 1,05
Slight curves	1,06 - 1,25
With curves	1,26 - 1,5
Sinuosity	1,51 - 2,0
Strongly expressed sinuosity	> 2

When identifying the sinuosity coefficient, it should be noted that on small-scaled maps the flow line is presented in principal and, in comparison with the natural state, the flow length appears to be very short, therefore, the sinuosity coefficient is lower. Therefore the sinuosity coefficient has to be determined on evenly scaled maps and comparative clarification of details. To achieve a sufficient level of precision, the sinuosity coefficient is to be determined for rivers with a width of about 5 m on maps scaled ≥1:5000. The sinuosity coefficient of big rivers can be determined with a sufficient level of precision on maps scaled ≥1:25.000.

The examined river sections must have at least one full sinuosity (air line in the figure above, i.e. sinuosity length), otherwise a very low sinuosity coefficient will be arrived at. Since meandering length is different for each type of water, no single value can be given, but, as a rule, it is supposed to be about 7-10 times the river width.

Table 17: Operational steps – Morphological Alterations

No	Action Step	Who?	(Intermediate) Product (map, table, text/graphic)	Data, file location, remarks
1	Examination of river sections where inert materials are precipitated and extracted, respectively regular excavation works to facilitate navigation Examination of river sections, covered by dikes from both sides Assessment of the actual sinuosity level Examination of river sections, mostly in urban areas, where, because of the protective measures against high water, rivers have a deeper bottom or the riverbed or banks are massively fortified Expertise based examination of other significant morphologic	Basin Directorate	GIS-maps of the 5 categories of morphological alterations under discussion As regards category 5 „other significant morphological alterations", the clarification report shall contain criteria and justification of such a decision.	
2	Determination of the share in percentage of morphologically affected sections of running water in respect to the length of the body of water. Juxtaposing results of importance areas: < 30 %, 30 % to 70 % and > 70 % morphologically affected sections of run Evaluating if achieving the good ecological status objective is endangered by morphological alterations.	Basin Directorate	Presenting in GIS of bodies of water rated in respect to the achievement of the good ecological status on the basis of the morphological assessment as: feasible not defined unfeasible	
3	Compiling a clarification report to be attached to data determination and map of results.	Basin Directorate	Report	

Operative steps to determine sinuosity coefficient are:

(1) preparation of appropriately scaled maps

(2) determination of the minimal length of river sections to be processed (river length in the section of one sinuosity length)

(3) digital presentation of the valley line

(4) digital presentation of the river line

(5) calculation of the real sinuosity coefficient as a ratio between river flow length to valley line length.

6.1.1.6.7 Other anthropogenic pressures

6.1.1.6.7.1 Reference to WFD

Annex II 1.4 WFD provides for identification of (all) other significant impacts on water status

6.1.1.6.7.2 Methodical approach

Other significant impacts are pressures of regional importance which do exert pressure on water. A short list of such loads is contained in Table 18 .

Table 18: Other anthropogenic pressures that may cause impacts

Nomination	Important for the following pressure factors	Regional Importance
Navigation, including maintenance of water ways	Pollution with various substances, morphological load	navigation water
Use as breeding pools	Pollution with various substances, morphological load, physical load (thaws, evaporation)	river basins or river sections
Use of water for recreation and sport	Pollution with various substances, morphological load	Sport water
Radiation from nuclear facilities	physical load	Water as water recipient

6.1.1.6.7.3 Required Reporting and Summary Actions

Table 19: Necessary activities at working level – other anthropogenic pressures

No	Action Step	Executor	Output	Remark
1	Inventory list of other significant loads caused by other anthopogenetic impacts (examples according to Table 8)	Basin Directorate, municipalities, sport and recreation facilities operator	Tables of use, coordinates of water sections	Legislative procedures for protection of environment and water use
2	Elaboration of maps	Basin Directorate	Map of significant water sections	
3	Report writing	Basin Directorate	Report, tables	

6.1.1.6.8 Structure of land use

6.1.1.6.8.1 Reference to WFD

Annex II 1.4 WFD provides for an estimation of land use patterns in accordance with Table 21 with regard to the impact they exert on water.

6.1.1.6.8.2 Methodical approach

The type and size of land use provides information for various activities with an impact on the environment. The following forms of land use are considered:

Table 20: Land Use Patterns

Body of water No	Land Use under Annex II item 1.4 of the WFD [%]				Other types of land use [%]
	urban	(production) industrial	agricultural	forest	
1	2	3	4	5	6

6.1.1.6.8.3 Necessary activities at the reporting level and information collection

Table 21: Operational Steps at working level - structure of land use

No	Action Step	Executor	Output	Remark
1	Identification of WB	Basin Directorate	map of bodies of water	Elaboration of a digital with WB
2	Use of CORINE data	Environmental and Water Executive Agency	digital data	Landsat Progamme
3	Determination of the percentage allocation of land use in the catchment area of each WB	Environmental and Water Executive Agency	Table of land use and bodies of water compilation map	

6.1.2 Groundwater

The WFD uses an integrating approach founded on river basin districts. The inventory of the groundwater consequently requires an examination of large, representative areas, i.e. use a regionalized approach.

6.1.2.1 Delineation of groundwater bodies

6.1.2.1.1 Reference to WFD

According to Art. 2 (12) WFD a groundwater body is a „distinct volume of groundwater within an aquifer or aquifers". The demarcation of groundwater bodies should correspond to a certain extent to the demarcation of surface waters as according to Art. 3 (1) WFD " where groundwaters do not fully follow a particular river basin they shall be identified and assigned to the nearest or most appropriate river basin district or districts."

The contour delineation of groundwater bodies in Bulgaria is carried according to Strategy for Implementation of WFD (2000/60/EC) Water Bodies Identification (Horizontal guide for application of the term "water body" within the WFD context).

Groundwater bodies should be delineated in such a way as to allow appropriate description of the quantitative and qualitative condition of groundwater. The quantitative condition should be reliably assessed – by means of using long-period monitoring data or by calculation of the water balance so that the flow from body to another is negligibly small or so it could be assessed independently as a balance component. The Member States should account for specific peculiarities of the separate water-bearing horizons delineating the bodies.

Therefore, it is recommended as a starting point to begin with the geological boundaries of the water body, then to proceed with the differentiation by other hydrogeological boundaries - groundwater divides, groundwater levels, groundwater flow lines, etc.

Every groundwater body is a separate unit irrespective of the availability of one or more leaking on the ground surface.

6.1.2.1.2 Methodical approach

In the delineation of groundwater bodies the criteria developed by the respective Dutch project, which follow the Horizontal guidance document, were applied. Based on this, the interrelation between surface waters and groundwater were taken into account in the analysis of the qualitative and quantitative status and for the preparation of the risk assessment of groundwater bodies.

The monitoring programmes and the programmes of measures differ from the Dutch project as they refer, in the first place, to the shallowest strata of the aquifers and to the zones of disclosure of groundwater bodies.

6.1.2.1.3 Basics

Hydrogeological description of the surface, geological and hydrogeological maps serve as the foundation of the delineation. They are available in the form of databases and GIS layers, e.g. GIS vector maps of surface catchment areas of the rivers up to the second order are available in the Executive Environmental Agency. They are used for delineation of the recharge zones and for the connection with surface waters.

Examples of data used: Geological map (GIS vector map, scale 1:100 000), hydrogeological maps (GIS, scale 1:500 000 scalar map), hydrogeological description of the surface.

6.1.2.1.4 Required Reporting and Summary Actions

For the report and information collection are envisaged the following maps:

- Map of groundwater bodies
- Map of the recharge zones of the groundwater bodies
- Map of the recharge zones of the groundwater bodies with the groundwater bodies contours.

For the river basins comprehensive maps should be available of the groundwater bodies spreading, i.e. groundwater bodies reaching the surface should entirely be presented in a map. Groundwater bodies located at deeper levels should also be presented in a map. Such a presentation allows the pinpointing of incomplete data.

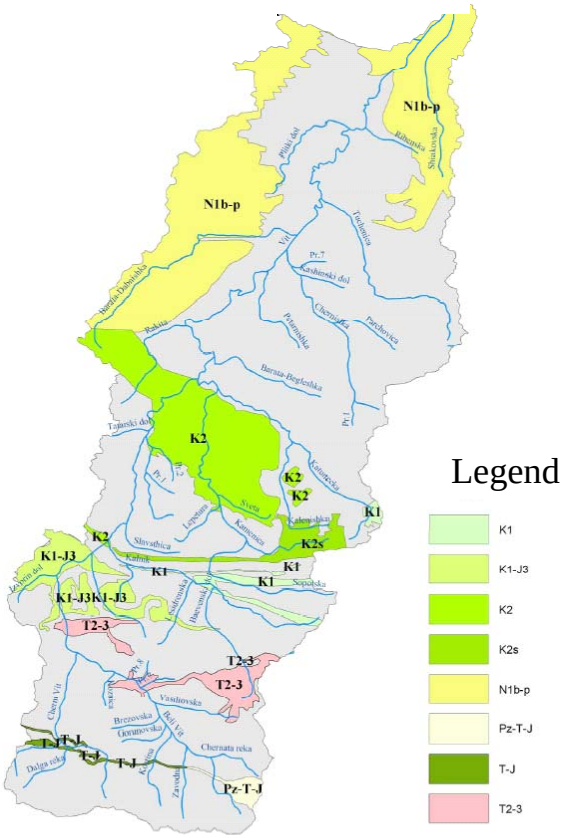
It is advisable to use geo-referential data which should be available in the form of database at one of the relevant institutions, if possible.

Table 22: Necessary activities at working level – delineation of groundwater bodies

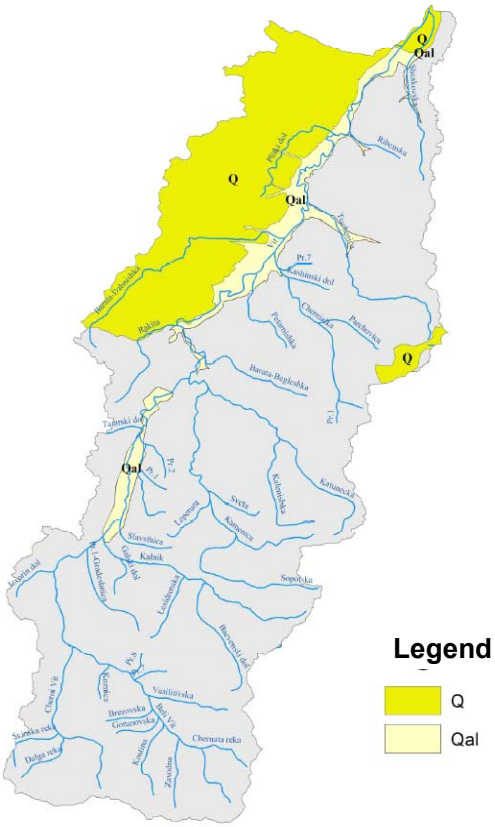
No	*Working step*	*Who?*	*(Intermediate) product (map, table, text, graphics)*	*Data / location*
1	Determination of the groundwater bodies and their digital representation in the groundwater bodies database	Updating of the work completed by EEA under Dutch Project (Geological Institute of the Bulgarian Academy of Science - sub-contractor)	GIS vector layers, attribute tables	GIS, Oracle, Access-databases and EEA
2	River basins, GIS layer	MoEW	GIS Vector-Layers	GIS server Basin directorate and EEA
3	Geological map	Made to order of the Committee for geology and mineral resources (now part of the MoEW)	GIS vector map scale 1:100 000	GIS server Geofund
3´	Hydrogeological map	Made following to an order by CGMR Scanned and geo-referred under the Dutch project in the EEA	GIS scalar map in scale 1:100 000	EEA
4	Groundwater bodies as GIS layers for different strata	Made under the Dutch project in the EEA	GIS vector layers - 8	GIS server, EEA, BD
5	Overlapping of thematic layers 2+4. Common presentation (overlapping) of river basins (hydrogeo-logical sub-basins) and groundwater bodies	EEA	End product	GIS server
6	Text documentation for preparation of the end products	EEA text	End product - text	
7	Preparation of specific table-form descriptions of the reports for the registered starting point status including statistical data (surface, geology/ hydrogeology, etc.)	In the EEA under the Dutch project	GIS and attribute tables - areas of surface water bodies, percentage of land use, GIS - with surface catchment areas.	Table with data referring to GIS projects

Examples of implementation

1. Groundwater bodies in upper Cretaceous aquifer in the Vit catchment area



2. Groundwater bodies in Quaternary aquifer in the Vit catchment area



6.1.2.2 Characterization of groundwater bodies

6.1.2.2.1 Reference to WFD

For the initial and further characterization under the WFD a general description of the hydrogeological, geological, pedological, and stratigraphic characteristics of the groundwater bodies is required.

Additionally, Annex II 2.1 WFD requires the identification of the general character of the overlaying strata of groundwater in each catchment area. This means that surface sediments (usually erosion material with low depth on hard rock close to the quaternary sediments) and the so-called covering layers (all rocks within the unsaturated zone over groundwater) are to be characterized.

6.1.2.2.2 Methodical approach

For the initial characterization of groundwater bodies a geological description of the water – embedding environment (the database comprising the relevant characteristics is complete), petrography (lithography), stratigraphy description, etc. had to be made. A completed database with these characteristics using vector geological map with size between 1:100 000 data from the hydrogeological map with size 1:200 000, Geofund Cadastre, EEA and archive geological data is available.

The database contains information on each separate groundwater body information about its filtration coefficient, porosity, amplitude in the groundwater level, average, minimal and maximal depths of the groundwater as from the surface, width etc. These thematic layers are not yet represented as GIS layer due to which they have to be unified in a map of hydrogeological units or in a combined map (e.g., type of rocks + permeability = type of aquifer).

The clarification texts in the reports describe additionally the hydrogeological character of the rock units.

Information on the character of the overlaying strata can be obtained from existing geological and soil maps and can be presented as a map of the vulnerability of groundwater to pollution or of the protection properties of the overlaying strata against groundwater pollution. The map of the overlaying strata of the groundwater is in the process of being generated with data from the database or by assessment of geological units, the maps on„Depth to GWB“ (distance to the surface), „Lithology“ and “Field Capacity”. Data is available in the EEA and in the Danube River Basin Directorate - Pleven with the necessary parameters and a description of the minimal, maximal and average depth of the overlaying strata for each groundwater body.

6.1.2.2.3 Basics

Central data storage and GIS processing

- Database for groundwater bodies under Access
- Database under ORACLE in the EEA
- Geological maps (vector GIS map of the scale of 1:100 000)
- Hydrogeological maps (scalar GIS map of the scale of 1:200 000) and
- Soil maps exist as GIS layers.

6.1.2.2.4 Required Reporting and Summary Actions

- The Making of the map „Hydrogeological characterization of groundwater bodies” with single thematic layers
- The Making of detailed maps for the sub-basins
- The Making of the map „Characterization of overlaying strata“

The maps should be explained by texts.

Table 23: Necessary activities at working level – characterization of groundwater bodies

No	Working step	Who?	(Intermediate) product (map, table, text/graphics)	Data location Remarks
1	Database of Groundwater Bodies	Basin Directorates	database	ACCESS Database
2	Generating of hydrogeological map with different thematic layers for DRBD	Basin Directorates	map	GIS-Server
3	Development of short text descriptions	Basin Directorates	texts	
4	Making of map "Characterization of overlaying strata" with division of the protection properties of overlaying strata into "favourable-average-unfavourable"	Basin Directorates	map	GIS-Server
5	Statistical assessment of the separate degrees of protection property for groundwater body	Basin Directorates	table	GIS-Server

On 19th September 2003 the “Directive of the European Parliament and Council for protection of groundwater from pollution” was developed as a daughter Directive of the WFD. It regulates for all Member States unified quality norms for good chemical status – for nitrates (50 mg/l) and for pesticides (0,1 µg/l). The Member States have to determine on their own the threshold values for the substances given below. The specified concentration values should be treated as a proposal for unified threshold values for the European Union with regard to eco-toxicological and human-toxicological criteria.

- Ammonium 0,5 mg/l
- Arsenic 10 µg/l
- Cadmium 1 µg/l
- Chloride 250 mg/l
- Lead 10 µg/l
- Mercury 0,2 µg/l
- Sulfate 240 mg/l
- Tri- and tetra-chlorethylen je 10 µg/l
- Vinylchloride 0,5 µg/l

The assessment of the status is made on the basis of the arithmetic mean of the average values from the different sampling points for each groundwater body. A particular groundwater body has a low-grade status when the quality norms and the threshold values are not complied with. Here, sustained trends and lasting increases have to be reversed. A trend reversal is recommended when 75 % of the norm or threshold value is reached.

The WFD prohibits direct discharge of harmful substances. The daughter Directive Groundwater specifies the groups of substances whose discharge into groundwater should be avoided or restricted:

- Organo-halogenic compounds and substances that may form similar compounds in water environment
- Organic compounds of phosphorous
- Organic compounds of tin
- Substances and preparations or products from their dissociation with proved carcinogenic or mutagenic properties, respectively, steroid, thyroid, reproductive or other properties that may lead to disorders in the function of the endocrine system in or through water.
- Persistent hydrocarbons as well as persistent and bio-accumulating toxic organic substances.
- Cyanides

According to the WFD a general prohibition for harmful substances is in force. The discharge of the following substances is admissible when the good status is not endangered:

- Metals and metal compounds;
- Arsenic and arsenic compounds;
- Biocides and plant protection preparations;
- Suspending substances;
- Substances contributing to eutrofication;
- Substances having durable impact on the oxygen balance (and which may be measured on the grounds of parameters such as BOD, COD, etc.)

For water bodies endangered by contaminated sites it is necessary to carry out special determination of the trends. It has to be ascertained whether the burden is spreading.

6.1.2.2.5 Principles for assessment of the objectives achievement

According to Art. 5 WFD the impact of human activity on groundwater has to be reviewed. Pressures on the groundwater have to be tested for its qualitative and quantitative status. To be examined separately under Annex II WFD:

- Point sources of pollution;
- Diffuse sources of pollution;
- Quantitative status (abstraction and artificial recharge);
- Other anthropogenic pressures.

Reviews during the inventory have shown that nitrogen input of from diffuse sources and here the nitrate immission pressure on groundwater is the crucial quantity for assessment of the achievement of the objectives.

It is not appropriate to use average values from the measuring of groundwater for the review of the groundwater bodies as the different values do not allow the establishment of a “level” average value expressing the status. The calculation of the median and the average value leads to completely inapplicable specialized inferences. Assessment criteria based on the statistical distribution of measurement points are more accurate. These show at what per cent value from the measurement points exceeds the borderline value. The statistical distribution makes possible an accurate analysis of the load. This allows to give an appropriate forecast on the achievement of the objectives for good status at a later step.

6.1.2.3 Pressures from point and diffuse sources

6.1.2.3.1 Description of the pollution from point sources

6.1.2.3.1.1 Reference to WFD

According to the WFD the inventory has to include the location of points in the groundwater bodies which are possibly endangered by penetration of hazardous substances from point sources. It is not envisaged to make a detailed examination and assessment of separate point sources in performing this particular step. In essence, a characterization of the potential point sources has to be made. In the course of the further characterization the point sources which lead to the classification of a groundwater body as not likely to achieve the objectives („at risk“) are presented in greater detail with a description of their factual impact on the good groundwater status.

6.1.2.3.1.2 Methodical approach

The potential point sources are registered in the database (abandoned and contaminated sites). This procedure does not take into account point sources on which a sanitation procedure has been conducted or is in the process of being conducted.

Each point source has to be assigned to a potentially burdened surface from the groundwater body with a dimension of about 1 km^2. It is assumed that there is a risk for the achievement of the objectives when the sum of the impact surfaces (in case of overlapping that is the area within the surrounding curve) exceeds 33 % of the surface of the respective groundwater body.

The further characterization studies whether the available harmful substances and hydrological conditions at the location of the point sources which lead to the initial characterization of the groundwater body as being at risk constitute an actual threat to the groundwater. Accordingly, following the scheme outlined above a new assessment of the groundwater body with respect to the surface has to be made.

The point sources are:

- Warehouses for old pesticides – there is a GIS layer available at EEA that is being updated on an annual basis
- Big municipal landfills – GIS layer
- Small landfills for household waste – GIS layer, where the geographic coordinates are approximates (not precise).
- B-B cubes and new depots (constructed in compliance with the relevant requirements for a depot) for household waste. For them, it is necessary to make a separate layer because they are a potential source of impact on groundwater.
- Production platforms and enterprises. It is necessary to perform an analysis of the existing databases in accordance with the Community legislation on Prevention and Control of Pollution and emitters in surface water (assessment of the available information and coordinates). An expert judgment on which point sources endanger groundwater is also necessary.
- Depots for production and dangerous waste – partial initial information is available at EEA without the respective coordinates however. An expert assessment as to which of them are dangerous for groundwater is necessary; in this case the missing coordinates are to be accounted with GPS.

6.1.2.3.1.3 Basics

The information and database for old deposits and old pollutants are available in the EEA.

6.1.2.3.1.4 Required Reporting and Summary Actions

- Making of a map with registered potential point sources
- Making of a map with graded achievement of the objectives for each groundwater body

The maps must be described and the results must be explained.

Table 24: Necessary activities at working level - groundwater; point sources

No	Working step	Who?	(Intermediate) product (map, table, text, graphics)	Data location
1	Database of point sources	Basin Directorates	Separate maps and tables and GIS maps	ACCESS-Database
2	Generating of map of the point sources for DRBD	Basin Directorates		GIS server
3	Generating of map for achievement of the objectives for groundwater bodies as per the point sources (impact radius) for DRBD	Basin Directorates	Map of inventory	GIS server
4	Study of the endangerment level of groundwater from point sources in groundwater bodies for which the inventory determines the achievement of the objectives as unlikely („at risk")	Basin Directorates		GIS server
5	Generating of map of achievement of the objectives for groundwater bodies in relation to point sources (impact radius) for DRBD	Basin Directorates	Map of further characterization	GIS server
6	Text explanation of the results	Basin Directorates	Text	

6.1.2.3.2 Description of pollution from diffuse sources, including summarized representation of land use

6.1.2.3.2.1 Reference to WFD

According to the WFD in the initial characterization has to identify the groundwater bodies liable to be subject to penetration by hazardous substances from diffuse sources. A detailed review and assessment of separate plain and linear sources is not provided for in this step.

Diffuse sources include:

(5) Populated areas without a sewerage system having over 100 inhabitants.

(6) CORINE LANDCOVER – LAND USE is to be used to differentiate types of land use as potential diffuse sources – arable land and perennial crops, urbanized territories (see Table 25).

6.1.2.3.2.2 Methodical approach

In a combined approach are registered both the areas on which potential diffuse spreading substances are located (the emissions approach) and the chemical composition of groundwater with respect to diffuse spreading on the surface (immission approach). For the emission approach is used data on land use. In the assessment of populated regions as emission sources the extension of the territory by 0.564 km. wide strip (within a radius of 1 km. around the populated area). For the immission approach groundwater analyses of sampling check points and from water abstraction facilities are related to the extent of the groundwater body and evaluated. The substances of interest are those introduced into or caused by diffuse source, e.g. nitrates, plant protection chemicals, chlorides, phosphates, ammonium, sulphates and pH. The assessment relates only to the groundwater leak on the surface. The nitrates content serves as the main parameter for diffuse spread.

The further characterization is only carried out of those water bodies which have been identified as being at risk. In these cases, additional data (areas vulnerable to nitrates, map of the soils showing actual field capacity) allows the combination of the assessment of the geogenic potential for retention of nitrogen with the assessment of the achievement of the objectives in the initial characterization.

6.1.2.3.2.3 Basics

CORINE LAND COVER 2000 on land use presentation. Map of populated areas without sewerage systems or without central waste water treatment. Map of nitrate vulnerable areas is used in more detailed characterizations of groundwater bodies. A central database for groundwater composition. Data on use of fertilizers per municipalities provided by the Ministry of Agriculture and Forests.

Table 25: Land use categories (CORINE Landcover)

1. Arrable land	1.1 Non-irrigated arrable land 1.2 Rice fields
2. Perennial plants	2.1 Vineyards 2.2 Fruit trees and fruit plantations 2.3 Olive groves 2.4 Year-round crops connected with the perennial plants
3. Perennial pastures	3.1 Pastures 3.2 Complex cultivation models 3.3 Natural meadows 3.4 Marshland and low bush-covered waste land
4. Forests and wooded areas	4.1 Agricultural lands occupied by considerable territories covered with natural vegetation 4.2 Agricultural - forest areas 4.3 Deciduous forests 4.4 Coniferous forests 4.5 Mixed forests 4.6 Sclerophilic vegetation 4.7 Transition forests / bush 4.8 Areas with scarce vegetation
5. Urban areas	5.1 Continuous urbanization 5.2 Interrupetd urbanization 5.3 Industrial and comemrcial units 5.4 Road and railway network and adjacent lands 5.5 Harbours 5.6 Airports 5.7 Mines for mineral extraction 5.8 Dung-hills 5.9 Building sites 5.10 Green urban areas 5.11 Sports and recreation facilities
6. Humid zones and water bodies	6.1 Internal marshland 6.2 Salt marshes 6.3 Salt mines 6.4 Inland plains flooded by tides ebb and flow 6.5 Water currents 6.7 Water bodies 6.8 Coastal lagoons 6.9 Estuaries
7. Others	7.1 Beaches, dunes and sand plains 7.2 Bare rocks 7.3 Parched territories 7.4 Glaciers and permanent snow cover 7.5 Turf bogs
8.Seas and oceans	

6.1.2.3.2.4 Necessary activities at report and summary level

Preparation of groundwater bodies map representing the land use and the populated areas without sewerage, respectively without central water treatment. Map representing the probability for achievement of the objectives.

Proposal for drawing up criteria as to the preparation of the risk assessment of the groundwater bodies. It is strongly suggested to use GIS methods for the emission approach.

The following GIS layers have to be determined:

(7) Municipalities with used nitrogen of more than 50 kg/ha/year and municipalities with used nitrogen of less than 50 kg/ ha/ year;

(8) GIS of groundwater bodies and their surface leaking. Through “cutting” to be made GIS layers for each GWB – with the parts of it that come out on the surface and with used nitrogen of more than 50 kg/ha/ year.

The land use has to be added to the resulting maps. It has to be differentiated between arable land and perennial plants, pastures and urbanized territories.

Populated areas without sewerage have to be identified as potential diffuse sources. Also, their percentage in their assigned water body has to be calculated. This percentage has to be one of the risk criteria.

The immission approach should use the data (average annual values) taken from the monitoring points for nitrate concentrations in groundwater bodies to identify areas as at risk.

For example:

NO_3 < 30 mg/l – “not at risk”

NO_3 > 30 mg/l – “at risk”

Table 26: Necessary activities at working level

№	Working step	(Intermediate) product (map, table, text, graphics)	Data location
1	Creation of central database for the groundwater composition	ORACLE, EXCEL database	Database under ORACLE, database of the EEA and CIRCA
2	Preparation of comparable data for the structure of hydrogeological units and groundwater strata (respective, for vertical structure of the groundwater body)	Table with data for groundwater bodies and monitoring points, and data – over standards – environmental threshold, pollution threshold – in different colors	EEA EXCEL tables – possible outlet from database
3	Generating of map of the immissions in the groundwater for each groundwater body in DRBD	Map with average annual nitrates values in groundwater for the points of each groundwater body	GIS-Server EEA
4	Development of criteria "at risk" for the concentration of different diffuse substances (nitrates in particular) in groundwater. Development of method for regionalization of nitrates concentration. Development of gradation of the „at risk" criteria for groundwater bodies based on the substances concentration regionalization.	Methodology is necessary for estimation if the groundwater body is "at risk", when part of its points exceed the standard – pollution threshold under Regulation №1 – On the workshop held in the EEA it had been decided if the nitrates concentration is more than 30 mg/l, the groundwater body to be "at risk"	
5	Generating of map for the achievement of the objectives for groundwater bodies with respect to the immissions – bodies "at risk" and "not at risk" – % surface	Map of the inventory – immissions	GIS-Server
6	Making of map „Nitrate vulnerable zones"	Basic map	GIS-Server
7	Preparation of map of land use (Corine 2000 data) including presentation of settlements without sewerage; different categories of land use (described above) + settlements without sewerage	Map of the inventory - emissions	GIS-Server
8	Development of „at risk" criteria for the different types of land use		
9	Generating of map for achievement of the objectives for groundwater bodies with respect to emissions for DRBD through overlapping of the map of land use with the map of nitrate vulnerable zones	Map of the further characterization	GIS-Server
10	Synoptic map " emissions / immissions" Overlapping of maps for risk assessment under the emission and immission approaches.	Final map for characterization of diffuse sources	GIS-Server
11	Preparation of textual part with presentation of the results for the report	Text	

6.1.2.3.3 Description of the pressure on the quantitative status in relation to water abstraction and artificial recharge

6.1.2.3.3.1 Reference to WFD

Annex V (2.1.1) WFD classifies as good quantitative status a groundwater level which does not exceed the long-term average annual water abstraction from the available groundwater resources. A parameter for the determination of risk to the quantitative status is either the groundwater level or the water balance of the groundwater body.

The assignation of the quantitative status in the inventory requires an inspection of the impact of anthropogenic activities on the quantitative status of the respective groundwater body; data for locations where water is abstracted at a level of > 10m³/d and for locations where water is directly discharged, respectively, infiltration is taking place.

The registered parameters of the quantitative status in the inventory refer to average annual water abstraction, to the assessment of the flow direction and the type of water exchange between the groundwater bodies and their associated surface water systems. Consequently, the water balance components have to be described in specific terms.

6.1.2.3.3.2 Methodical approach

It has to be checked whether the data on the groundwater levels are sufficient to assess the quantitative status.

The central database of hydrographs for measuring points and wells is found in the National Institute for Meteorology and Hydrology. Data for the last five years are available in MoEW, BD and EEA. These data should also be collected in the central database. If a sufficient assessment for each groundwater body is not feasible, a balance between the water abstraction and the recharge of groundwater at each groundwater body has to be evaluated. For groundwater bodies classified in the inventory as not likely to achieve the objectives, it is recommended to carry out a detailed examination of the actual and not of the permitted water abstraction (water use rights).

6.1.2.3.3.3 Basics

It is necessary to provide a database comprising the points of measurement of the groundwater level with perennial data for the groundwater level. The perennial data of the groundwater level should contain the perennial characteristics of the actual and permitted water abstraction and injection in wells. Maps of the water abstraction and the recharge of groundwater have to be drawn up for each groundwater body.

6.1.2.3.3.4 Required Reporting and Summary Actions

The water levels and debits of springs are to be presented in graphics and the relevant trends are to be determined. To this end should be available data for a period exceeding 15 years. The assessment is to be carried out by employing a unified statistical method. The assessment of the natural status should use time variation curves of the groundwater level in selected non-influenced measurement points in groundwater bodies and/or wells (reference points for monitoring).

Groundwater bodies for which assessment is impossible have to be assessed by a balance between water use and water recharge.

The final product is a map of the achievement of the objectives regarding the quantitative status for each separate groundwater body.

Table 27: Necessary activities at working level – groundwater; quantitative status

No	Working step	(Intermediate) product (map, table, text, graphics)	Data location
1	Development of central database for groundwater level		ACCESS-Database
2	Selection and cartographic representation of groundwater measurement points with long-year operation. To be indicated those groundwater measurement points that show long-term, not constant fall in groundwater level.	Map	GIS - server, EEA
3	Generating of map of groundwater recharge for each groundwater body for DRBD	Map	GIS - serevr
4	Generating of map of water abstraction for each groundwater body for DRBD having water abstraction point, recharge areas, sum of water abstraction and water recharge for each groundwater body	Map	GIS server
5	Generating of map of the balance: groundwater abstraction – groundwater recharge for DRBD	Map	GIS server
6	Development of criteria „at risk“ for the measurement points with long-year decrease of groundwater level as well as criteria „at risk“ for the balance between groundwater recharge and groundwater abstraction for each groundwater body		
7	Generating of map for achievement of the objectives with regard to groundwater bodies in terms of quantitative status for DRBD	Final map	GIS server
8	Preparation of textual part for representing the results for the report.	Text	

6.1.2.3.4 Analysis of other impacts on groundwater status

6.1.2.3.4.1 Reference to WFD

Apart from the impact of point and diffuse sources and the quantitative status the WFD requires an assessment of other impacts of anthropogenic activities which may influence the groundwater quality, groundwater quantity and the groundwater flow regime. These can be for instance the cascades, dams or flood retention basins, waste water discharge in aquifers (e.g. discharge of water in connection with research and extraction of oil and natural gas), spoils, large-scale measures of drainage of marshlands and mining, or large-scale construction projects which affect groundwater. The relevant data has not been collected in a database. These measures have to be evaluated in terms of their impact on the entire groundwater body.

6.1.2.3.4.2 Methodical approach

First the occurrence of such uses has to be checked. This should be done mostly with a view to a necessary determination of less stringent environmental objectives or the extension of the deadline for the achievement of the objectives. If it becomes evident that the uses described above make the achievement of the objectives unlikely, then these uses have to be described as impacts on groundwater bodies.

6.1.2.3.4.3 Basics

- Expert judgments
- Maps of groundwater bodies influenced by anthropogenic use (for instance by industry, transport development projects, mines)

6.1.2.3.4.4 Required Reporting and Summary Actions

- Description of other anthropogenic impacts
- Making of a map indicating the locations of the uses described above
- Making of a map with an assessment of the achievement of the objectives

6.1.2.3.5 Groundwater dependent terrestrial ecosystems

6.1.2.3.5.1 Reference to WFD

Annex II (2.1) WFD provides that the inventory of groundwater has to identify those groundwater bodies for which there are directly dependent surface water ecosystems or terrestrial ecosystems. The explicit identification of such ecosystems is required for the further characterization.

6.1.2.3.5.2 Methodical approach

The following areas and data are used:

- Areas from Natura 2000 (areas as per Directive 92/43/EEC and bird reserves)
- Protected landscape areas
- Natural reserves

From the database are selected those areas that, due to their dependence on groundwater are under protection or those containing biotopes dependent upon groundwater.

Such areas are overlapped in GIS with areas of the potential groundwater level decrease due to water abstraction (wells, extensive groundwater drainage) which in undisturbed conditions have a distance to the surface water level of less than 5 m. If geometrical parameters for areas of potential water level decrease around the selected wells are unknown, a com-

mon impact zone (for instance, sanitary-protection areas) has to be defined. Additionally, results from sample filtration tests or from water level measuring in exploitation can be used in support and the data transferred to wells in similar hydrogeological situations. If it can be established by these methods that a groundwater body contains a directly dependent terrestrial ecosystem, then this groundwater body has to be considered as potentially endangered.

6.1.2.3.5.3 Basics

- Database with Natura 2000, reserves and protected landscape areas;
- Maps or point values of the natural levels of groundwater in the area of the directly dependent terrestrial ecosystem
- Maps of soils dependent on groundwater

6.1.2.3.5.4 Required Reporting and Summary Actions

The identified groundwater dependent terrestrial ecosystems in areas of artificial level decrease are presented on maps and in tables.

6.1.2.3.5.5 Necessary activities at working level

Table 28: Necessary activities at working level – terrestrial ecosystems

No	Working step	Who	(Intermediate) product (map, table, text, graphics)	Data location
1	Development of central database "terrestrial ecosystems"	DRBD		Access-Database
2	Presentation of terrestrial ecosystems having relation to groundwater as protection	DRBD	Map	GIS server
3	Presentation of the location for artificial water abstraction (wells, groundwater drainage) through delineation of the impact area on the static level of groundwater < 5m , that is located in the selected terrestrial ecosystem (step 2)	DRBD	Map	GIS server
4	Presentation of the impact zones of the artificial water abstractions selected in step 3	DRBD	Map	GIS server
5	Selection of those terrestrial ecosystems that are located within the selected in step 3 impact zones	DRBD	Map, table	GIS server
6	Drawing up of textual part presenting the results for the report	DRBD		

6.2 Impact Assessment / Risk Assessment

6.2.1 Methodical Approach

The National Report for the Implementation of the WFD contains a chapter on characteristics of the bodies of water in Bulgaria, which contains a section named Impact Assessment.

Below, on the base of the methodology applied in the Federal Republic of Germany and with a view to the data and information available in Bulgaria, a simplified method is suggested, suitable for being applied, monitored and documented in Bulgaria. Certainly, the suggested methodologies can be replaced with better ones when the data are completed and with better or more appropriate information provided for the implementation of various methods.

The assessment of likelihood for the set objectives to be achieved, should, besides identification of pressure, also identify the pressure impact on surface water under Annex II (1.5) WFD.

The applied impact assessment method contains two steps:

(1) Impact Assessment(s) regarding elements/parts of bodies of water, supported by respective data/information.

(2) Summary assessment which is in fact the transfer of the assessment of the water body elements/parts to the whole body of water (WB).

With a view to assessing the achievement of the objectives by surface running water, it is appropriate, given the current phase of processing, to apply the following assessment steps/stages:

(1) pressure caused by organic substances (OS) (as a result from dixoxygenating or oxygen combining substances) -impact assessment of organic substances

(2) pressure caused by biogenetic substances (BS) - impact assessment of biogenetic substances

(3) hydromorphological modifications (HMM)

(4) specific hazardous chemicals (SHC)

Two out of these four steps refer to biological modifications, one to the assessment of the chemical status of water and the fourth refers to ambient modifications.

According to Annex V WFD biological elements are important with regard to the final identification of the water in good status. In the same time, chemical and hydromorphological quality elements are defined as being supplementary for identifying the reasons for which the good status is likely or unlikely to be achieved.

The assessment of objective achievement is carried out in 3 steps:

1. **Assessment of the objective achievement as regards WB elements**

   Each WB element (element length is assumed being the one indicated on the base of the available data and is not necessarily expected to have the same length when various impacts are assessed) is in the first place assessed with regard to the achievement of the objectives in four assessment categories, in accordance to criteria set out in chapters 6.3.5.4 to 6.3.5.7 below.

2. Assessment of the objective achievement as regards surface WB

This assessment is carried out by applying the four assessment criteria, according to the assessment categories listed in chapters 6.1, respectively regarding the assessment of the objective achievement by the whole WB (i.e. summary of results from the previous item).

3. Assessment of the objective achievement as regards HMWB

The approach of assessment of the objective achievement is applied similarly to HMWB.

6.2.2 Definition

The element assessment of water bodies is usually carried out by a two-level assessment system, while transfer of assessment to the whole body is carried out by a three-level system:

Table 29: Scheme of risk assessment on WB element/part level

Objectives feasible	designation colour: green	= not at risk
Objectives unfeasible	designation colour: red	= at risk

Table 30: Assessment scheme on WB level

Objectives feasible (WB not at risk)	designation colour: green	= not at risk
Objectives unfeasible (WB at risk)	designation colour: red	= at risk
Achievement undefined (WB might be at risk)	designation colour: grey	= possibly at risk

The methods of assessment for evaluating the objective achievement for the elements/parts of bodies of water and their integration into the body of water are described below for the four assessment steps. When assessing the achieved objectives it is possible to not only to use the schematic approach based on the environmental data but also to use the expert judgment necessary in a number of cases. Expert judgment shall be grounded in the documents of results which have to be prepared (maps, tables, clarifications of maps and tables).

6.2.3 Significant pressure by substances (emissions)

Art. 5 WFD provides for identification of the impact of human activity on the surface water status. Subject to examination are both pressures caused by substances and morphological pressure on surface running water. According to Annex II (1.4) WFD substances that are liable for causing pressure are:

- Substances introduced through point and diffuse sources
- Hydromorphological pressure (water abstraction, morphological modifications and flow regulation).
- Any other significant loads, to be presented separately.

Emission investigation provides additional information for the assessment of the potential to achieve the objectives as regards running water loaded by substances. In practical terms

„pressure impact assessment" shall be done, whenever possible, on the basis of emission data.

6.2.4 Organic substance impact assessment

6.2.4.1 Organic substance pressure assessment category

Organic substance impact assessment is carried out on the basis of criteria of biotic index as an integrating status parameter (see National report on river basin water management in the Republic of Bulgaria (monitoring for complying with the requirements of Art. 5 (5, 6) WFD).

The assessment of the objective achievement is carried out firstly in reference to water elements/parts of WB (see above).

Table 31: Organic substance pressure assessment category – water elements

Biotic Index	Water element assessment
> 3-4	feasible
< 3-4	infeasible

Assessment of the objective achievement as regards surface WB is carried out in reference to the pressure caused by organic substance, as well as in the cases to follow, by applying the rule 30% / 70%.

Table 32: Pressure by organic substances assessment category – WB

WB Assessment	
For < 70 % of the WB length objectives are likely to be achieved	feasible
For > 70 % of the WB length objectives are unlikely to be achieved	infeasible
Other possible cases	not defined

Expertise is required to clarify whether hydromorphological alterations in surface body of water are also expected to impact organic substance pressure.

6.2.4.2 Biogenetic substances assessment category

Biogenetic substance eutrofication potential is identified on the basis of phosphates P and nitrogen N values. It is presumed that data from measuring P and N is not sufficient so as to individually assess the WB elements. In such cases large homogeneous „impact areas" are formed, assessed and transferred to the whole body of water.

Assessment for the objectives achievement for biogenetic substances is carried out, in contrast to the approach applied to organic substances load and hydromorphological modifications, at its first stage not to the elements/parts of the body of water, but with regard to impact areas (these are small catchment areas of parts of rivers which are loaded, respectively not loaded or slightly loaded). The reason is that these substances can be discussed in the light of quite homogeneously loaded sub-basins/catchments. It is additionally presumed that

expertise is good enough to assess the likelihood of achieving the objectives set for these sub-basins. Depending on the data the following approach is selected:

- When measuring indicates a presence of phosphates and nitrogen, expertise should outline impact areas for which measuring results indicate likelihood that objective will or not will be achieved.
- When measuring indicates no phosphates and nitrogen content, expertise should outline impact areas for which the objectives are likely or not likely to be achieved. Expertise shall be justified through an unambiguous calculation of loads or data set on the basis of point and diffuse sources.

Table 33: **Biogenetic substances assessment category**

Quality Standards	Assessment of impact areas
concentration of orthophosphate P ≤ 0,2 mg/l and nitrate N ≤ 6,0 mg/l (o-PO4-P and NO3-N as an average value per year) ----------or---------- no average values and expert assessment available: „Achievement of the objective is expected“	feasible
concentration of orthophosphate P > 0,2 mg/l or N nitrate > 6,0 mg/l (o-PO4-P and NO3-N as an average value per year) ----------or---------- no average values and expert assessment available: „Achievment of the objective is expected", infeasible	infeasible

Afterwards, the result from the impact area assessment is transferred to the elements/parts of the water bodies and subsequently to the whole WB. It is now possible, notwithstanding the impact area outline, to assess the existing water body on the basis of its elements.

Table 34: **Biogenetic substance assessment category for WB**

Assessment of WB	
At < 70 % of the WB length feasible	feasible
At > 70 % of the WB length infeasible	infeasible
Other groupings and assessment	not defined

6.2.5 Hydromorphological alteration assessment category

The following types of activities are considered „hydromorphological alterations":

- water extraction from surface water
- flow regulation and
- morphological alterations.

According to the WFD there are no EU criteria for assessing significant loads caused by hydromorphological modifications.

6.2.5.1 Water extraction from surface water

Water abstraction is carried out, regulated and controlled by the means of a permit. This approach has been applied in the country since the Water Act of 2000 became effective, as well as Order 1383 for setting out the minimal tolerable flow for regulating the river flow in compliance with environmental aspects. Water abstraction information is supplemented by putting the following questions on the agenda:

- „Smaller" water abstraction „smaller" quantities and
- The assessment of conformity with Order No 1383.

For this purpose, a study has to be made whether water use permits are observed and to what extent water abstraction observes the ecological minimal flow set out in accordance with Order No 1383 for setting out the minimal tolerable flow with a view to achieving the respective ecological requirements. All known water abstractions of a longer duration without reverse injection shall be taken into account.

Table 35: Hydromorphological alterations assessment category for WB

Assessment of WB elements	
water abstraction conforms to Order 1383 **= yes**	feasible
water abstraction conforms to Order 1383 **= no**	infeasible

Table 36: Hydromorphological modifications assessment category for WB

Surface WB assessment	
At < 70 % of the WB length feasible	feasible
At > 70 % of the WB length infeasible	infeasible
Other cases excl. from the above ones	not defined

6.2.5.2 Flow regulation

The criteria are reviewed in details in chapter 6.1.1.10.

Data collection and assessment shall be carried out, if necessary, together with "water abstraction" and "morphological alterations".

Flow regulation refers mainly to the problem of the admissible and available channel line. Lack of permeability/channel has an impact on the body of water up and down stream. It is suggested that the lack of permeability should be presented on the map as point information or is depicted on the map, but excluded from the assessment of the respective body of water or the body of water located up or down stream.

6.2.5.3 Morphological Alterations

River section morphology to which at least one of the following criteria applies, is to be considered heavily modified. An assessment whether the section is unlikely to achieve the a good ecological status is therefore necessary.

- River section whose bottom is regularly dredged for gravel extraction, respectively for securing navigation.
- River sections dike covered from the both sides.
- River sections where the real sinuosity coefficient considerably differs from the potential natural sinuosity.
- Urbanized river sections on a lower level and/or whose banks and bottom are fortified.
- River sections with other significant morphological modifications.

As already mentioned in chapter 6.1.1.11, water morphology is identified on the basis of the supplementary “riverbed sinuosity” value and is given a value through the sinuosity coefficient, since no data is presently available about the water structure (see chapter 6.3.4.5). The actual sinuosity coefficient for the individual river section is identified by applying the methodology referred to in 6.1.1.11. For assessment purposes, the sinuosity coefficient shall be compared to the natural, actual coefficient, i.e. a site-specific assessment shall be done. In this way, a low sinuosity coefficient of 1 for rivers with natural riverbed curve is a clear indication for a significant damage to morphology, while such a coefficient for rivers running through a gorge may correspond to the natural, specific conditions for the type.

The natural specific sinuosity coefficient can be identified for many Bulgarian waters on the basis of the riverbed by means of older or historical maps, worked out before the moment of hydrotechnical measures for shortening the riverbed length.

Example: Osam River

Riverbed shortening in the lower channel of the Osam river was carried out in the 1970s, so the initial riverbed can be recovered by the use of maps drawn before 1970 (see the figure below). In this example valley length (6,50 km) and the initial course length before being corrected (19,47 km) used to form a natural, specific sinuosity coefficient of 2,99 and an actual sinuosity coefficient (the present channel length of the Osam river 6,62 km) of 1,02. Where older or historical maps are unavailable, the potential natural sinuosity coefficient can be found in the specialized literature as „hydraulic geometry equations“(see Figure 8).

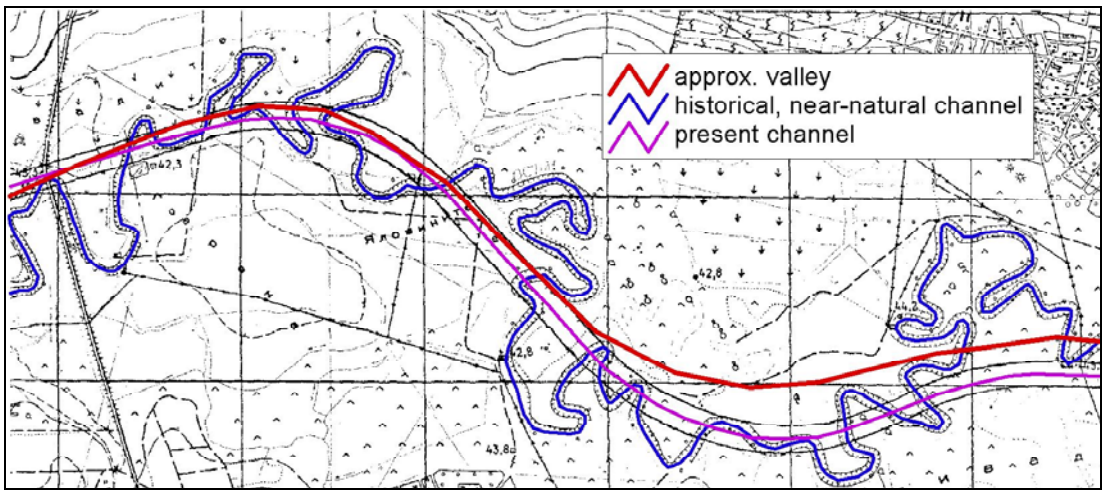
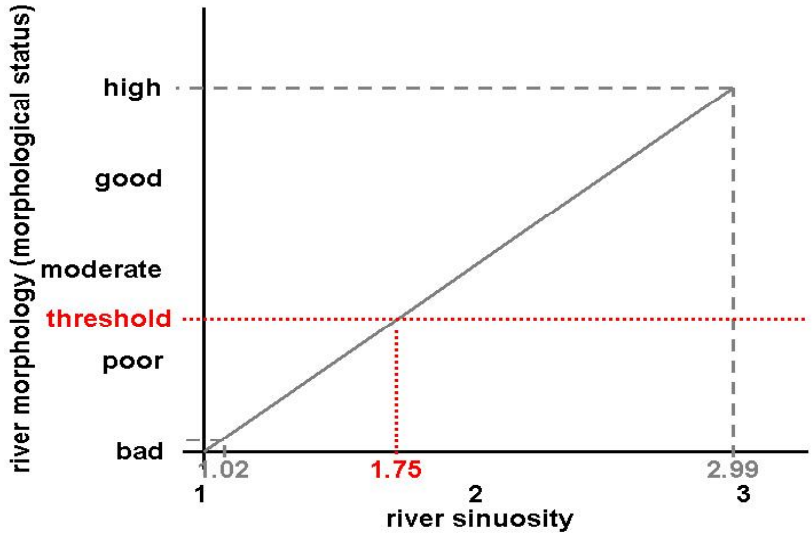


Figure 8: Scheme of morphological alteration (Example: Osam River)

The interdependence between the sinuosity coefficient („river sinuosity“) and water morphology („river morphology“) is not defined since no data (maps) are available. Where precise research data is lacking, the use of a linear subjection, as presented on the next figure, is recommended. Furthermore, lack of data makes the definition of the precise connection between the water structure and the ecological status impossible. On the basis of the results from research projects in other countries it is recommended to proceed from the threshold value of morphological status „moderate / poor“, from which a high probability can be presumed that the ecological status will not be achieved (see Figure 9). Depending on the natural type-specific sinuosity coefficient a type-specific threshold value of sinuosity coefficient is derived. For the example of the Osam river section with a natural sinuosity coefficient of 2,99 the threshold value for sinuosity coefficient is about 1.75 for „moderate / poor“ morphological status. The present sinuosity coefficient of 1,02 is far below the threshold value, so it can be presumed that this river section will never achieve the good ecological status.

Figure 9: Interdependence between River Sinuosity and Morphological Status



The described method provides for a rough assessment, suitable for waters which can freely form riverbed curves; respectively the sinuosity coefficient can be reduced through riverbed correction. As far as gorge water and the so-called confined meanders, incised into canyons, are concerned, it is generally not possible to correct the riverbed, which makes the method unworkable.

Operative steps for riverbed correction impact assessment / reducing sinuosity coefficient:

- Determination of the actual sinuosity coefficient according to the method described in chapter 6.1.1.11.
- Determination of the natural type-specific sinuosity coefficient
- Determination of the subjection of the sinuosity coefficient and the water structure status (using the linear subjection, since no more precise data are available).
- Determination of the subjection between the water structure and the ecological status, as well as derivation of the threshold value for distinguishing river sections which are going to, respectively not going to achieve the good ecological status (marginal values indicated above are used if precise data are not available).
- Registration of marginal values for sinuosity coefficient by using the threshold value of water structure.
- Comparison of the actual sinuosity coefficient with the threshold value:
  (1) Actual sinuosity coefficient > threshold value => river section is likely to achieve the good ecological status, i.e. achieving the objective is feasible
  (2) Actual sinuosity coefficient < threshold value => river section is unlikely to achieve a good ecological status, i.e. achieving the objective is unfeasible
  (3) Assessment of the objective achievement for the river section is carried out by observing the results from sinuosity coefficient assessment and the other four criteria mentioned above, in accordance with the following table.

Table 37: Morphological modification assessment criteria – river sections

Summary of water structure data (untill water structure mapping)	**Assessment of river sections**
Morphological modifications = no	feasible
Morphological modifications = yes	infeasible

The assessment of the objective achievement as regards surface bodies of water is carried out in accordance with the following scheme. The rule of 30 / 70 is applied.

Table 38: Morphological modification assessment criteria - surface bodies of water

For < 70 % of the SWB length objective achievement is expected	feasible
For > 70 % of the SWB length objective achievement is not expected	infeasible
Other combinations	not defined

6.2.5.4 Specific hazardous chemical assessment category

6.2.5.4.1 Principal issues

When assessing the specific hazardous chemicals (achieving the objectives at hazardous emission values both as regards the ecological and chemical status), the use of the average values for the past three years is recommended.

Specific hazardous chemicals are assessed on the basis of the effective quality standards. As no effective quality standards exist in Bulgaria, an approximation of the objective achievement shall be applied or where even this is not possible expertise has to be used.

6.2.5.4.2 Classification of hazardous substances and quality components

The specific hazardous chemical assessment contains the following stages

- in reference to the environmental assessment, significant hazardous substances (as per Annex VIII WFD, other general physical and chemical (N, P-free and hazardous substances specific for the river basin)
- specific hazardous substances for assessing the chemical composition (Annex IX and X WFD / priority substances).

6.2.5.4.3 Application of quality standards

Environmental quality standards are referred to as Quality Norm **QN.** In reference to the substances listed in the WFD List of significant hazardous substances, except a few priority substances, the requirements of Annex X WFD shall be applied.

Substances not covered by the Environmental standards are regulated by preliminary/draft Environmental standards of the European Commission, other proposals for Environmental standards (see tables Relevant Substances Surface Water; Quality Norm). In the event of a high content of some substances in the water, but low content in the sediment (and vice versa), the risk is assessed by using the matrix mentioned in QN, respectively for water or sediment. Higher values in other matrices have to be listed when describing the body of water in section „other loads", and the conditioned (geogenetic) pressure should be given proper identification. This pressure shall be taken into account when drafting the future monitoring programme.

6.2.5.4.4 Impacts on parts of water bodies

6.2.5.4.4.1 Monitoring points

All existing measuring points of transregional, regional and local networks providing representative results, shall be used.

6.2.5.4.4.2 Handling the measures values at <QN but >1/2 QN

Quality standard = QN = LAV

Control values between the half and the whole quality norm lead to an assessment and shall be documented as „feasible objective achievement". However, they have to be taken into account when drafting the future monitoring programme.

When the applied QN differ from the QN to be approved by the European Commission and QN is exceeded, the assessment shall be determined „not defined yet" (if the expert judgement is the same).

6.2.5.4.4.3 Class specific definitions, if no measured values

As regards „industrial chemicals" (e.g. nonyl-phenol) from point sources the assessment can be made individually on the basis of expertise on potential emissions/enterprises emitting hazardous substances until measured values are obtained.

6.2.5.4.4.4 Spatial allocation of monitoring points/control values of impact areas

The assessment in the step „specific hazardous chemicals", unlike the approach applied to organic substance pressure and hydromorphological modifications, is initially carried out not with regard to the elements of the water body, but regarding impact areas (this means smaller sub-basins affected or not affected by loads). Therefore, a river sub-basin shall be identified as an impact area and shall be accorded one or several monitoring points and be considered representative.

6.2.5.4.5 Impact area assessment

The following criteria have to be considered when determining impact areas.

Table 39: Quality assessment category regarding chemicals in impact areas

Actual State	Impact area assessment
average value ≤ QN ----------or---------- no measured value and expert assessment: „feasible" ----------or---------- average value > QN, programme of measure already in process, expected reduce of pressure (base line scenario)	feasible
environmental quality standards are not adopted the current provisional quality norms are exceeded ----------or---------- no measured values and expertise: „not defined"	not defined
average value > QN ----------or---------- no measured values and expertise: „infeasible"	infeasible

6.2.5.4.6 Achieving the objectives for surface WB

6.2.5.4.6.1 Spatial allocation of monitoring points/control values of WB.

Juxtaposing the impact area assessment of the respective elements of bodies of water. They, on their hand, are parts of the surface bodies of water.

The achievement of the quality objectives regarding chemicals is assessed as follows:

Table 40: Quality assessment category as regards chemicals for impact areas for surface body of water

For < 70 % of the WB length objective achievement is expected	feasible
For > 70 % of the WB length objective achievement is not expected	infeasible
Other groupings	not defined

6.2.5.5 Artificial Water Bodies (AWB)

Surface waters are considered artificial, if created by human activity at a place previously free from significant surface water. Thus they appear to be a result neither of direct physical changes nor corrections of natural water bodies. The environmental potential of both artificial surface bodies of water and heavily modified WB have to be identified (if the good or the highest environmental potential is not already given).

The identification of artificial water bodies, including characterization criteria, is still in its initial characterization stage. The final classification shall be prepared and included in the Management Plan 2009 and shall be revised every 6 years.

AWB (as far as the above criteria are fulfilled) are:

- navigation channels, water-power plant, transport of logs, letting them down the course or draining/irrigation channels;
- lakes in ditches, open mines;
- artificial lakes and artificial water reservoirs, charged with overflowing water;
- port basins.

The approximate value of 10 km is used as a minimal length of an artificial surface body of water. In some justified cases the minimal length of an AWB can be lower.

With view to prioritization, substances significant for the chemical status, according to Annex IX and X WFD, significant specific substances for environmental status assessment, according to Annex VIII, have to be classified in a „specific hazardous chemicals" assessment category.

The assessment regarding achievement of the objectives shall be carried out for each step of the assessment of surface bodies (incl. AWB and HMWB). AWB as a rule are classified as „objective achievement unfeasible" in reference to „hydromorphological modifications" assessment step.

6.3 Economic analysis

6.3.1 Reference to WFD

Fundamental to the elaboration of the economic analysis are:

- Art. 5 WFD in relation to Annex III (Economic Analysis) and
- Art. 9 WFD (cost recovery)

The WATECO-Guidance Document Nr. 1 „Economics and Environment“ prepared by the working group Water and Economics for the Common Implementation Strategy (CIS) EU-Commission (WATECO, 2003) contains instructions concerning the application of the economic elements of the WFD.

6.3.2 Requirements of the economic analysis

Central points of the economic analysis are:

- Economic significance of water uses,
- Baseline Scenario up to 2015,
- Cost recovery for water services
- Cost-effectiveness of measures and combination of measures

According to Art. 5 WFD, an economic analysis of water uses has to be made. The water use comprises water services as well as any other action according to Art. 5 and Annex II which is of significant importance to the water status.

The economic analysis shall contain enough information in sufficient detail (taking account of the costs associated with collection of the relevant data) in order to:

(a) make the relevant calculations necessary for taking into account under Art. 9 WFD the principle of recovery of the costs of water services, taking account of long term forecasts of supply and demand for water in the river basin district and, where necessary:

- estimates of the volume, prices and costs associated with water services, and
- estimates of relevant investment including forecasts of such investments;
- (b) make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures under Art. 11 WFD based on estimates of the potential costs of such measures.

The close relationship between the economic analysis and the technical parts of the WFD implementation is of particular importance. This concerns especially the use of data to be taken from the inventory according to Annex II and their estimated change until 2015 in the preparation of the Baseline Scenario.

Figure 10 shows the 3 steps of economic analysis in a simplified form:

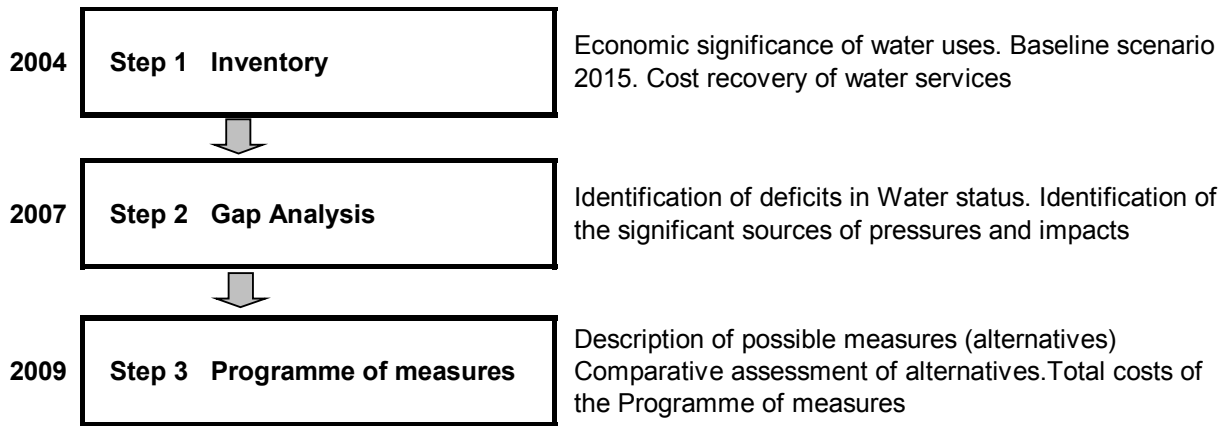


Figure 10: Three-step process of economic analysis

During the first step (Step1: Inventory) the following analyses are prepared:

1. Economic analysis of water uses
   - Identification of different water uses and water services
   - Evaluation of the water significance for the economy
   - Socio-economic development of the river basin districts (number of inhabitants, economic development);
2. Preparation of the Baseline-Scenarios
   - Key economic drivers
   - Water use development
   - Measures and investments planned in the water sector
3. Actual situation for cost recovery of the water services.

The economic analysis shall mainly provide the following information:

- Actual status of water use and long-term forecasts for water use and water availability in the river basin district
- Economic significance of water use
- Cost recovery of water services and spreading of water use to the user
- Economic impact of the measures according to the Programme of measures.

The economic analysis is concentrated on the river basin level. The aim is to characterize the respective river basin district from an economic perspective. For this purpose water uses and the economic significance of human activities linked with the use of water or water bodies are described.

The uses of water are divided into three categories:

1. Water abstractions
2. Discharge of waste water or discharge of substances into water bodies
3. Use of surface waters

The water uses are related to the economic activities and the evaluation of their significance based on social-economic parameters. The economic activities can be divided and structured into sectors such as households, industry and agriculture.

The selection of the main water uses and human activities is carried out in several steps in relation to analysis according to Annex II WFD. The first step is oriented and based on the expert knowledge of activities which are already established as having significant impact and on existing, i.e. available information. Additionally, economic sector areas are taken into consideration depending on the water quality. The relation of the economic characterization of the river basin with the results of the analysis according to Annex II WFD is established in a second step.

The inventory is based on the following assumptions:

1. Primarily, available data and information are collected and analysed. Additional collection of information should be restricted in order to reduce the costs and the additional work for economic analysis.
2. The methodology has to be oriented to the structure of water services (water supply, sewerage) in the river sub-basins. Detailed economic analysis of the (financial) cost situation with regard to individual companies is not necessary.
3. The economic analysis is part of the inventory under Art. 5 WFD. Similar to technical inventory of surface waters and groundwater, a generalized (compact) presentation of the economic parameters of water uses and water services in the river basin districts has to be prepared.

More stringent requirements on the methodology and data quality are needed at the second and third step of the economic analysis for the identification of cost-effective measures, respectively for balancing of environmental and resource costs of water bodies having deficits and of water bodies „at-risk" and for the determination of cost-effective combinations of measures.

6.3.2.1 Economic significance of water use

The economic analysis requires identification and presentation of the economic significance of water use in various economic sectors with impact on the water status. It illustrates different activities of water users and facilitates the assessment of the socio-economic impact of those measures envisaged by the Programme of measures.

The main kinds of water uses are water abstraction and waste water discharge, as well as other kinds of use, such as back-watering and bank strengthening for other purposes (for instance, energy generation, navigation, etc.), as far as these kinds of "water use" are of significance for the water status.

Water abstraction comprises:

- Water abstraction for public water supply
- Water abstraction by industries
- Abstraction of cooling water for thermal power plants, and
- Water abstraction for irrigation in agriculture.

Waste water discharge comprises:

- Discharge of municipal waste waters (waste and storm waters)
- Discharge of industrial waste waters (direct discharge) and
- Discharge of cooling water form thermal power plants

The specific water use in m³/inhabitant or m³ compared to the number of employed persons or to the gross added value allows a conclusion to be drawn concerning the economic sig-

nificance and efficiency of water uses within the considered sectors. The lesser this value is, the more efficiently the respective water resources are used.

For the other uses proper criteria have to be selected.

A proper parameter for economic significance description is “efficiency of the water use”. For this purpose the water abstraction and waste water discharge are divided by water uses and are compared to the number of inhabitants connected to water supply and sewerage systems, and to the number of employed persons or the gross added value, respectively, as a water use efficiency indicator (see Figure 11).

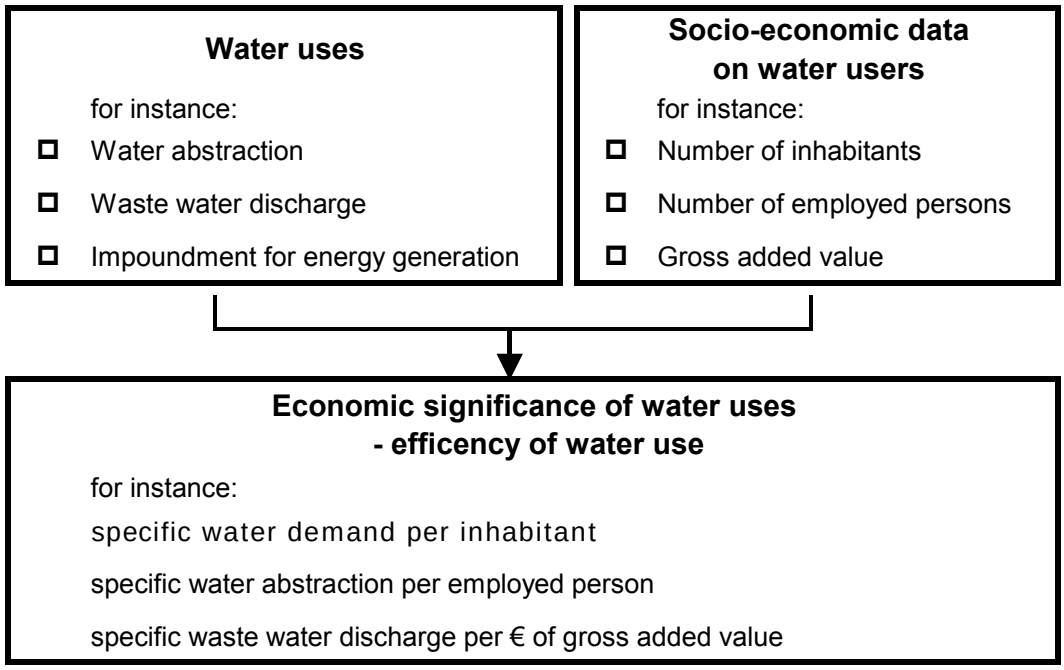


Figure 11: Identification of the economic significance of water use

6.3.2.2 Baseline Scenario 2015

Within the framework of the Baseline Scenario 2015 the development of water use up to the year 2015 should be assessed. The results should indicate those points in which critical loading may occur (water bodies „at-risk”) and whether or not good water status can be achieved until the year of 2015.

The following conceptions are included in the analysis:

- Estimation of the current and future situation (for instance, water use development)
- Impact of the human activities and of changes in the water policy which have effect on water supply and waste water treatment, (national and regional investment programs and projects for water quality improvement)
- Technologies and climatic changes of crucial importance.

Within the framework of the Baseline Scenario, a demographic prognosis should be prepared and the economic sectors development should be assessed. On this basis the water consumption and water sources (surface waters, groundwater) should be determined. Further, all known measures planned until the year 2015 within the water sector and waste water treatment should be investigated.

Grounded on WATECO-Guidance Document Nr. 1, the Baseline Scenario encompasses the following parts (see Figure 12):

- Documentation of water uses in 2001 (water abstraction, waste water treatment, other uses) having impact on the water status.
- Prognosis for changes in the water uses and pressures on water caused by economic and socio-economic factors, as well as by the implementation of the legislative requirements.

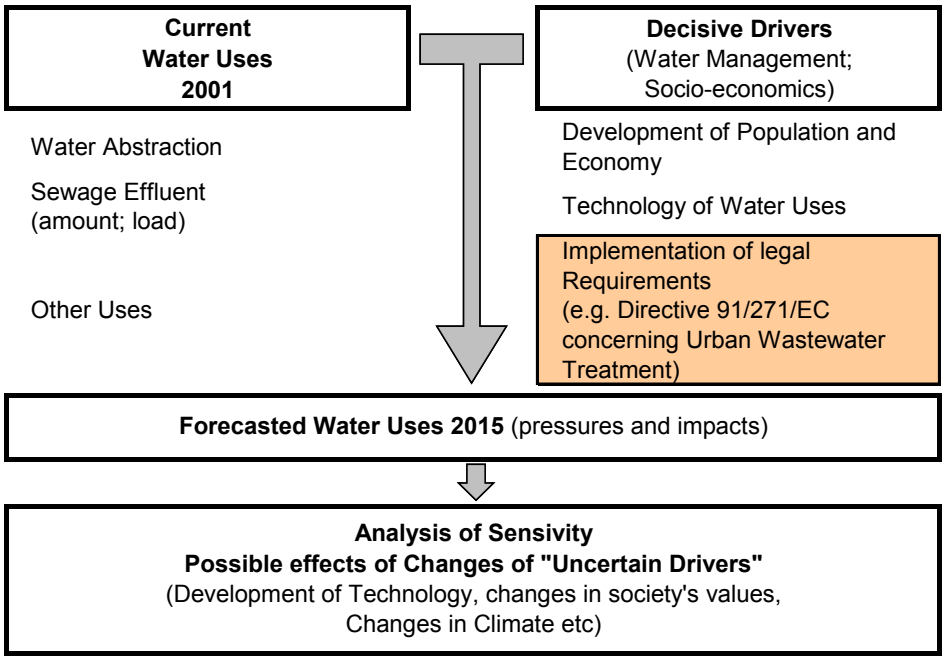


Figure 12: Approach applied in the elaboration of the Baseline Scenario 2015

The current situation regarding the water demand is based on the result from section 6.2.2.1 (economic significance of water use). For the various water uses, scenarios with different assumptions for specific water demands can be established (for instance, m³/inhabitant, m³/employed person, m³/irrigated agriculture area, m³/gross added value), for example:

- Status quo-Scenario: maintenance of the specific demands
- Trend-Scenario: maintenance of the specific changes in demands during the last years
- Scenario of Efficiency: accelerated implementation of measures for water uses efficiency improvement (for example, saving of drinking water, multiple use of water, more efficient irrigation methods).

As a basis for identification of the main socio-economic factors of impact in the scenarios, the existing long-term trends for the population development can be used, e.g. the regional prognosis for the population development and for the development of the economy.

The purpose of the economic analysis is to study the economic factors of impact, which will probably cause additional pressures on water and shall have effect upon the water status

progress. Factors which definitely have no significant effect can be neglected. The results of the Baseline Scenario will inevitably contain uncertainties, therefore the results should be seen as a tendency.

In the preparation of these activities, the factors of impact for households, industry and agriculture which may have effect on the water demand and supply (of specific quality) have to be investigated. In order to illustrate the measures being already undertaken for the water protection, the investments made for water protection, waste water discharge and water supply shall be documented.

6.3.2.3 Cost recovery of water services

The matter of cost recovery is treated in Art. 9 WFD: “Member States take into account the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in particular with the polluter pays principle”.

It should be noted that there is a difference between the requirements of an economic management concerning the recovery of costs incurred for the calculation of water prices and the requirements of cost recovery of water services including the environmental and resource costs.

The term full cost recovery means that the users of water services shall cover the full costs for water supply, storage, treatment and distribution as well as the storage, treatment and discharge of waste water. Still it is disputable which environmental and resource costs have to be included in these costs.

The term “water services” includes all services according to Art. 2 (38) WFD which are rendered to households, public institutions or for any economic activity:

1. Abstraction, impoundment, storage, treatment and distribution of surface waters or groundwater,
2. waste water collection and treatment facilities, which subsequently discharge into surface waters

The main features of water services are the public water supply (recharge, abstraction, purification, storage and pressure maintenance, distribution, use of impoundments for water supply need) and the public sewerage system (waste water and rain water storage, treatment, discharge into combined and separate systems).

In case of own water supply or direct waste water discharge of water users the costs are assumed to be recovered; in this case the analysis should be concentrated on the costs environmental and resource costs, to the extent they have considerable effect upon the water economic balance of the water body. (Steps 2 and 3 of the economic analysis). The following water uses should be examined as to their significance:

- Industrial water supply (water supply for own needs),
- Agricultural water supply (irrigation),
- Industrial waste water disposal (direct discharge).

The water-backings for the purposes of electric power production and navigation as well as all measures of flood protection are not included in the term “water services” and they shall be taken into account in case of considerable pressure on water at steps 2 and 3 of the economic analysis.

Identification of the cost recovery for water services comprises:

- Payment of water service charges (water prices, waste water collection charges)
- Cost structure and profitability of the service providers
- “Internalized” environmental and resource costs.

The proportion of costs covered by state subsidies is of particular interest in the analysis in terms of fair allocation of costs to polluters.

According to Art. 9 WFD, cost recovery for water services must be identified while giving consideration to environmental and resource costs. Environmental and resource costs can be defined as follows:

Environmental costs are costs for damages caused to the environment, ecosystems, the economy and individuals as a result of water uses – worsening of the environmental quality of aquatic ecosystems or worsening of the quality of crop-growing areas. They may also be called “external costs” or “public costs”.

Resource costs are costs arising from failure to use a resource for other purposes efficiently which occurs when a resource is exploited beyond its natural renewal and recovery capacity, e.g. in connection with excessive groundwater abstraction or heating of water bodies through discharges of cooling water from heating plants. Resource costs may also occur due to scarcity caused by pollution if it means that supply of adequate quality water is depleted. They are also called “opportunity costs”.

Normally, the environmental and resource costs are not included in the prices and charges for water services. They usually fall to third parties. However, parts of the environmental and resource costs are internalized in compliance with specific regulations. Internalization of environmental and resource costs means that the impact of water uses on third parties (“external effects”) is measured in economic terms (“monetarised”) and apportioned to water uses. Internalized environmental and resource costs are transfer payments that are usually paid by water users in the form of charges to compensate for the impacts of water abstraction (e.g. groundwater charges) or the discharge of waste water (wastewater collection charges) and are based on general legislative provisions or case-specific provisions in connection with authorization of water uses. From a practical point of view, it is recommended that the environmental and resource costs should not be determined for the whole territory, but to be differentiated by a regional principle only for water bodies “at-risk” and water bodies with deficits.

6.3.3 Identification and mapping of the protected areas

According to Art. 6 WFD each Member State shall establish within the inventory a register of all areas lying within each river basin district which have been designated as requiring special protection under specific Community legislation for protection of their surface waters and groundwater or for conservation of habitats and species directly depending on water.

The register shall include all bodies of water identified in Art. 7 (1) WFD as used for abstraction of water for human consumption and those designated for such use in future (sanitary security zones) as well as all protected territories identified under European legislation, namely the following:

- Areas identified for protection of economically significant species,
- Recreational waters according to Directive 76/160/EEC including zones designated as bathing waters,

- Areas vulnerable in terms of nutrients as per Directive 91/676/EEC as well as sensitive areas as per Directive 91/271/EEC (sensitive and vulnerable zones in relation to nutrients),
- Areas designated for protection of species and habitats as per Directive 92/43/EEC (areas for protection of the flora, fauna and habitats) and as per Directive 79/409/EEC (bird reserves), inasmuch the protection objectives depends on the preservation or improvement of water status (areas from NATURA 2000).

The WFD prescribes to include in this list water bodies from which water is abstracted on average over 10 m^3 a day or serve for satisfying drinking water needs of more than 50 persons even if they are not identified as protected areas. No selection is to be made so that under certain particular circumstances there will also be listed the sanitary security zones for small-scale water abstractions, respectively for smaller number of persons and sanitary security zones for mineral water.

Directive 78/659/EEC of 18th July 1978 on the quality of fresh water to be protected or improved in order to protect fish life need not be covered when identifying areas of economically viable aquatic species. This Directive does not contain a requirement for the identification of certain protected territories. It only requires the water to be divided and indicated under definite criteria.

The areas vulnerable with respect to biogenic substances identified as endangered areas in Directive 91/676/EEC, as well as the areas identified as sensitive as per Directive 91/271/EEC have to be covered. The phrase “vulnerable in relation to nutrition substances” as a species-related notion which should be interpreted as “endangered territories („vulnerable zones“) as per the Nitrates Directive 91/676/EEC and the „sensitive areas“ as per the Directive for urban waste water treatment plants 91/271/ EEC.

The purpose, for protection of human health and of living resources as well as of water ecosystems and for securing of the legally complied use, is to reduce the nitrates input by agricultural sources or caused pressures on water and to prevent subsequent pollution. To this aim it is important to implement measures with respect to the storage and input of all nitrogen compounds in agricultural areas as well as with respect to certain methods of management.

Within the sites of NATURA 2000 are included also the territories for protection of the flora, fauna and habitats (reference to Directive 92/43/EEC for habitats and protection of natural habitats and wild flora) and the bird reserves (reference: SPA = Special Protected Area, Directive 79/409/EEC of 2nd April 1979 for protection of wild birds).

6.3.4 Water protection zones

6.3.4.1 Reference to WFD

Pursuant to Art. 6 WFD, every member state shall establish a register or registers of all areas in a river basin district which under the specific Community legislation for protection of surface and groundwater or protection of habitats and species directly depending on water have been determined as requiring specific protection. The register or registers shall include all water sites specified in Art. 7 (1) WFD and all protected territories comprising in Annex IV WFD, namely:

(1) All water sites used for water abstraction for human consumption and having debit of 10 cubic metres on average or which service more than 50 persons. These are the territories determined for water abstraction for the purpose of human consumption – sanitary – security zones around the sources for drinking water and household water supply, determined on the grounds of:
   - Regulation No 3 dated 16.10.2000 on the Conditions and Order of Designing, Research, Validation and Operation of the sanitary-security zones around water abstraction facilities for drinking and household water supply and around sources of mineral water, used fro healing, prophylactic and hygienic needs.(State Gazette, issue 88, year 2000);
   - Regulation No 9 dated 16.03.2001 on Qualities of Water Designated for Drinking and Household Purposes (the State Gazette, issue 30 dated 28.03.2001) transponing Directive 98/83/EEC dated 03.11.1998 on Quality of Water Designated for Human Consumption;
   - All sanitary-security zones proclaimed as per older regulative documents (Regulation No 2 dated 01.08.1989, Orders of Municipal administrations, etc.) Are to be complied with and reregistered taking into consideration the requirements of Regulation No 3 dated 16.10.2000 and to obtain water use permission.

(2) Territories proclaimed as comprising economically significant water biological species;

(3) Water sites designated for recreation including territories indicated as bathing water as per Directive 76/160/EEC, and determined on the grounds of:
   - Regulation No 11dated 25.02.2002 on Bathing Water Quality (the State Gazette, issue 25 dated 08.03.2002), transponing Directive 76/160/EEC on Bathing Water Quality;
   - Regulation No 14 on Resort Resources, Resort Areas and Resorts (the State Gazette, issue 79 year 1987, amended and supplemented – the State Gazette issue 88/2000);
   - Regulation No 7 on Surface Running Water Quality (the Sate Gazette, issue 96 year 1986);
   - Order No РД-272/dated 03.05.2001 issued by the Minister of Environment and Water on surface water categorization in water sites or parts thereof

(4) Territories sensitive to nutrition ingredients, including territories proclaimed of vulnerable areas in compliance with Directive 91/676/EEC. These are territories proclaimed as vulnerable zones in which water is polluted by nitrates originating from agricultural sources, pursuant to:

- Regulation No 2 on Water Protection from Nitrate Pollution Originating form Agricultural Sources (the State Gazette, issue 87/year 2000) and Order of the Minister of Environment and Water under No РД-795/dated 10.08.2004;

As well as territories determined as sensitive zones in compliance with the criteria specified in the following:

- -Supplement No 4 to Regulation No 6/dated 09.11.2000 on Emission Norms for Admissible Contents of Harmful and Hazardous Substances in Waste Water Diascharge At Water Sites (the State Gazette, issue 97, year 2000) and Order of the Minister of Environment and Water with number РД-970/dated 28.07.2003.

(5) Territories proclaimed as protection areas of habitats or biological species, in which the maintenance or improvement of the water condition is an important factor for their protection, including the respective sites of Natura 2000, proclaimed in compliance with Directive 92/43/EEC for protection of habitats and wild flora and fauna and Directive 79/409/EEC for wild birds protection. These territories have been proclaimed by Orders of the Minister of Environment and Water taking into consideration the options envisaged in the following:

- Protected Territories Act (the State Gazette, issue 133 year 1998);
- Biodiversity Act (the State Gazette, issue 77 year 2002);
- Conventions signed and ratified by Bulgaria and applicable to the territory of the whole country, such as:
  - Convention on Biodiversity (ratified);
  - Convention on humid zones having international significance, in particular as habitats of water birds (signed without ratification obligation);
  - Convention on international trade with endangered species of wild flora and fauna (ratified);
  - Convention on protection of world cultural and natural heritage (UNESCO – applicable for the territory of the Republic of Bulgaria);
  - Convention on protection of European wild flora and fauna and natural habitats (ratified);
  - Convention on preservation of migrating species of wild animals (signed for particular groups of animals).

6.3.4.2 Methodical approach

Registration of water protection areas in a database with geometric parameters:

(1) For territories designated for human consumption water abstraction – sanitary – security zones around the sources for drinking and household water supply, the register contains:

- site – Sanitary Security Zone (as per Establishment Order);
- water source type (ground or surface water);
- location (code of the water body, populated area, municipality, county);

- geographical coordinates (of strips: I, II and III);
- area [decars] (of strips: I, II and III);
- project debit – over 10 cubic metres per day;
- registration description– Establishment Order.

(2) For territories proclaimed as comprising economically significant biological species for the time being in the Republic of Bulgaria there are not any species defined as such due to which they are not subject to the register of the water protection zones.

(3) For water sites proclaimed as recreation areas including territories indicated as bathing water as per Directive 76/160/EEC, when such are proclaimed, the register contains all attribute data comprising in such zones proclamation.

(4) For territories sensitive to nutrition ingredients including territories proclaimed as vulnerable zones in compliance with Directive 91/676/EEC and territories proclaimed as sensitive as per Directive 91/271/EEC, the register contains data indicated in the orders for establishment of these vulnerable and sensitive zones.

(5) For territories proclaimed for protection of habitats or biological species in which the maintenance or improvement of the water condition is an important factor for their protection, including the respective sites of Natura 2000, proclaimed in accordance with Directive 92/43/EEC for protection of habitats and wild flora and fauna and Directive 79/409/EEC of wild birds protection are used the following:

- GIS layer provided by Directorate “National Environment Protection Service’ at MEW, after its completion;
- GIS layer provided under the project “Protection of Habitats and Species in Bulgaria: Closer to EU” – Natura 2000 of MEW, after its completion.

6.3.4.3 Basics

Register of the areas for protection of water, both surface and ground water.

6.3.4.4 Necessary activities at report and summary level

Map of water protection areas (sanitary security areas) around water sources for drinking water supply and around sources for mineral water.

Table 41: Necessary activities at working level

	Working step	Who?	(Intermediate) Product (map, table, text, graph)	Data/ Location
1	Development of central database "Water Protection Zones" per separate species	BDir , EEA, MoEW, Project "Natura 2000"	Data tables	ACCESS - database
2	Presentation of groundwater protection zones	BDir	Map	GIS - server
3	Presentation of surface water protection zones per species	BDir	Map	GIS - server
4	Preparation of text part presenting the results for the report	BDir	Map, attribute tables, text (if necessary)	GIS - server

BDir – Basin Directorate; GIS – Geographic Information System; EEA – Environment Executive Agency; MoEW – Ministry of Environment and Water; GWB – Groundwater Bodies

6.4 Monitoring

6.4.1 Reference to WFD

Art. 8 WFD sets the requirements for monitoring of surface waters and groundwater and of protected areas. Monitoring programmes on the status of lakes, running waters, coastal waters and groundwater have to be elaborated. They should be ready for implementation until 22 December 2006 and have to meet the requirements listed in Annex V WFD.

6.4.2 Tasks and approach

The tasks of the monitoring programmes are the following:

- Determining water quality via a representative monitoring network (determination and control of water status)
- Determination of the trends (long-term changes in relation to the status in the year 2000, WFD prohibits deterioration of the status)
- Check of the measures efficiency (operational monitoring network)
- Determination of the causes for a deficit with respect to good status (special network for investigative monitoring, e.g. input of harmful substances from diffuse sources, re-naturization of running waters).

Open questions still exist in the field of biological quality components. The existing monitoring networks have to be evaluated and new ones that are compliant with WFD developed and an appropriate data management system implemented

All types of water including national waters (surface waters and groundwater) and the transboundary and coastal waters up to one sea mile (and in case of measurement of the chemical status of transboundary waters - up to 12 sea miles) are to be integrated into the Monitoring Programmes. Depending on the degree of difference in the characterization and description of water bodies, the number of water bodies included in the monitoring programme has to be increased. The purpose is to give an overall overview on the water bodies.

The number of monitoring points can be decided by the Member State. They have to establish a monitoring system which covers a sufficient number of separate water bodies of each water body type. Separate water bodies are always monitored for their ecological (surface waters), chemical (surface waters and groundwater) and quantitative status (groundwater).

Three types of monitoring for surface waters are envisaged in Annex V WFD:

- Surveillance monitoring
- Operational monitoring
- Investigative monitoring

Each type of monitoring has specific tasks and objectives.

A monitoring programme for groundwater monitoring has to be developed. The quantitative status shall primarily be determined by measurements of the groundwater level. If sufficient data is unavailable, the water balance has to be calculated. The monitoring of water quality has to include surveillance and operational monitoring.

6.4.3 Elements of surface waters monitoring

The Water Directorate of the MoEW has prepared an operating time and work schedule to arrange all elements of the monitoring programmes on surface waters (surveillance, operational and investigative monitoring) for all four Water Basin Directorates by the end of 2006.

A national co-ordination unit consisting of representatives of the MoEW-Water Directorate, the EEA and the four River Basin Directorates is established as the responsible body for the co-ordination and implementation of all the steps in the schedule.

6.4.4 Elements of groundwater monitoring

Art. 7 and 8 WFD require supervision of the quantitative status and chemical status of groundwater. In this respect the Member States must develop monitoring programmes. These have to be ready for implementation by December 2006.

The monitoring programmes check the results from the (initial and further) characterization in relation to the achievement of the objectives for groundwater determined in the WFD. More detailed requirements for the monitoring programmes are outlined in Annex V WFD.

For the realization of the monitoring programmes the existing monitoring networks and programmes for measurement can be used. An examination and the possible need of change in relation to WFD are necessary and should precede the monitoring programmes.

Each groundwater body is to be included in the monitoring programmes. There is a possibility for grouping individual groundwater bodies. Groundwater bodies have to be identifiable with respect to their quality and use, groundwater bodies. Within one group it is not necessary to monitor each groundwater body through monitoring points. The results obtained from measurement at one or several groundwater bodies inside the group may be accepted as valid for the rest within the same group. For determination of the quantitative and qualitative status different types of groupings of groundwater bodies are possible.

The monitoring process should take into account all items required by the WFD with respect to the objectives achievement, i.e., also those which according to inventory have not lead to an assessment “likely/unlikely” for the achievement of the objectives.

The scope of the monitoring is derived from the extent of the information necessary to check on the objectives achievement. Taking this into account the monitoring of groundwater bodies which are “not at risk” need not be as extensive as the one for groundwater bodies which, according to the inventory have obtained the assessment “at risk / possibly at risk” for the objectives achievement.

6.4.4.1 Monitoring of the quantitative status

6.4.4.1.1 Reference to WFD

The monitoring of the quantitative status of groundwater bodies is determined in Art. 8 WFD. Art. 11 (5) WFD presupposes that the monitoring programme is able to establish whether the objectives set for the water body under Art. 4 WFD will likely be achieved. If it is not able to do this, the monitoring programme has to be adjusted accordingly.

Annex V WFD defines the groundwater level as the parameter for the monitoring of the quantitative status. The density of the monitoring points should allow an assessment of the impact from the discharge and water abstraction. The measurement frequency has to take into account the long-term and short-term variations in groundwater recharge. Additionally, the monitoring has to verify that the groundwater Level in “groundwater dependent terrestrial

ecosystems" is not subjected to anthropogenic activities that may cause significant violations in these areas.

6.4.4.1.2 Methodical approach

The groundwater measurement networks are supported by different institutions. Where other operators perform supervision of groundwater, for instance monitoring of water abstraction, controlling of waste collection depots/landfills, accidents and urban areas performing environmental control, there are not any or very few monitoring points of the competent authorities.

All groundwater bodies in the country are subject to monitoring, i.e., even the ones that during the inventory have been assessed as likely to achieve the objectives.

Additional information on the quantitative status may be obtained through registering of the groundwater levels in wells.

6.4.4.1.3 Necessary activities at working level

Monitoring networks of the Executive Environmental Agency, the National Institute of Meteorology and Hydrology and the Water Supply and Sewerage Companies:

It should be checked which of the existing groundwater measurement points throughout the country's territory are suitable for monitoring purposes. If necessary several groundwater bodies may be united and monitored by a selection of specific groundwater measurement points.

6.4.4.1.3.1 Monitoring network of operators of wells and pumping stations

The minimum requirements for the density of monitoring points, the measurement frequency controlling and the data provision have to be included in the water use permissions. It is necessary to check which of these monitoring data have to be centrally stored.

6.4.4.1.3.2 Additional monitoring points

It should be checked whether all groundwater bodies are represented by a sufficient number of monitoring points.

6.4.4.1.3.3 Monitoring in accordance to WFD

The assessment of the quantitative status of each groundwater body should include at least one representative point to monitor the groundwater level. For smaller groundwater bodies, especially those for which there are no monitoring points, a representative monitoring point of the neighbouring groundwater body has to be identified to represent the groundwater level (grouping of groups of groundwater bodies). For large groundwater bodies and such under anthropogenic impact, of instance, water abstraction, the situation is documented with the assistance of many monitoring points.

6.4.4.1.3.4 Selection criteria

The time variation curve of the groundwater level has a typical appearance. It shows not only the annual seasonal variations but also the effects of long-year periods with more or less rainfalls. They are not directly influenced by the water level and are not located in immediate proximity to the zone of lowering of the level caused by wells.

The monitoring points cover the upper and deeper aquifers even where deeper aquifers have not necessarily to be monitored.

The construction of the monitoring points should allow supervision for a long-year period.

The location of the monitoring points should possibly be protected against damages, for instance, by vehicles.

The terrain on which are located the monitoring points must be public property or private land for which can be obtained permissions or agreements with the land owners for the permanent use of the terrain as a monitoring point.

6.4.4.2 Monitoring of the groundwater dependant terrestrial ecosystems

In Annex V WFD the terrestrial ecosystems dependent on groundwater quality status are listed. Good quantity status can be achieved only if no considerable deterioration of the groundwater dependent terrestrial ecosystems has been noticed.

The groundwater dependent terrestrial ecosystems which have been determined after the initial characterisation should be controlled and assessed with respect to the above items within the framework of the monitoring programmes.

If a specific groundwater dependent terrestrial ecosystem is situated within an area of groundwater table drop or water abstraction point, or if such a situation cannot be excluded for sure, it should be checked beforehand if this terrestrial ecosystem has deteriorated as a result of water abstraction. If deterioration is possible, the monitoring procedure is applied in order to ensure exclusion of future deterioration of this system. Where deterioration cannot be established, notice of a possible past deterioration has to be taken. The intervals of measuring within the monitoring should be determined depending on the land eco-system so that short-term and long-tem modifications are reflected according to the need.

The monitoring program only includes terrestrial ecosystems for which research measures have at present established that they shall not be subject to future deteriorate.

If a specific terrestrial ecosystem is situated within the area of groundwater table drop of water abstraction point with a durable (at least 10 years) and approximately one and the same flow, within the WFD framework, it may not be further monitored, since it was assumed that almost any eventual deterioration can be excluded in the future. terrestrial ecosystems, which should be monitored in the future, but for which deterioration cannot be established from the data collected in sufficient quantity shall in future be excluded from operative monitoring.

If any water supply facility considerably increases its groundwater abstraction in the future, the respective terrestrial ecosystem should be included in the monitoring procedure. This should be checked in the framework of the procedure for issuing of water use permissions. Any considerable decrease of the abstraction could allow to cease the monitoring for one or more terrestrial ecosystem.

Working steps:

The surfaces being categorized after inventory as “at-risk” shall be carefully checked by the DRBD. For this purpose, all data required for an assessment shall be taken into account, for instance, hydro-static and exploitation water level, water supply installation extension, the permitted and the actually abstracted water quantities.

The determined surfaces shall be examined by the respective environment protection authorities on the basis of the information available to them and then these surfaces shall be categorized.

6.4.4.3 Monitoring of groundwater quality

For the monitoring of the groundwater quality status the WFD requires the aforementioned monitoring programmes. The programmes are used for verification of results obtained from the initial categorization. At the same time, the monitoring programmes should ensure the observation of the Directive’s objectives.

The groundwater monitoring network has to be constructed according to the requirements of Art. 7 and 8 WFD. The monitoring network has to allow the coherent and comprehensive examination of the groundwater chemical status for each river basin and long-term anthropogenic trends of harmful substances increase. On the basis of the characterization and impact assessment according to Art. 5 WFD and Annex II, the Member States prepare for each period during which the River Basin Management Plan is in force, a programme for surveillance monitoring. The results from this programme are used for preparation of the operational monitoring programme, which shall be applied in the remaining period of the River Basin Management Plan.

According to Art. 17 WFD the European Community shall adopt a daughter Directive after the entry into force of the WFD in which the criteria of good chemical status are specified in more detail, as well as the specification of the trends and their reversal.

The submitted Draft Directive contains specific criteria for assessment of the good chemical status, for the determination of important and durable trends of increase and for determination of the initial points of the trend reversal. The Draft Directive is entirely concerned with the groundwater quality. Based upon the initial and further characterization, including the examination of impact of human activity, it covers the groundwater pollution caused from point and diffusive sources.

In Guidance Document No. 7 (AG CIS 2.7) different programmes for groundwater monitoring are presented. On one hand, the surveillance monitoring network should reflect the common groundwater quality of each groundwater body or groups of groundwater bodies, and on the other hand, groundwater quality should be surveyed by an operational monitoring network according to the features which cause a significant anthropogenic impact upon the groundwater quality.

The range of the parameters should be in conformity with the respective characteristics of the groundwater bodies or of groups of groundwater bodies, but should contain at least the following parameters:

- oxygen,
- pH-volume,
- electric conductivity,
- nitrates and
- ammonium

Additional parameters (quality norms and limit values) are reflected in the daughter Directive on groundwater.

6.4.4.3.1 Methodological approach

For the groundwater quality assessment, all related results available from the examinations should be used.

6.4.4.3.2 Reference to the WFD

Control of the chemical status of groundwater is envisaged to be realized in the surveillance and operational monitoring.

First of all the monitoring networks should encompass the most shallow aquifers, so that the pressures on the groundwater are covered in a proper manner. In the future, the required measures for the protection of groundwater being at risk not to achieve “good status” shall be estimated according to whether they have contributed to a reversal of the trend and thus have helped improving the chemical status.

For this purpose, the monitoring points at the uppermost aquifers are most suitable, since evident results from the measures undertaken are expected to be noticed first at this point. Based on the results obtained from the inventory the diffuse pressures (main parameter is nitrates) are taken into account.

The pressures from point sources which, as a rule, are of local importance and show a very heterogeneous spectrum, should be controlled by special local monitoring networks.

The impact and development of measures undertaken before the end of the program should be established, especially for those water bodies which may not achieve their objectives, and for which it is already obvious that without prompt measures “good status” will be achieved.

Quality characteristics of the groundwater monitoring points:

The data networks of monitoring programmes should be constructed for operation during the next decades. This means, that a long-term exploitation period should be planned for each monitoring point. Only in this way proper registration of the time variations in the groundwater quality can be guaranteed. For this purpose, timeless permissions or agreements for use as monitoring points should be obtained, so that the continuous samplings can be ensured.

6.4.4.3.3 Requirements of the basic data

The basic data concerning the monitoring point are of crucial importance in all types of assessment. By using the abscise and ordinate it can be guaranteed that at each monitoring point certain characteristics can be compared (for example, the groundwater body location, the respective geological unit, land use). The set of the main data from the monitoring point should meet the minimum requirements of the data base relevant to the groundwater on the subject „basic data“.

Additional criteria for the selection of representative monitoring points are

- A long-term life of the monitoring point should be guaranteed;
- All necessary basic data are available and meet the requirement criteria;
- The focus should be placed on the springs, shallow wells, respectively, the water quality of which represents shallow groundwater;
- Single comparison of land use in the monitoring point catchment area;
- If possible, availability of continuous measuring rows, especially for the nitrates;
- Concentration of nitrates in the groundwater should be “typical” for the respective main land use (agriculture, woods, and settlements).
- Shares of the typical land use within one groundwater body should be illustrated sufficiently well through representative monitoring points.

6.4.4.3.4 Surveillance monitoring

The surveillance monitoring is the basis for the validation of the initial categorization. The selection of proper monitoring points has to be made in correspondence with the existing situation of the groundwater bodies and is based on expert knowledge and special knowledge of the specific sites. The surveillance monitoring is conducted on the basis of the parameters being mentioned in the WFD and in the daughter Directive on groundwater. If anthropogenic impact on the groundwater quality has not been noticed, then the frequency of the examinations can be reduced.

6.4.4.3.5 Operational monitoring

The operational monitoring is carried out supplementary to the surveillance monitoring and is used for exercising control on the implementation of the programmes of measures. The operational monitoring network should be denser within areas of pressure. The range of parameters and intervals of sampling are determined according to the real situation in the respective groundwater body. The results are used for identification of any crucial tendencies. According to Annex V WFD, the monitoring should be conducted at least once a year.

Selection of monitoring points (surveillance and operational monitoring):

The groundwater quality and the negative impact upon it can in most cases be determined by the type of land use:

- For each monitoring point, the percentage share of the respective land use within its catchment is identified. The catchment area at a certain water supply facility can usually be identified by the respective sanitary-hygiene zone. If for a certain monitoring point, there is no sanitary-hygiene zone, a zone can be prepared by accumulation of geographic data (Corine), e.g. a buffer zone around the monitoring point. Moreover, a manual assessment of the predominant impact of the land use can be possibly made by the competent authorities.

- At the monitoring points the main type of land use is compared at their catchment area. Synonymous impact of the land use of “agriculture” type (arable land, meadows) and „woods“ is noticed, when the share of one of these types of land use within the catchment area is at least 75% .
- In the type of land use “settlement” the monitoring points are to be identified as “settlements”, if at least at 40% of the area are of this type..
- All monitoring points for the catchment area in which no certain type of land use can be identified (> 75% - for agriculture and woods, and > 40 % - for settlements, respectively), are indicated as „mixed land use“.
- Selection of all monitoring points in a certain groundwater body, within the catchment areas of which more than 75% of the land use for agriculture is available (arable land, meadows), woods, or more then 40% settlements are present.
- Reducing the number of monitoring points in case of a synonymous land use on the basis of the following criteria:
  a) predominantly shallow wells, springs, respectively, since they represent in a proper manner the upper horizon of the aquifers;
  b) availability of sufficient number of analyses of groundwater bodies being conducted during the last 5 years;
  c) the existence of the selected monitoring points should be guaranteed;
- The proposals for reference monitoring points shall be centrally developed, verified by the expert on the spot (DRBD) and, if necessary, modified. Thus the competent authorities shall determine by using their expert judgment and local knowledge the selection of monitoring points which shall be used for surveillance and operational monitoring purposes.
- In order to identify the impact of land use in the groundwater body, the average values are generalized for the groundwater (the leading parameter being “nitrates”) at the monitoring points with a synonymous type of land use, and are weighted by using percentage shares of the land use for the respective groundwater body. The weighted average value by the allocation of the land use in the respective groundwater body is used for verification of the representative character of the selected monitoring points.

6.4.4.3.5.1 Procedure

From the total data pool, the land use from a restricted number of monitoring points is compared. The selected monitoring points are maintained in a reference table which in addition to the technical construction data contains assessments made by the competent authorities.

6.4.4.3.5.2 Necessary activity at working level

The necessary activity at working level is the description of the natural quality characteristics of the groundwater at groundwater body level. The deduction of the threshold values allows the diffusive impact on the groundwater quality to be recognized.

Monitoring should be conducted at least once a year, so time changes in the groundwater quality can be completely covered. Different time intervals and monitoring points at which sampling is not continuously carried out are not suitable as far as the comparison of the results is possible only under certain circumstances.

6.4.4.3.5.3 Necessary activity on reporting and information collection level

The data transfer to the Community is carried out on data-sheets. Initially, data from the existing monitoring network are reported. According to the WFD requirements (Annex V) and the daughter Directive on groundwater the parameters' volume should be compared with the existing parameters' volume.

6.4.4.3.5.4 Criteria for selection of exemplary surveillance monitoring points

The quality characteristics of the groundwater at a groundwater body level /a group of groundwater bodies has to be considered by taking into account the existing results with respect to their grouping (the objectives are likely to be achieved, the objectives are unlikely to be achieved).

6.4.4.3.5.5 Criteria for selection of exemplary operational monitoring points

The operational monitoring is focused on groundwater bodies which are not likely to achieve the quality objectives. The density of the monitoring points, the frequency of sampling and the volume of parameters have to correspond to the actual local situation.

Reference to other EC-reports and information of the European Environmental Agency:

Within the EC-framework, the concept that the different reports and data on groundwater available shall be covered by a single monitoring network is under discussion (see WISE - Water Information System). In this context the issue of the relation of the monitoring conception with the existing European reports was often raised. The existing monitoring networks have been discussed before the introduction of the WFD and do not take into account an approach to "ground water bodies and the groups of ground water bodies".

The monitoring of the deeper groundwater is carried out according to the existing regulations.

6.4.4.4 Groundwater dependent terrestrial ecosystems – chemistry

In Annex V WFD, the groundwater dependent terrestrial ecosystems are also included in relation to the chemical status. Good chemical status can be achieved only if considerable deterioration of the groundwater dependent terrestrial ecosystems is not established. This concerns the terrestrial ecosystems being directly dependent on the groundwater. They should not deteriorate as a result of the groundwater quality.

The groundwater dependent terrestrial ecosystems which have been identified after the inventory have to be examined and assessed.

For groundwater dependent terrestrial ecosystems situated within areas of impact of the emitters of harmful substances, no eventual future additional deterioration can be expected, if a long-term impact is already at hand, and sanitation measures or monitoring has already been undertaken.

When point sources of harmful substances are monitored in accordance with the effective legal regulations, and the required sanitation measures have been undertaken, it can be assumed that the situation will not deteriorate further. For this reason, any further individual consideration is irrelevant.

Groundwater bodies which have been classified as unlikely to achieve the objectives because of the input of harmful substances can be improved in their current status by the implementation of some monitoring programmes and programmes of measures until the achievement of a "good status". At the groundwater dependent terrestrial ecosystems of such groundwater bodies deterioration of the status is not affected by reduction of the input of harmful substances. Further individual consideration is therefore irrelevant. It can be stated from experience that no information is available which proves that the groundwater

dependent terrestrial ecosystems are considerably deteriorated by harmful substances contained in the groundwater.

6.4.4.5 Monitoring of other anthropogenic impacts on the groundwater

Other anthropogenic impacts can be categorized as affecting the quality in its broad sense (i.e. groundwater level, flow direction, springs flow rate) or the quality of the groundwater. When in the course of the inventory such types of water “at risk” have been identified, proper monitoring networks should be constructed, especially for such type of impact.

6.4.4.6 General guideline for monitoring network development in the Danube River Basin

Step by step proposal for the development of the monitoring network in the Danube river basin

1. Creating an overview of all existing groundwater monitoring sites (measuring points: wells, piezometers, springs, boreholes)
2. Selection of monitoring points with well-known metadata (coordinates, depths, stratigraphy)
3. Selection of measuring points preferably in the upper aquifer (outcrop of aquifer, recharge area of aquifer: springs, shallow wells)
4. Correlation of each measuring point to the relevant aquifer
5. Selection of those monitoring points with data for at least the last five years and continuity of sampling in the future
6. The data flow to the DRBD Pleven (or the organisation which will interpret the data) has to be ensured for each measuring point.
7. Review of all analysed parameters of the last five years for each selected monitoring point, especially focused on the parameters nitrate, ammonium, pesticides, oxygen, pH-value, conductivity. Furthermore, all parameters being significantly at risk
8. Allocation of the monitoring points to the groundwater bodies.
9. Allocation of the monitoring points to the land use in the catchment area of the monitoring point.
10. Selection of operational and surveillance monitoring points due to the main pressures in the groundwater body: Determination of the relevant land use for the catchment area of the monitoring point.

Example:

- >75 % agriculture "agriculture" ⇨ operational monitoring
- >75 % woods "woods" ⇨ surveillance monitoring
- >40 % settlement "settlement" ⇨ operational monitoring
- unspecified "mixture" ⇨ operational or surveillance monitoring
- point source monitoring point in catchment area with point source

1 Integration of local expert knowledge to assure the assignment of the land use to the monitoring points

2 Creating a table with monitoring points, groundwater bodies, aquifer, typical land use, sustainability

3 Selection of a low number of measuring points per groundwater body depending on the size of groundwater body and the importance regarding the main pressures. At least, for every significant land use in the groundwater body, there has to be a minimum of 1 representative measuring point.

Table 42: Templates of the documentation of the monitoring points

Measuring point ID	x-coordinate	y-coordinate	Measuring point name	GWB ID	Measuring point type	Average NO3-content all analyses	Landuse	Operational/ Surveillance
13726	3466950	5501970	Pleven xy	BG 019	Well	40,5	Agriculture	o
13730	3466100	5501800	Pleven yx	BG 019	Spring	11	Wood	s

Measuring point ID	x-coordinate	y-coordinate	Measuring point name	GWB ID	Measuring point type	Influence by abstraction	Medium depth to groundwater table (m)
13724	3466100	5501200	Pleven xy	BG 019	piezometer	yes	3
13712	3466050	5501030	Pleven yx	BG 017	piezometer	no	40

As a surveillance monitoring point can also be selected one typical monitoring point whose catchment area has a nearly identical percentage of different land use with the whole groundwater body:

Example: Groundwater body: 45 % agriculture, 30 % woodland, 25% settlement = catchment area of measuring point: 43 % agriculture, 32 % woodland, 25% settlement

6.4.4.7 Monitoring for the quantitative status

- Creating an overview of all existing groundwater level monitoring sites (measuring points: wells, piezometers, springs, boreholes)
- Selection of monitoring points with well-known metadata (coordinates, depths, stratigraphy)
- Correlation of each measuring point to the relevant aquifer
- Selection of those monitoring points with data for at least the last five years and continuity of measuring in the future
- The data flow to the DRBD Pleven (or the organisation, which will interpret the data) has to be ensured for each measuring point.

- Allocation of the monitoring points to the groundwater bodies
- Review of the time variation curve of the groundwater level for each piezometer for the last five years (minimum).
- Identification, if the time variation curve is influenced by groundwater abstraction or not.

Example:

If a GWB body has not been identified as “at risk”, one groundwater piezometer with a representative time variation curve for the natural groundwater level changes in each aquifer will be sufficient.

If a GWB body has been identified as “at risk”, a piezometer influenced by water abstraction selected in addition to one groundwater piezometer with a representative time variation curve for the natural groundwater level changes in each aquifer will be sufficient.

6.5 Preparation of Programmes of Measures and River Basin Management Plans

6.5.1 Reference to WFD

The process of preparation of the Programmes of Measures (PoM) is regulated in Art. 11 WFD, the elaboration of the River Basin Management Plans in Art. 13 WFD and Annex VII.

The CIS-Guidance Document Nr. 11 “Planning Processes“ describes the approach applied in preparation of the Programmes of measures and River basin management plans.

6.5.2 Time schedule and approach

The process of working out the Programmes of Measures and River Basin Management Plans should end until the year 2009.

Table 43: Time schedule for the implementation of the WFD

No	Brief Description	Deadline acc to WFD	Status of implementation (9/2006)
1	Legal Implementation	2003	completed
2	Inventory and Assessment	2004	almost completed
3	Monitoring	2006	started
4	Public Participation	2006 ff	started
5	Program of Measures and River Basin Management Plan	2009	beginning of pilot projects
6	Implementation of Measures	2012	
7	Achievement of the objectives	2015	

After completing the inventory and the risk assessment, according to WFD, by taking into account the actual level of planning in the Bulgarian water sector and the related aspects (for example, the regional and municipal planning, agriculture, opportunities of funding, etc.), a series of different steps concerning the water bodies with “deficits” (water bodies „at-risk”, possible-at-risk“, respectively) should be undertaken.

Until 2007: Interim overview of the significant water management issues (catalogue of measures) according to Art. 14 (1b) WFD.

Until 2008: Draft of the River Basin Management Plan (management alternatives), according to Art. 14 (1c) WFD

Until 2009: Programme of Measures according to Art. 11 WFD and Annex VI part B

Until 2009: River Basin Management Plan, according to Art. 13 WFD and Annex VII

For the water bodies which are or probably shall achieve good status (water bodies „not-at-risk“), no measures are envisaged within the framework of the WFD implementation (see

Figure 13).

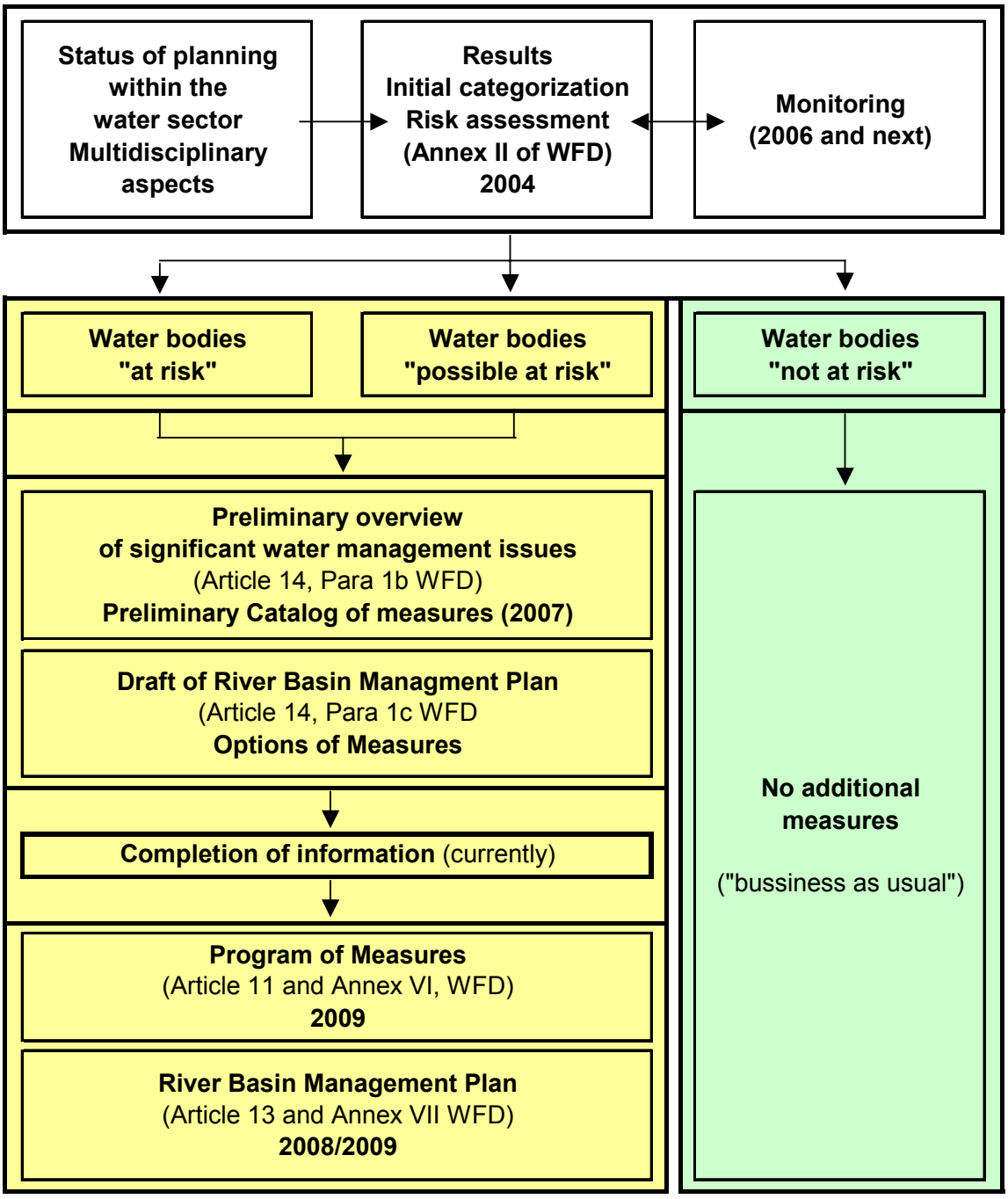


Figure 13: Process of preparation of the Programmes of Measures (PoM) and River Basin Management Plans (RBMP)

The structure of the planning process is illustrated in Figure 14. It covers the following steps:

- Assessment of the status and setting of objectives;
- Description of alternative solutions;
- Description of the effects from the possible measures;
- Assessment of impacts;
- Identification and justification of extreme circumstances and regulation of exceptions;
- Selection of cost-effective measures and combinations of measures.

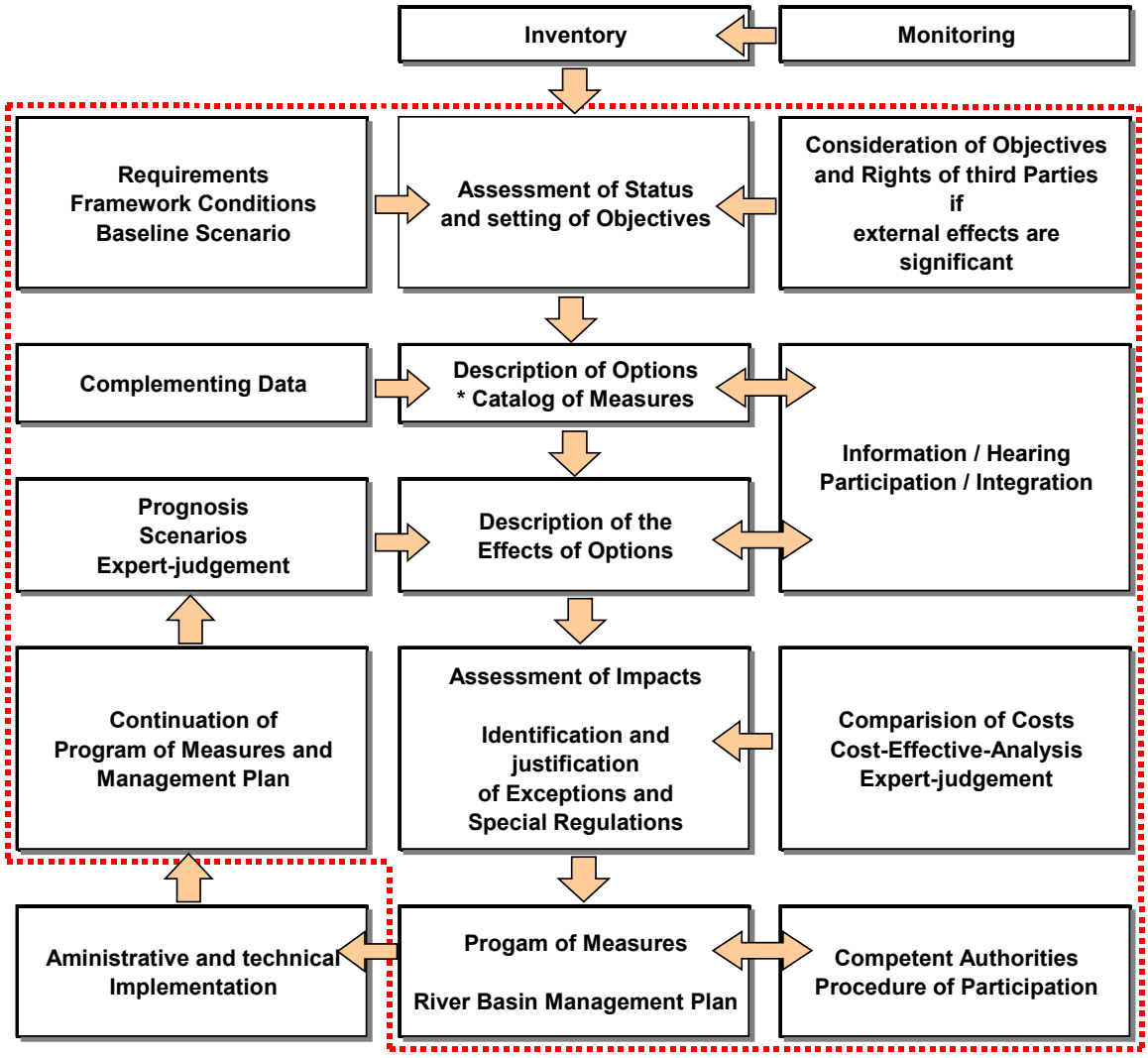


Figure 14: Structure of the planning process for preparation of Programmes of Measures and River Basin Management plans

6.5.3 Programmes of Measures

As part of the sustainable water management planning, a Programme of Measures has to be worked out. The conditions of this programme are described in Art. 11 WFD. It has to be ready by 2009. It contains the basic measures which should be conducted towards the achievement of the set objectives until the year 2015. The decision about the measures to be undertaken is made at a national level.

If the basic measures are not sufficient for achievement of the set objectives, supplementary measures have to be undertaken such as supportive measures or voluntary agreements, economic and fiscal instruments. In Annex VI part B WFD a non-complete list of such measures is published. The Member States, however, can undertake other measures, if they are in accordance with the WFD regulations in Art. 1 (see Table 44).

Table 44: Basic and Supplementary Measures according to Art. 11 WFD

1. Basic Measures according to Art. 11 WFD

a.) Protection of resources (Art. 10 WFD)
b.) Cost recovery (Art. 9 WFD)
c.) Efficient and sustainable water use (Art. 4 WFD)
d.) Achievement of environmental objectives (Art. 4 WFD)
e.) Restriction of water abstraction and impoundment
f.) Restriction of artificial recharge of groundwater
g.) Restriction of discharges from point sources (Art. 10, 16 WFD)
h.) Restriction of discharges from diffusive sources
i.) Ensuring proper hydro-morphological conditions
j.) Prohibition for direct discharge of harmful substances into groundwater
k.) Elimination of pollution with priority hazardous substances
l.) Measures for prevention of unexpected pollutions (e.g. accidents, floods)

2. Supplementary Measures according to Annex VI Part B WFD

i.) Legislative instruments
ii.) Administrative instruments
iii.) Economic and fiscal instruments
iv.) Negotiated environmental agreements
v.) Emission controls
vi.) Codes of good practices
vii.) Recreation and restoration of wetlands areas
viii.) Abstraction controls (water-supply management)
ix.) Restriction of water demands (demands management)
x.) Water uses effect management
xi.) Preservation / construction of facilities (for example for desalting and infiltration)
xii.) Educational measures
xiii.) Research, demonstration and development projects

Factors for uncertainties such as meteorological, demographic, social, technical and political factors can be included in the Programme of Measures.

6.5.3.1 River Basin Management Plans

According to Art. 13 WFD River Basin Management Plans have to be developed for the river basin districts. They should be published within 9 years from the entry into force of the Directive. The plans' contents are given in Annex VII WFD.

Table 45: Contents of the River Basin Management Plans according to Annex VII WFD (review)

1. General description of the River basin district
2. Significant pressures and anthropogenic impact
3. Protected areas
4. Monitoring network and monitoring results
5. Environmental objectives
6. Summary of economic analysis
7. Summary of Programme of measures
8. Register of programmes and plans for sub-basins, sectors, etc.
9. Summary of the public information and consultation measures
10. List of competent authorities
11. Contact points and procedures for obtaining data and information

With regard to the extent of the tasks to be implemented for the unified Directive enforcement, coordinated development of basic specialized assignments and detailed guidelines for working out management plans should be arranged within a nine-year period.

6.5.3.2 Processes of planning, assessment and decision making

The rational processes of planning, assessment and decision making are the basis and precondition for each action. For all processes of planning, assessment and decision making the following considerations have to be taken into account:

1. The existing situation should be assessed and the conclusions be drawn (for example, classification of water bodies: "heavily modified water bodies", "water bodies, for which extraordinary circumstances are to be grounded, regulation of exceptions", "water bodies at-risk", "water bodies not-at-risk") or
2. Proper measures towards achievement of certain objectives (Programmes of measures, River Basin Management Plans) have to be elaborated.

The central issue of all planning, assessment and decision making can always be formulated as:

Which measures under the current conditions will meet the objectives in the most effective way?

The processes of assessment and decision making have to pass the following obligatory phases:

1. **Setting of Objectives**: In order to assess the facts/circumstances and ground the decisions, they have to be properly outlined, analyzed and the proper objectives have to be defined. This requires the collection and preparation of essential information on the facts and existing conditions as well as the identification of the objectives to be achieved. It should be taken into account that the essential information is based on facts (data, prognosis) and on a value system.

2. **Creation of Alternatives (management options)**: In this second phase, the opportunities for achievement of the set objectives are developed with observation of the existing conditions. Creative thinking at this step could essentially lead to a good solution of the problem.
3. **Assessment of Alternatives (Options) and decision**: The alternatives for decisions should be assessed in view of the objectives and the conditions with regard to the efficiency, impact on the environment, effects on the regional development or other "side" or external effects (environmental and resource costs), and often under subjective "normal" criteria. If alternative actions and essential criteria can be expressed in figures, "the best" decision can be determined by the application of mathematical methods. In a complex situation of decision making with many competitive target criteria a single "optimal" decision will be hard to find. Instead, a "satisfactory" decision should be found. A decision is satisfactory when it corresponds to the level of requirements of the decision makers, i.e. when it meets the minimum values for every target criterion, and is in sufficient compliance with the different "special" objectives as laid down by the participants and by the parties concerned.

After the decision implementation (for example, water bodies arrangement, programme of measures, management plan) it is necessary in most cases to control the decision and the objectives achievement (→ monitoring). Monitoring should be applied at the phase of the status assessment, so that the development of the essential conditions can be covered as well as the objective achievement itself. Thus the objectives shall be achieved in due time even in case of changes or under wrongly assumed conditions.

6.5.3.2.1 Methods of assessment

The assessment of the impact of measures (for example, selection of cost-effective measures) requires, depending on the complexity of the significant circumstances, objectives and impacts (interactions, „side" or external effects), the application of different methods.

Common, as a rule one-dimensional tasks of optimization (for example, conceptualization and dimensioning of installation, costs minimization or selection of cost-effective measure and combination of measures), can be resolved by a simple comparison of costs. This concerns to a large extent the number of measures and combination of measures within the framework of the WFD implementation.

Complex tasks, for which multiple objectives and preferences have to be weighed, and for which "side" or external effects are noticed (environmental and resource costs), require multi-dimensional assessment in the form of analysis of costs and benefits. The application of "verbally-grounded" methods (Delphi Method) is only justified, if uncertainty in the assumed conditions and impact of the complex measures exists. In this case they also shall contribute to a justifiable decision.

In Table 46 the work steps and methods of the economic assessment are illustrated.

Table 46: Criteria of economic assessment

	Working steps	A Cost Comparison	B Cost-Benefit-Analysis	C Expert judgement
1	Target criteria	Minimum of Costs	Cost-Efficinecy	Specific objectives (sub-objectives)
2	Measures effect	Costs	Costs, Benefits	Benefits of sub-objectives
3	Impact assessment	Series of Costs	Series of Cost-Benefit-Relation	Achievement of objectives (sub-objectives)
4	Sensibility verification (sensibility analysis)	Initial data variation	Variation of weight objectives	Variation of the "uncertain" informations
5	Total assessment	Ranking of "Costs"	Ranking of "Efficiency"	Verbal assessment (balances)

Notes:
Under A: Calculation in view of the economic management (measures without „external" effects)
Under B: Measures with significant „external" effects (environmental and resource costs); depending on the project conditions different methods can be applied.

6.5.3.2.2 Procedure of assessment of the relation between the surface water and groundwater

6.5.3.2.2.1 Diffusive sources

The purpose of the WFD is the protection of the inland surface waters, transitional waters, coastal waters and groundwater (Art. 1). Thus, a common legislative framework for all individual phases of the water circle is formed. As a result, great attention is paid to the flows of relevant substances representing the transitions between the individual phases. The WFD requires the elaboration of programmes of measures for the prevention or restriction of the discharge of harmful substances from diffusive sources which could cause pollution. Of great importance is the selection of cost-effective measures. For this reason, an assessment has to be made to identify the type of sources which contribute the main substances input – point or diffuse sources. Moreover, River Basin Management Plans should be submitted which have to contain an assessment of the pollution caused by point and diffuse sources.

- Nitrogen

As point sources in the substances balance, the urban waste waters treatment plants, sewerage overflow facilities and the scattered settlements are considered.

As diffuse sources the dissolved substances are considered, which fall with the main flow (groundwater recharge) in the open water basins.

In the first place, it is possible to make a nitrogen balance. The most reasonable is the preparation of the loads balance. The nitrogen (predominately in the form of nitrates) impacting the water bodies through the groundwater (including its input through the atmosphere), as well as through the waste water discharges from the settlements (waste water treatment facilities, sewerage overflow facilities and scattered settlements) in the open water basins. The nitrogen (nitrates) loading represents a great problem for the groundwater and the seas. For the open water basins the nitrogen loads represent less risk, as a rule.

- Phosphorus

For the phosphorus the load balance can be made only with more difficulties. In the surface waters it is imported in the form of particles through the surface run-off (erosion, washing out). The events connected to the high waters play important role in the substances transportation. The loading of surface waters by phosphorus is caused mainly by the point discharge of waste waters and by “diffusive” input of particles as a result of erosion processes. Moreover, the phosphorus being emitted annually from the urban waste water treatment plants, as well as the phosphorus loads input from the sewerage overflow facilities considerably exceed those from the groundwater.

The average phosphates concentration in the groundwater in the province Hessen (Germany) for example varies from 0.05 up to 0.07 mg/l P. This phosphates concentration should be considered as normal for the groundwater and represents no risk. For the surface waters and the seas, the increased phosphates content represents a great risk.

- Priority hazardous substances /specific river substances

For a great part of the parameters as given in the list of the priority hazardous substances (Annex X of WFD), their diffuse input is not quite probable. The main source of groundwater loading by these substances are the discharged waste waters. The residual quantities of preparations for plant protection fall into the water basins mainly from the waste water treatment plants, sewerage overflow facilities, by erosion, carrying away and surface run-off. As a rule, there is no surface input of residual quantities of preparations for plant protection from groundwater. Considerable point input of residual quantities of preparations for plants protection from the groundwater cannot be excluded, however. The preparation of balance of the residual quantities of preparations for plant protection is very difficult since their concentration is highly dependent on the season. Making of balance of the preparations for plant protection input as loads from the treatment structures is desirable.

An applicable assessment method is outlined bellow:

- Determination of the annual loads in the flow (t/a) of the urban waste water treatment plants by multiplying the concentration in the waste waters (mg/l) with the respective annual waste water quantities (m^3/a).
- Determination of emission from scattered settlements by using the extent of connection of the settlements to the urban sewerage system. For Germany, such calculation can be made on the basis of the loads being specific for one inhabitant according to ATV-A 131 and the treatment capacity of the multi-chamber septic tanks. For Bulgaria, the respective assumptions should be examined.

- The loads input from the sewerage overflow facilities are determined by estimation using the overflow water quality and the concentration of the substances in the mixed waters.
- The diffusive loads from groundwater are determined by using the hydrological parameters (total flow, direct flow and recharge of groundwater), as well by the average concentration of nitrates and phosphorus. For the nitrates the specific concentration for the land use (arable land, meadows, woods and urbanized) is used. From the average nitrates concentration for a specific type of land use, an assessment of the nitrates input from the groundwater into the open basins is made.

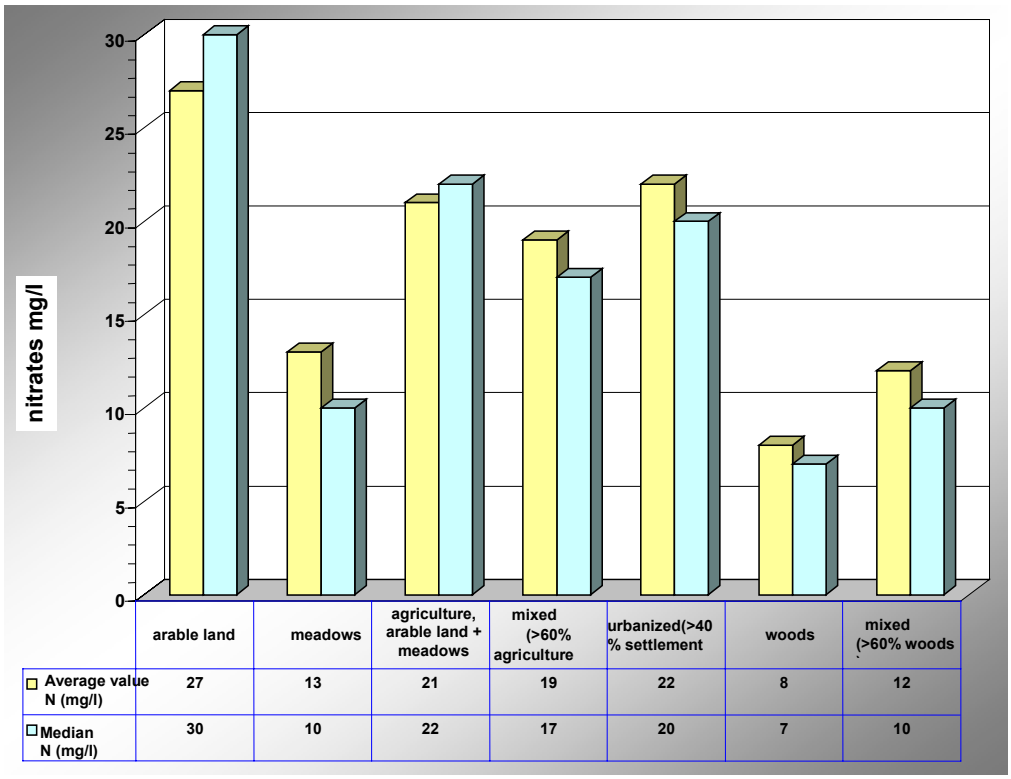


Figure 15: Average nitrates concentration in the groundwater in the province Hessen (Germany) depending on the land use

After the point and the diffuse nitrogen loads are identified by the described assessment method, they can be compared to the selected area. The ratio between the point and diffuse input substances is an important factor showing in which manner the biggest quantitative loading upon the groundwater can be realized.

This ratio on the other hand allows a conclusion to be made concerning at which place(s) should be implemented the necessary measures for reducing the nitrogen loads.

For Hessen it is assumed that the average phosphorus concentration is 0.07 mg/l. This value corresponds to the Hessen average value for the groundwater with respect to the phosphorus. It should be checked whether the situation in Bulgaria is similar.

Description of the main points in the determination of the phosphorus loads:

- Identification of the diffusive input from groundwater by means of hydrological parameters (total flow, direct flow and groundwater recharge), as well as the average phosphorus concentration of 0.07 mg/l P in the groundwater.
- Identification of the potential washing out of soil through „the total equation for soil washing out (ABAG)“ for arable land in the close vicinity of waters with potential washing out of over 10 tones of soil per ha per annum.
- Washing out of P (kg/ha *a) = washing out of soil (t/ha*a) x P-concentration in the soil (%) x coefficient x 10; for phosphorus concentration is assumed to be 4%; the coefficient is 2.53 x washing out ^-0,21.
- Determination of the annual loads (t/a) in the waters discharged from the urban waste water plants by multiplying the concentration in the discharged waters (mg/l) with the respective quantity of the annual waste waters (m³/a).
- Determination of emissions from the scattered settlements by using the extent of connection of the respective settlement to the urban sewerage system.
- The loads input from the overflow sewerage facilities are determined through estimation by using the overflow water quantity and the concentration of the substances in the mixed waters.

A simplified approach for assessment of the phosphorus washing out quantity:

- Only surfaces situated within the buffer zone from 300 m up to waters are considered
- Within the buffer zone from 300 m only areas with agricultural use (arable land), fallow land, respectively are considered
- Common estimation of the risk from erosion (for example by altitude models) for the arable land/fallow land by formation of risk categories (see Table 47)

Table 47: Categories of Risk of Erosion

	Risk categories	**Washing out of soil in tones (t) per ha and per year** t /(ha * a)
Category 1	Very low	< 2
Category 2	Low	2 - <4
Category 3	Medium	4 - <6
Category 4	High	6 - < 8
Category 5	Very high	>= 8

Acc. to Frede: Handbuch zum Gewässerschutz in der Landwirtschaft (Manual for water protection in agriculture)

- phosphorus content in soils is from 0,04 up to 0,08 %; assumed to be 0,06% as average;
- assessment of the dressing coefficient
- washing out of soil 0,21 x 2,53 (can be used as an exemplary value)
- calculation of phosphorus washing out

P (year) = washing out of soil x P-concentration x dressing coefficient x 10

Example:
Category 3: appr. 5 t washing out of soil in tones
P-concentration: 0,06 % (varies between 0,02 and 0,1 %)
Dressing coefficient 2,53 x washing out of soil -0,21 = 1,8
Calculation:
5 t/ha * year x 0,06 x 1,8 x 10 = 5,4 kg P/ha * year input substance
Under the observation of the measuring units: 0,06 % P = 0,6 g P/kg soil
i.e. 5000 kg/ha x 0,6 g/kg P x 1,8 = 5400 g P/ha = 5,4 kg P/ha

Risk categories of waters of the washed out phosphorus (see Table 48)

Table 48: Risk Categories of P-washing out

Risk categories	P-washing out in kg/(ha and year)
Very low	< 2
Law	2 - <4
Medium	4 - <6
High	6 - <8
Very high	>= 8

It should be taken into account that the P and N loads assessment represents only a rough evaluation, which should be progressively extended and deepened. The provisional values as obtained are an important direction showing what substance input pathway is more crucial. In the final reckoning, this information serves as an entry value in the formation of measures to be undertaken for reduction of the input substances. For the biological impact of phosphorus in the surface waters, the concentration in the vegetation period is decisive. The measures should be oriented according to this fact.

Other approach (see Table 49).

The individual components of flows of substances for nitrogen and phosphorus should be progressively deepened step by step. On one hand, the surfaces of especially high risk potential should be determined, and on the other hand – the more precise determination of input values for the loads assessment should be further made (for example, erosion, possible conversion of substances).

Table 49: Steps to deeply identify the flow of substances

Nr	Working steps	Remarks
1	Working out in detail (going deep) in the assessment approach	Iterative process
2	Deducing the relations between concentration and flow	Iterative process
3	Transferring the results to other groundwater bodies	
4	Identification of the required measures	

6.5.3.3 Identification of cost-effectiveness of measures and combination of measures

Annex III b) of the WFD provides for the implementation of combinations of measures with efficient costs. The inventory and risk assessment are the starting point for this action. A particular attention shall be paid to the pressure by substances (for example, nutrients, plant protection preparations, and priority hazardous substances) as well as to the hydro morphological pressure. These shall be compared to five, i.e. basic pressure directions (point sources, diffuse sources, water abstraction, flow regulation, morphological alterations). Within such pressures a distinction shall be made as per the polluters (settlements / households, agriculture, industry etc.). Such pollutants can be compared to various kinds of pressure (e.g. waste water discharge, substances from agricultural lands input, hydro power and navigation). Deficit parameters shall be determined for each kind of pressure (i.e. environmental impact). For example, in the case of input of diffuse substances by agriculture such parameters are “nitrogen, phosphorus, plant protection preparations” or in the case of a flow regulation for the purposes of navigation or hydro power plants such parameters are “impaired flow dynamics, impaired permeability and river bed straightening”. One or several measures can be applied so as to eliminate the identified deficits. The term “measures” means specific technical and mainly locally focused activities, e.g. construction. Measures can be supported by additionally introduced “instruments”, which might be of administrative, economic or informative nature and have a long-term validity and large scope of application.

The selection process related to combination of measures goes through seven steps. This multistep assessment process shall take into account the environmental efficiency of the individual potential measures, as well as their combinations (presented and specified on the basis of a “cause-impact” matrix) as well as the implementation timeframe. The upper bound is the feasibility for the objectives achievement by 2015. By applying microeconomic (e.g. investment costs, depreciations, exploitation costs, financial costs) and macroeconomic (i.e. significant negative impacts of a measure in relation to other kinds of water uses) cost assessment the priority of the possible measures and instruments shall be defined. On such a basis shall also be identified the most cost-effective combination for elimination of the respective pressure.

The next figure illustrates the approach applied to determine the specific programme of measures for achievement of water objectives. The WFD requires identification to be made by 2004 of the moment status of water and cause of pressures. Afterwards, by 2009, there is time to reach an agreement related to the specific programme of measures. The objective shall be achieved by 2015.

Working step 1: Selection of measures schemes

On the basis of the inventory of river basins a summary shall be made of the identified pressures on the respective water bodies, in order to be presented the situations as per individual pressures (from point sources, diffuse sources, water abstraction etc.). Attention shall be paid to the fact that the polluter (agriculture, settlements, industry etc) and the pressure level have to be described in accordance with the WFD classification. Depending on the pressures situation, a scheme shall be selected for measure identification.

Working step 2: Selection of efficient measures

The efficient measures to eliminate the deficits are identified on the basis of the river basins schemes depending on the polluter (the available kind of pressure). The contribution of the individual measures for pressure reduction shall be defined by applying Annex I.

The "cause-impact" matrix can be used to obtain a better understanding of the implemented measures efficiency (see Table 50). Such a matrix shall be prepared for each basin subject to examination. "Local knowledge" is crucial for the intensity impact assessment.

Table 50: Determination and identification of the priority of measures efficiency by applying a "Cause-Impact" Matrix

Measures	Environmental Deficit Indicators (WFD, Annex V)				Sum of individual evaluations (Σ)	Priority Classification
	Macrophytes	Algae	Benthic invertebrate fauna	Fish Fauna		
1.1						
1.2						
1.3						
2.1						
2.2						
2.3						
2.4						
3.1						
3.2						
Other Measures						

The measures efficiency as described in the matrix shall be measured by the indicators provided for in Annex V of the WFD. How strong is the impact on some of the following indicators: algae growth, macrophytes, macrozoobenthos, and fish fauna? The assessment shall be made by putting a sign in the cross points of measures and indicators as follows: *x* for a weak impact, *xx* for an average impact, *xxx* for a strong impact and "-"for no impact. Then the cross signs shall be counted up to obtain a classification sum (see Table 51).

Table 51: Environmental efficiency classification key

Sum of Individual Evaluations	Efficiency Denotation	Classification
12 – 9	High environmental efficiency	3
8 – 5	Average environmental efficiency	2
4 – 1	Low environmental efficiency	1
0	No environmental efficiency	0

Working Step 3a: Combination of measures

As a rule, no measure shall be implemented independently. Usually, a combination of several measures is required with the respective instruments considered. First of all, the Bachfischer preferential matrix shall be applied to assess the efficiency of combination of two measures. In the frames of this matrix, in the cross points of the individual measures, the total impact on one pressure by one pollutant shall be indicated. “Local knowledge” is required again for this impact identification. The matrix shall be filled in like here to described and adjusted to the specificities for each examination. The assessment shall be made again by using the signs +, ++, +++ and -.

Table 52: Preferential matrix of measures

		Measures 1		
	Class	**1**	**2**	**3**
Measure 2	**1**	**+**	**++**	**++**
	2	**++**	**++**	**+++**
	3	**++**	**+++**	**+++**

A combination of two measures can resist a pressure by “diffuse sources”. A combination is possible between 2.1 and 4.2, 2.1 and 5.3, 2.1 and 5.3 (see Table 53). The first and the third combinations are the most efficient ones; therefore, they are considered main combinations.

Table 53: Matrix of the Assessment of a combination of measures

Measure No	sheet	Ecological effect of measure combinations					
		1.1	1.3	2.1	4.2	5.1	5.3
Point sources: Sewage treatment plants	1.1		+	++	++	+	++
	1.3			++	++	+	++
Diffuse Sources	2.1				+++	++	+++
Outflow	4.2					++	++
Morphological changes	5.1						++
	5.3						

The assessment shall take into account the following points:

- Arising Costs
- Time period of the impact
- A possible declination in another indicator, resulting from the implementation of several measures.

Working Step 3b: Identification of supportive instruments and impact assessment

The instruments have informative and administrative nature and can be applied as a supplement to the individual measures. Annexes I and II [29] contain their description and interrelation with measures.

The instruments are intended to change the behaviour of the groups concerned and have prevailingly a direct impact. The first impact assessment shall be derived from the kind of implementation (implementation intensity):

- Legislative instruments
- Deductions and financial preferences
- Corporative instruments and voluntary agreements
- Informative Instruments

Working step 4: Description of the interrelation between instruments and combinations of measures

The interrelation between combination of measures and instruments shall be assessed. The instrument impact on the further implementation of combination of measures shall be illustrated in a matrix (see Table 54). The letters U, B, O and G shall be used.

The instrument shall be given a U, if the instrument is supportive to the measure, a B, if the instrument necessitates the implementation of the WFD, an O, if the instrument renders the measure obsolete, a G, if the instrument leads to reduced/less expensive of the measure.

Table 54: Interactions between measures and instruments

Measure	Point Sources Sewage treatment plants & industry					Point Sources Combined sewage/ precipitation				Diffuse Sources Combined sewage/ precipitation				Water Abstraction	Flow Control		Morphological Changes			
	1.1				1.2	1.3	1.4	1.7	1.9	2.1	2.2	2.3	2.4	3.1	4.1	4.2	5.1	5.2	5.3	5.4
Instrument	BOD, COD	NH_4-N	N_{total}	Ptotal	Membrans; Filters	Combined & separation process, qualified	Decentralised measures	Rain spillway basin rain ret. pond, soil filt.	Percolation trenches filters etc.	Riparian buffer strips	N discharges	P discharges	Application of pesticides	Water level	Residual water	Flood protection	Passability	Restructuring	Inherent dynamism	Bank and bed
Charges financial incentives																				
I Subsidised organic farming		(O)	(O)	(O)						(U)	U	U	U (O,G)							
II Charge on organic fertilisers		(O)	(O)							(U)	U G									
III Tax on mineral N fertilisers		(O)	(O)							(U)	U G									
IV Tax on pesticides										(U)			O G							
V Use of water abstraction charges														(U)				(G)	(G)	
VI Restructuring of the nature conservation & fishing charge										B (U)							B (U)	B (U)	B (U)	B (U)
Cooperation arrangements / voluntary agreements																				
VII Cooperation between water industry & agriculture		(G)	(G)							(U)	U G	U G	U, (O,G)							
VIII Advice to farmers		G (O)	G (O)	G (O)						U	U	U	U							
IX Advice to local authorities on water body maintenance														U	U	U	U	U	U	U
Statutory instruments																				
X Synergy effects between IPPC and WFD	U B	U B	U B	U B	U B															

Case 1: Instrument supports measure: U
Case 2: Instrument necessitates implementation of WFD: B
Case 3: Instrument causes measure to become obsolete: O
Case 4: Instrument leads to reduced/less expensive implementation of the measure: G

Working Step 5: Costs Determination

This phase is intended to determine the costs related to measures and instruments. Costs are direct and indirect. Direct costs can be:

- Construction related costs for water protection measures
- Administrative costs for measure identification

They can be identified on the basis of the experience gained so far.

Indirect costs can be (macroeconomic):

- Opportunity costs (environment and resource costs)
- Limitation of Water use
- Implementation-related loads or charges for third parties

Annex I deals with the comparison of charges and costs of measures, respectively costs of combinations of measures. Such data shall be compared to specific local charges and experience gained from previously implemented measures to obtain an overview on the size of costs.

Annex II contains hypothetical instrument-related costs. This cost assessment shall be given a thorough consideration. When identifying any instrument-related costs it has to be considered that interested parties may bear instrument-related costs while another group benefits from the situation. In this case the costs can be deduced from one another. Since instruments are supposed to be supportive to measures, instrument-related costs can reduce measure-related costs, e.g. by lower maintenance costs, allocation of costs among polluters or improving of measure efficiency.

Costs can be presented as purely project costs or as annual costs (annuity). Purely project costs are the general costs for the whole project period from the moment of their identification. Future costs are accounted for on the basis of a single interest rate. A possible balance value of the facility after depreciation shall be deduced from the initial investment.

In the event of annual costs, the general costs shall be allocated among the years of the total project duration. In any case, the annual depreciation rates shall be taken into account instead of the initial investment. Costs arising after the respective time period expires are not considered.

The kinds of costs in the cost calculation process:

- Investment costs (including design, land acquisition, supplementary investment and equipment costs)
- Depreciation costs
- Current exploitation costs (including costs for materials, staff, maintenance and repair):
- Potential financial costs

The calculation process has to include assumptions of:

- Price development
- Applied interest rate
- Period and course of depreciation
- Contingencies

The cost calculation process shall take into account microeconomic costs (investment costs, administrative costs related to the instruments and measures) and macroeconomic costs (costs accrued to third parties as a result of the instruments and measures implementation, potential monetary advantages for certain groups of interested parties).

Working step 6: Identification of the most cost-effective combination of measures

Now the results from steps 3 and 4 shall be compared. The following questions have to be asked:

- Is it possible to achieve the set objective by 2015?
- Have the measures and instruments a sufficient effect?
- A what point does the efficiency start?
- How much are the direct costs related to the measures and instruments?
- How much are the indirect costs related to the measures and instruments?

Table 55 illustrates how the results can be represented in a matrix.

Table 55: Representation of the trade-off criteria

Combination of Measures	Achievement of the Objectives by 2015	Economic Efficiency	Period	Direct Costs	Indirect costs
	A	B	C	D	E
Combination J	Highly feasible	Very Good	Short term	500 000 – 600 000 €	High
Combination C	Feasible	Good	Short term	50 000 – 100 000 €	Average
Combination G	Feasible	Good	Medium term	300 000 – 400 000 €	Low
Combination S	Unfeasible	Low	Medium term	450 000 – 550 000 €	Very High

Working step 7: Coordination with programmes of measures for sub-basins

Note: Measures are usually applied to only specific sections of a river. Other sections of the same river can also be subject to other measures. Therefore, the interrelation between the individual measures and objectives shall be taken into consideration. The transregional co-ordination has three potential benefits:

- A potential cooperation for achievement a common benefit for all water elements ;
- Impact of measures on other water elements;
- Potential synergic effects between the individual measures on water elements

Besides the environmental benefits and economic costs, measures and instruments must be selected after considering the interrelation between the individual water elements.

6.5.4 Public information, consultation and participation

In Art. 14 WFD the Member States are required to stimulate the active participation of all interested parties and to provide public information and consultation. On the one hand this refers to the preparation and updating of management plans of the respective river basins. Therefore there must be promptly published the timetables and work programmes for the preparation of the management plans (3 years in advance) as well as an overview of the most significant water management issues in the river basins (2 years in advance). After that a draft river basin management plan is to be published (1 year in advance).With regard to all three steps the public should be able to express its opinion in writing. Upon demand additional information and documentation has to be provided. In item 14 of the Preamble the subject of the public participation and its role for the overall success of the Directive is touched upon. Item 46 of the Preamble emphasizes the importance of thorough information of the public in order to secure and facilitate its participation in the planning process. According to Annex VII WFD it should be evident from the River Basin Management Plan where and how additional information can be obtained. Besides, this plan is to comprise measures that would attract public participation as well as to assess its participation in and influence on the plan.

The central provision of the Directive for public participation is found in Art. 14 WFD. Three main types of participation are distinguished:

- Active participation in all aspects of implementation of the Directive especially, but without limitation, in the planning process;
- Consultation and three phases of the planning process;
- Access to additional information.

The Member States are to stimulate the active participation and provide possibilities for consultation and access to additional information.

The first level of participation is consultation: the competent authorities hear the opinions of the population and the interested parties (stakeholders), in order to benefit from their knowledge, impressions, experience and ideas.

Two forms of consultation are distinguished: written and verbal.

The written consultation is a minimal requirement under Art. 14. (1) WFD which requires Member States to publish and make available for comments to the public, including users. The verbal consultation is more active and in it, the stakeholders are given the opportunity to communicate in a dialogue or participate in a discussion with the respective authorities.

The written consultation is a minimal requirement for the implementation of the Directive; the verbal consultation is “good practice”. The two types are frequently combined.

Practical guidelines for written consultation with respect to the Directive:

1. A timetable for consultation organization has to be included within the data specified under Art. 14 WFD in the very beginning of the process of policy planning or activity;
2. It should be clarified who will be heard on which issues, within what time period and for what purpose, as the consultation process is open to all;
3. Consultation with respect to documentation (timetable, work programme, significant water management issues, draft for the river basin management plan) should be organized in the most pragmatic and smooth manner (including a short sum-

mary within two pages stating the most important issues with respect to which a standpoint is being developed); summaries for the general public should be prepared;

4. The documents should be provided to the electronic media and be accessible to the largest possible audience as well as all interested groups and persons;
5. All interested parties may express their opinions in relation to the documents within 6 months;
6. The expressed attitudes are to be analyzed in detail and without bias as the results are to be made accessible to all, the expressed opinions should be rendered accurately and the reasons for the adopted decision are to be clearly stated;
7. The consultation is to be supervised by the respective units and to be analyzed by determining a coordinator of the consultation who is to supervise the distribution of the acquired knowledge.

According to Art. 14 WFD consultation concerns the requirements listed below and the timetable of the consultations (with repetitions every six years for future River Basin Management Plans).

- December 2006 (at the latest) July 2007: Timetable and work programme for production of plan, including clarification of the respective measures related to the consultation procedure, written consultation.
- December 2008 (at the latest) July 2009: Interim overview of the most significant water management issues for the respective river basin; written consultation.
- December 2008 (at the latest) July 2009: Availability of River Basin Management Plan, written consultation.
- December 2009 (at the latest): Start of the plan's realization.

Another level of participation is the participation in the development and implementation of plans. The interested parties actively participate in the planning process as they identify problems and contribute to finding their solutions. Another level of participation is the common adoption of decisions and self-determination. The common adoption of decisions means that the interested parties not only actively participate in the planning process but also partially assume responsibility for the results. Thus water users may be represented in organizations of the river basin district. Self-determination means that the water management is (partially) provided by participants, e.g. a foundation of associations of water users. The different levels of participation do not mutually exclude one another, but rather complement each other: consultation includes information, active participation includes consultation.

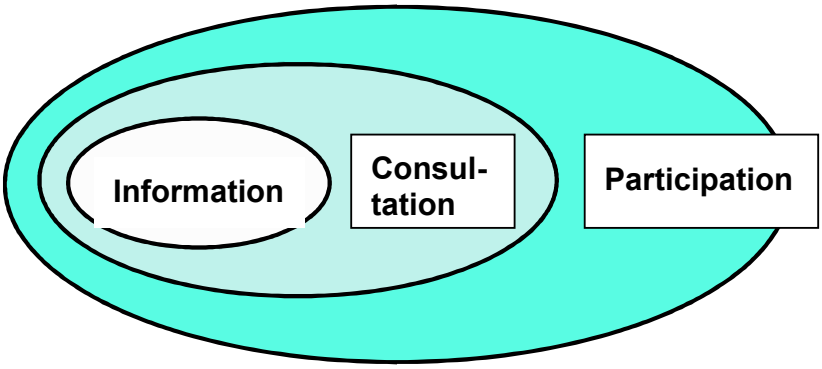


Figure 20: Levels of participation

Earlier active public participation, even before the three-level consultation on the management plans, should be required by the WFD. This way, the whole process of planning would become transparent, any possible conflicts could be detected in time and be eventually resolved, the acceptance of the plans be promoted and a basic attitude of trust developed between the relevant authorities and the parties affected by the measures.

The most important potential advantages of the public participation are (without excluding one another):

- Promotion of public awareness both on environmental issues and on the particular state of the environment in the respective river basin districts and local river basins.
- Use of the knowledge, experience and initiatives of various interested groups and through these, improvement of the planning quality, measures and management of the respective river basin districts.
- Acceptance, involvement and support on the part of the public with respect to the decision making process;
- Transparent and creative decision making;
- Less contradictions, incomprehension and delay, as well as efficient implementation;
- Social study and experience - when the participation leads to constructive dialogue between all the interested parties, different associations, administrations and experts may learn from the others' knowledge with respect to water management issues.

Participation may achieve long-term and generally accepted decisions for the management plans. Potential conflicts or problems of management and costs are avoided at an earlier stage. The general public of a given country is to be well informed on the management plan for an entire or international river basin district and to be provided with the possibility to express its attitude with respect to it. For this purpose the administration, apart from the numerous discussions with the affected parties, needs to develop new techniques of public participation. Such a possibility is provided by the Internet in order to popularize the respective level of preparation of the management plan. Thus public participation with respect to the timetable and the work programme for production of management plan can be secured with regard to significant water management issues in the river basin and last but not least, by presentation of a draft management plan in the period before the entry into force of the management plan.

The management plan has to include the measures of information and consultation of the public taken, the results from this participation and the changes in the management plan caused by the public participation.

6.5.4.1 Identification of the interested parties

The WFD uses different notions in relation to the public. In connection with consultation and access to additional information the phrase "public" is used. This phrase is not defined in the WFD, but the definition in Art. 2 (d) of Directive on the assessment of the effects of certain plans and programmes of the environment (SEA - 2001/42/EC) is applicable to the WFD as well: „One or several natural or legal entities, and, in compliance with the respective national legal provisions or state practice, their association, organization or groups". Art. 2 (4) of the Arhus Convention contains the same definition. Item 14 and 46 of the Preamble of the Directive use the phrases "public, including users" and "general public" in an identical meaning.

With respect to the active participation the phrase "interested units" is used. Interested units in the stages of active participation can mean every person or group or organization having

a particular interest ("Stake") in a given subject or simply being affected or because they may have a certain influence on the result. This includes all members of the public who have not yet realized that they are affected (in practice, often individual citizens or very small NGOs and enterprises).

In this manual the phrases stakeholder and interested groups are used in the same sense as “interested units”.

Due to practical reasons it is impossible to actively involve all potential stakeholders in all aspects of the implementation. A certain selection has to take place. In this selection the following factors should be taken into consideration:

- The connection between the stakeholders and the water management issue in question;
- The scope and context in which the participants usually work and who they do represent;
- The role in which participants are being affected (e.g. decision maker; water user, affected party, stakeholder, expert or measure implementing office)r;
- The ability an possibility of participants to actively involve themselves;
- The political, economic, social and ecological context.

Different stakeholders have different contributions. Some of them mainly offer ideas and information they have at their disposal. Others have direct interests such as land ownership etc. which may be directly affected. In many cases organizations may represent individual interests. At each project phase the role of the different interested parties has to be checked. Some of them are affected at earlier stages than others, represent a larger group, are more active or have at their disposition more (financial) funds or knowledge.

Some of the stakeholders communicate with greater difficulty than others which should not influence on their identification as such. Annex I WFD presents a procedure for the selection of basic interested party, i.e., analysis of the stakeholders. Stakeholders are mainly chosen by the degree of importance of a certain subject to them at a certain step of the project. It should be taken into account that the establishment of transparency and trust is important in order to justify the final choice of one interested party in preference to the others.

Possible types of stakeholders can be described who may be affected by water management. The description does not yet allow inferences as to their significance:

Specialized community organizations from the private and public sector, voluntary groups and NGOs of experts (social, economical, devoted to environment). This includes all official units, nature protection groups, economy, industry, insurance companies, and science.

Authorities, selected ministries, official units, municipalities, local authorities, NGO units acting at local level.

For the sake of expedience they are subdivided:

- Associations at local level – restricted to regional level, for instance, societies of the citizens and municipal councils;
- Societies lead by interests – for instance, construction associations, fishermen societies, birdwatchers societies;

Individual citizens, farmers or entrepreneurs acting out of their own interests, e.g. large-scale land owners or individual inhabitants.

The interested groups are to be included as early as possible, prior to adopting any decisions. Only then do the authorities benefit the most from their viewpoints, experience and knowledge and may achieve a high degree of participation, influence and principal consent with the subsequent decisions. It is never too early.

When the interested parties participate at a very early step of the development of the plan, their role must be clearly explained to them as well as the way their contribution will be treated. Otherwise it would be better for them not to participate. For instance, in organizing public participation during research (that is to serve the determination of the urgency of the problem and for the adoption of a decision as to whether to start solving said problem) information has to be provided beforehand that the research may result in the project not being realized. It is a fact that people waste time and energy in discussing problems even though politicians have already decided not to deal with these particular problems.

In relation to participation the relativity principle should be observed. It is necessary that the costs expressed in terms of time and money are put in proportion to the possible benefit. This refers not only to the organizational process but is also important for the participation process. Relativity should be assessed on an individual basis with regard to the type of intention for participation, the respective circumstances, factual state of affairs and common sense. Below are given some questions that may help to assess the relativity in a particular case:

- At which step of the project would you like to involve the public?
- What is the specific problem consisting in at this step and what activities do you expect?
- Is the result from this phase still flexible and open or is it already defined?
- What is the target level of participation?
- What form of public participation do you imagine?
- Which interested parties should participate?
- What are your limits with respect to finances and time?
- What political interrelation is your intention involved in (for/against/neutral)?
- What acceptance level do the procedures for public participation have at the moment?
- Who takes the final decision?
- Who is the participant from your organization and in what is the mode of his/her participation?
- Are there any current processes/ research employing such modes?
- How would you communicate?
- What results may be expected? Is it likely that the participation of the interested parties would influence the results in a positive way?
- What would you like to achieve by attracting the public participation?
- Identification of the problems by third persons
- Engagement of other participants
- Innovative decisions
- Recognition of the selected measures.

6.5.4.2 Timetable of participation

Art. 14 WFD states that the participation of all parties interested in the general implementation of the Directive is to be encouraged. The success of this participation certainly does not consist only in information and consultation at all the three steps according to Art. 14 (1) WFD (i.e., (a) timetable and work programme, (b) interim overview of the significant water management issues, (c) draft of management plan). The management plan is to a large extent a summary of preliminary adopted decisions and preliminary public participation. It would not be sufficient to begin public participation as late as 2006 if the public has not participated in the adoption of the preceding decisions. In order to secure transparency and acceptance, the public participation has to be started as early as possible. Irrespective of this the three step procedure of Art. 14 (1) WFD will only be successful if the preceding steps of information, establishment of awareness and consultation are completed.

The timetable related to the programme cycle of the Directive is the next determining factor for planning the time of public participation. The different steps of planning offer various possibilities for public participation. The Directive determines a sequence of phases and terms for implementation that are given below:

PHASE 1 UNTIL THE END OF 2003

Determination of the river basin districts, determination of the competent authorities, transposition of the Directive in the national legislation.

PHASE 2 UNTIL THE END OF 2004

Description and analysis (Art. 4 WFD): Description of the river basin districts, assessment of the anthropogenic activity impacts on environment and economic analysis of water uses. Assessment of the probability for the water bodies within each river basin district to be endangered of not achieving the set environmental objectives.(deficit analysis, Annex II WFD).

Drafts for elaboration of programmes of measures and draft management plan. Other descriptions in the deficit analysis of the water bodies identified as endangered so that the monitoring programmes and the programmes of measures to be optimized

Start of the monitoring programmes

PHASE 3 UNTIL THE END OF 2006

For the purposes of information of and consultation with the public about the management plans the Member States develop a timetable and work programme for the preparation of a management plan accessible for a presentation of opinions (the Member States allow for at least six-month term for presentation of position with respect to these documents).

PHASE 4 UNTIL THE END OF 2007

For the purposes of information and consultation of the public with respect to the management plans the Member States develop an overview of the most significant water management issues in the river basin districts accessible for presentation of opinions (Member States allow for at least a six-month term for the presentation of positions relating to these documents).

PHASE 5 UNTIL THE END OF 2008

For the purposes of information and consultation of the public with respect to the management plans the Member States develop a draft of river basin management plan accessible for presentation of opinions (Member States allow for at least six-month term for presentation of position with respect to these documents).

PHASE 6 UNTIL THE END OF 2009

Implementation: Implementation of the Programme of Measures and the River Basin Management Plan

PHASE 7 UNTIL THE END OF 2012

Implementation: Implementation of the Measures

PHASE 8 UNTIL THE END OF 2015

Assessment and updating, exceptions: Is a good water status achieved? Are the objectives for the protected areas achieved? Preparation and publication of subsequent plans and programmes, exceptions.

PHASE 9 - 2027

Deadline for the achievement of the objectives after two extensions of the term: Detailed description of the tasks within the different phases may be found in the “Manual for public participation in relation to the Water Framework Directive“. It was adopted on 21 November 2002 by the water directors of the Member States of the European Union, Norway and Switzerland.

6.5.4.3 Co-ordination of the interested parties

The more parties are included in the planning the more varied will be their experience, views and knowledge. It is important to appreciate the diversity of knowledge of the interested parties such as scientific expertise about the region or the knowledge of amateurs living there. One has to be well aware of the fact that both experts and amateurs can contribute to a better understanding of the heart of a problem and to a better co-ordination of the planning work. Past experience in water management shows that the typical “expert decisions” often do not reflect the existing conditions and may have undesired negative effects. These could be avoided by combining expert knowledge with existing local knowledge and experience. This is probably also valid when the reference conditions are determined. The available historical knowledge of the authorities and of certain public bodies can be of crucial importance in the determination, for example, with respect to the previous appearance of rivers and wetlands.

Methodical planning should create conditions in which the interested groups are able to learn from one another. This can occur outside the obligatory information processes (reports or presentations) in unilateral and non-communicational ways.

The concept of the procedure should stimulate an active dialogue between all participants. Sometimes, a gathering of interested parties will itself lead to new outlooks on prospects, objectives, successes and problems in the work of other participants. Therefore, the organization of regular meetings and co-operation between the interested parties should be encouraged to prevent problems from actually arising. However, although a dialogue leading towards mutual understanding is important, the participation process should be more then a “babble”. Experience and research show that interested parties are motivated by successes in an undertaking.

In many cases the interested parties do not share the same opinions and interests. The participation process should motivate the interested parties to respect the opinion of other participants. In such cases independent moderating of discussions is often useful. For some parties, including for the competent authorities, this will not be easy to accept, especially if previous meetings have lead to animosity and the adoption of differing opinions. Nevertheless, an approach towards mutual understanding in public participation is only successful, if

differences are clearly expressed and the reasons for them established, in order to create common ground from which further negotiations can commence.

A difference of opinion can take different forms such as: disagreement on the essence of the problem (problem identification), on the type of information considered as acceptable (scientific, non-scientific) or on the approach to further activities and the probable results from the application of these approaches. The competent authorities play a central role in these cases as they should work actively towards the creation of a climate of mutual respect in the invitation and participation of all interested parties by recognition of the diversity of interests, opinions and views.

6.5.5 Exemptions, artificial and heavily modified waters

The purpose of the WFD on the Community level is to achieve a good ecological and chemical status for the surface waters and that further deterioration of their status is to be prevented. Some exemptions are accepted with respect to the time and the nature of the achievement of the objectives (later achievement of objectives, reduction of level of objectives). The identification of artificial and heavily modified waters is another exemption.

There are two important reasons for the introduction of special regulations concerning artificial and heavily modified waters with reduced objectives for the good ecological water potential:

On one hand, the introduction of the natural water status as the reference status for the ecological assessment is not suitable for artificial waters; on the other hand there are some apprehensions that for some natural waters the good ecological status can only be realized after a termination of their use.

The WFD allows the Member States to identify artificial and heavily modified waters, where the ecological assessment and the programme of measures are not directed, as in the case of natural waters, towards the achievement of a very good status (reference status), but towards "the highest ecological potential". To worl out precise definitions of the assessment criteria of „heavily modified waters" a working group EC HMWB (Heavily Modified Water Bodies) was formed at the end of 1999. In November 2002, this group presented a Manual on identification and designation of artificial and heavily modified waters, which was accepted by the European Water Directorates on 21 November 2002 in Copenhagen. The Manual sets two conditions for identification: initial categorization as "heavily modified" until 2004, workable legal definitions of „artificial" and „ heavily modified" water body in the first management plan, not later than 2009.

6.5.5.1 Designation of artificial and heavily modified surface waters

6.5.5.1.1 Artificial waters

Surface waters are defined as artificial if they are created as a result of any human activity at certain place, where there was not any considerable surface water before. They do not occur as a result of any direct physical changes or of any displacement or correction of the existing water bodies. The ecological potential of artificial and heavily modified waters has to be determined. The objective is to achieve good ecological potential (as far as good or highest potential is not possible).

The classification of the artificial surface water bodies, including clarification of reasons is only preliminary in the initial categorization. The final designation should be presented in details in the River Basin Management Plan in 2009 and should be controlled every 6 years.

In artificial water (to the extent that they meet the above conditions) the matter in question is about:

- Navigation channels, hydro power plants, wood material transportation or draining/irrigation, ditches, respectively;
- Artificial ponds , ponds of open pits;
- Dams and artificial pools recharged by overflow waters;
- Ports.

The minimum length of an artificial water body is about 5 km. In some justifiable cases, the surface water body can be below this length. In contrast to artificial waters, there are some natural waters modified within the water construction. They should be identified initially as being heavily modified if necessary. The classification is performed on the basis of the knowledge about the region of the competent authorities.

6.5.5.1.2 Heavily modified waters

The surface water body is categorized as being heavily modified (HMWB = Heavily Modified Water Body) when it is considerably changed as a result of physical alterations from human activities. Further, it should be known whether the measures undertaken for the achievement of a good ecological status will negatively affect water uses of the respective water body (see CIS- Guidance document on the identification and designation of heavily modified and artificial water bodies). According to this document, the classification as “heavily modified” derives not just from the assessment of hydro-morphological alterations, but also from the designation of „modification“(i.e. non-reversibility of use).

The ecological potential of heavily modified and artificial water bodies have to be determined. The ecological objective is to achieve a good ecological potential (if good or highest statues does not already exist). Since the procedures for the determination of the ecological potential are not yet developed, the report for 2004 should be restricted to an initial classification of heavily modified surface waters. The final designation should be presented in details in the River Basin Management plan in 2009 and should be controlled at every 6 years.

The initial classification of the heavily modified water bodies is performed in four steps:

1. Determination of the status quo (with respect to water elements) on whether significant hydro-morphological alterations are present;
2. Assessment of the future development (with respect to water elements) on, whether the hydro-morphological impacts are reversible with respect to the intensity of use until 2015.
3. Delineation and preliminary classification of surface water bodies which are assessed as heavily modified as a result of the human activity on their nature.
4. Comparison of the results of the preliminary classification as heavily modified with the assessment of the achievement of the objectives with respect to the hydro-morphological alterations.

At dams, the anthropogenic impact on the hydromorphology of running water in lakes leads to changes in the water category, so they are initially are designated as heavily modified water bodies (insomuch as they have not classified already as artificial) withut further verification.

The first step, the determination of Status-Quo, has the purpose of presenting in detail the actual status of the hydro-morphological alterations, insomuch as the timetable for the initial categorization allows this.

It is divided into 3 sub-steps:

(1) Assessment of the existing water structure mapping

(2) Additional collection of data on waters without structure mapping

(3) Additional covering of the available regional knowledge.

The water element is considered as hydro-morphologically altered in sub-step (1), if it meets at least one of the criteria (a) through (f).

(a) total evaluation = 5, = 6 or = 7

With the available data, the following additional identifications are undertaken.

Table 56: Criteria for identification of the hydro-morphological alterations

Criteria	Significance
b) Partitioning constructed facilities = 5	Water falls
c) Streamline = 5 and bank fixation = 5	Heavily altered stream line and the fixed part of the bank is about 10% of its total length
d) Use of meadows = 6 and buffer strips along the bank = 0	The meadows are mainly built-up or strengthened or are arable land and building up of > 50%, without buffer strips along the bank
e) Flow regulation = 5	Impoundment at more than 50 m. length (upon mean water discharge)
f) Water overflow = 7	Strongly decreased

The following data are collected in the course of the additional data gathering (sub-step (2)):

(e1) Morphological alterations as a result of crucial change of the stream line

(e2) Passability (partitioning construction facilities).

A water element is considered as being hydro-morphologically altered in sub-step (2), if it meets the following criteria:

- Morphological alterations as a result of crucial change of the stream line = YES

This is represented as a pressure, but is not used as a criterion for preliminary classification as being heavily modified:

- Passability = NO (at partitioning construction facilities).

In covering of the regional knowledge (sub-step 3), the following data are being collected:

- Overflow regime of operation
- Leading / outlet water segments > 300 м
- River partition facilities, where water structure is not mapped
- Segment of impoundment over the river partition facility

To cover of the impoundments, the following should be performed:

- For big hydro power plants with a backwatering height of several meters, the back-watering depending on the valley slope can be several kilometres. This segment of backwatering is covered in principle.
- For the remaining facilities of the hydro power plants, a standard segment of back-watering of 1 km over the partitioning facility is specified as a rule. Insomuch as this proposal describes the actual segment of backwatering, it is determined on the basis

of regional knowledge of the water management authorities and an assessment of the actual backwatering is performed.

A water element is considered as being heavily hydro-morphologically altered in sub-step (2) , if it meets one of the criteria mentioned above.

At step 2 an assessment is made (with respect to the water elements) regarding the development of the future use of the water body and whether the resulting hydro-morphological impacts until the year 2015 will be reversible. The intensity of use is controlled through the regional specialized knowledge, eventually by taking into account the legal status (for example, available plan inferences). Irreversible use is accepted if the following criteria are met:

- Urbanization / local culture/, i.e. considerable constructions for
  - ⇒ Flood protection
  - ⇒ Settlements / industry / infrastructure/ agriculture;
- Hydro power plants, water reservoirs, backwatering
- Water ways.

For the multiple small used waters can be assumed that in a number of cases the good status can be achieved through ecologically-oriented water maintenance.

The water elements for which a reversal of existing hydro-morphological impacts is possible in principle is assumed, are classified at step (2) as „no hydro-morphological alterations are present in the water element“. They are later treated (i.e. in step (3)) as water elements, which according to step (1) are classified as „no criterion is met“.

The preliminary classification of heavily modified waters is performed at steps 3 and 4. At step 3 the surface water bodies are initially delineated, for which homogenous conditions regarding the presence and non-presence of hydro-morphological alterations are possible. The minimum length of 5 km serves as a tentative value for such surface water bodies (in some cases this figure can be lower).

In step 4 the total length of the existing water element for all surface water bodies, for which at least the criterion “heavily modified hydro-morphological alterations in the water element” is met, has to be determined. Depending on what portion of the heavily (irreversibly) modified hydro-morphological alterations in a given surface water body has been established, the initial classification of the surface water body at step 4 shall be performed by one of the criteria:

Table 30: Criteria for initial classification of heavily modified water bodies

Result from the assessment of the covering	Preliminary classification as heavily modified water body
Case A: 0% and < 10 % of the SWB length irreversibly hydro morphologically altered	The water body is not a heavily modified water body
Case B: 10% and< 30 % of the SWB length irreversibly hydro morphologically altered	Candidate for classification as heavily modified water body
Case C: More than 30 % of the SWB length irreversibly hydro morphologically altered	Heavily modified water body

If the regional knowledge leads to a different assessment from the schematically assessed data (this can happen where data, for example structure maps, are found to obsolete or insufficient), the water management authorities can use expert judgment.

Finally, a comparison of the results from the initial classification as a heavily modified surface water body has to be made with the assessment for the achievement of the objectives for the hydro-morphological alterations, to obtain a definite final result,.

On these results, it has to be determined in which cases the conclusion for the achievement of the objectives for one surface water body in the assessment category „hydro-morphological alterations “and the assessment of the future development of the water body heavily modified cannot be harmonized with the ecological purpose of the prevention of further deterioration in the water status according to Article 4 (1) (a) (i) WFD. These cases have to be examined, coordinated and once again compared to the surface water bodies classification and the assessment for the objectives achievement.

The preliminary classification as a heavily modified water body is based on the combination of the assessments for the objectives achievement compared to the water structure and the further assessment with respect to the use reversibility.

Only after making this comparison is the preliminary classification as heavily modified and the assessment for the objectives achievement “hydro-morphological alterations” completed.

6.5.5.2 Assessment of other impacts

As other possible impacts on running waters, the following subjects were examined:

- Acidity increase
- New substances

6.5.5.2.1 Acidity increase

The impact of the substance input which increases the water acidity (running waters and lakes) is of regional importance.

Based upon long standing physical-chemical examinations of the water acidity, the hydro-chemical division of the running waters into different acidity classes, especially for the pH-values regime was developed as a basis of the biological indicator:

Acidity class I: non acid

- pH-value is usually considerably above 6,5, usually at 7,0, as a rule pH-minimum does not drop below this value.

Acidity class II: low acidity

- Low acidity rate with single drops of pH-values, usually not below 5.5. Acidity-resistant organism are not already present.

Acidity class III: Periodically high acidity rate

- pH-value usually is considerably below 6,5, but it is usually established not to be below 4.3. In a case of a low discharge rate, for example in the summer-autumn, the values could be within the neutral range during a long period of time. As a result, the fish reserve is decreased, pH-values are lethal for the caviar and the incubated fishes from the trout regions. Only organisms tolerant to this acidity are present.

Acidity class IV: Permanent high acidity rate

- As a rule, pH-value remains year-round within the acidity range below 5,5, and the pH-minimum drops during the period of snow melting or heavy rains below 4,3 and even below this value. Such values are lethal for all local species of fishes. Only some species being acidity-resistant are present.

The acidity index VZ of one taxon corresponds to the highest acidity class, in which the taxon is present. For example, a taxon with VZ 2 can be present in waters with acidity class 1 or 2, but only rarely in class 3 or 4. The running waters are divided into acidity classes which correspond to the lowest possible VZ-value that may be established, i.e. to acidity coefficient of the sensible to acidity taxons.

6.5.5.2.2 New substances

During the last few years it has become evident that even small quantities of a substance can have effect upon the water biocenosis, such as substances with endocrinal effect and medicines. Little to nothing is known about their interrelations.

7. Summary

After twenty years of preparative work the Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (the EU Water Framework Directive, WFD) finally entered into force as of 22.12.2000 when it was published in the Official Journal.

The Directive is applicable all over Europe with regard to groundwater, lakes, surface waters from the springs to the sea as well as coastal waters up to the first nautical mile.

The most important objectives of the WFD are:

- a good ecological and chemical status of surface waters,
- a good chemical status and a good quantitative status of groundwater, as well as a considerable cost recovery related to water supply and sewerage services.

With a view to the achievement of these objectives, the WFD contains provisions for:

- The coordinated elaboration of River Basin Management Plans, which must take into account all aspects of water protection.
- The preparation and implementation of programmes of measures as an integral part of the River Basin Management Plans, as well as
- The provision of early and broad public information and consultation in the processes of measures planning and implementation.
- Various elements and characteristics of the WFD, such as: Assignments related to the water status in the Member States (ecology, chemical status, quantity),

Specific tasks related to a coordinated water management of river basins (national and international coordination),

- Assignments related to a clearly structured, strongly formalized planning process (inventory accompanied by an analysis, monitoring, management plan with programme of measures, measures implementation),
- Assignments related to a close public involvement (information and consultation), as well as the exclusive mandatory implementation of the Directive (specific and legislative implementation within preliminary defined deadlines),

The WFD will have a serious impact on, respectively change, the protection of water in Europe and the activities of water authorities.

A further improvement of the water protection in Europe must, on the one hand, guarantee to the public the possibility of a long-term use of water and, on the other hand, support more persistently and to a greater extent the development of waters as an integral part of nature.

A vigorous and permanent observance of the system of the structured planning steps offers the chance of a successful, professional implementation of the Directive within the envisaged deadlines.