

# **COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC)**



## **POLICY SUMMARY**

**to  
Guidance Document No 9**

Implementing the Geographical Information System Elements (GIS) of the Water  
Framework Directive

**Produced by Working Group 3.1 – GIS**

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## 1. What is the purpose of the GIS guidance document?

The WFD CIS guidance document No. 9 – GIS aims at guiding experts and stakeholders in **the implementation of the GIS elements of the Water Framework Directive (WFD)**, with specific emphasis on its reporting needs. The guidance will be useful for developing national strategies for implementing the WFD. In particular, it will help in:

- Preparing the geographic datasets for the production of the maps required by the WFD;
- Preparing the final maps; and
- Reporting maps and GIS layers to the European Union.

The document has been developed by an informal European working group of experts under the umbrella of the Common Implementation Strategy. It builds on:

- The expertise and experience of the members of the working group;
- The input and feedback from a wide range of experts from European Union Member States, Candidate Countries, Eurostat, EEA, JRC and DG Environment; and
- Regular interactions with other working groups of the Common Implementation Strategy.

## 2. GIS Requirements under the Water Framework Directive

The Water Framework Directive provides a legal framework for a wide range of actions, aiming to achieve good status for all waters in the European Union by 2015. Many of these actions require the handling of spatially distributed data and as such can potentially benefit from the use of Geographical Information System (GIS) technologies. In addition, the Directive explicitly calls for the reporting of most of the (spatial) information in a GIS compatible format. This is due to the fact that most of the data is to be presented in its spatial context and that questions like ‘where are the critical areas?’, ‘how much area is involved?’, or ‘which points are in a designated area?’ can easily be answered when the data are kept in their spatial context and when the background database has the appropriate design.

The provision of (or access to) the requested GIS layers will not only facilitate the reporting of the Member States themselves; it will also facilitate the further compilation and analysis of the information at the European level. This is in line with current efforts under the INSPIRE (Infrastructure for Spatial Information in Europe) initiative of the Commission and the Member States, aiming at the development of a harmonised European spatial data infrastructure.

While the Directive clearly specifies which information should be provided in the form of maps, it gives little information on the technical specifications for these maps. The **goal of the GIS Working Group**, therefore, was to elaborate such specifications and to make them available in the form of a guidance document. The guidance document should help

the Member States with the preparation of the GIS layers in such a way that they follow a common and agreed standard.

The implementation of the WFD requires the handling of spatial data both for the preparation of the River Basin Management Plans and for the reporting to the Commission. In the first case, GIS techniques will be essential for the derivation of various information layers (e.g. on the characteristics of river basins and water bodies), while in the second case, GIS will be the tool for the preparation and delivery of the maps and GIS layers required for reporting. Considering the limitations in time and the immediate needs stemming from the WFD implementation, the focus of the current GIS guidance document is on the WFD reporting obligations. While this is a short-term goal, it is noted that in the long-term the development of specifications for a system including the possibility to access underlying measurements and statistical data or even for performing the various analyses as required for the preparation of the River Basin Management Plans might be considered. The elaboration of guidelines for these long-term options would, however, require substantial time and effort and is subject to a request by the Strategic Co-ordination Group for the Implementation of the WFD.

### 3. Timetable for the preparation and delivery of maps and GIS layers

Table 1 summarises the twelve maps to be reported under the WFD and indicates when each map has to be available either internally to a River Basin District or externally to the Commission:

**Table 1: Maps required under the WFD Reporting Scheme.**

Map Name	Layer Name	Availability and Reporting Dates <sup>1</sup>
<b>1: RBD - Overview</b>		
	River basin district (RBD)	12/2003 (RBD)
	River basin, sub-basin	06/2004 (CEC)
	Main rivers	
<b>2: Competent Authorities</b>		
	District of competent authorities	12/2003 (RBD) 06/2004 (CEC)
<b>3: Surface Water Bodies (SWB) - categories -</b>		
	Surface water bodies - Rivers - Lakes - Transitional waters - Coastal waters if applicable, indicated as artificial SWB or heavily modified SWB	12/2004 (RBD) 12/2009 (CEC)*
<b>4: Surface Water Bodies (SWB) - types -</b>		
	Types of Surface Waterbodies	12/2004 (RBD)
	Ecoregions	12/2004 (CEC)

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Map Name	Layer Name	Availability and Reporting Dates <sup>1</sup>
<b>5: Groundwater Bodies</b>		
	Bodies of groundwater	12/2004 (RBD) 12/2009 (CEC)*
<b>6: Monitoring Network for Surface Water Bodies</b>		
	Operational monitoring sites. Inclusive monitoring sites for habitat and species protected areas ----- Surveillance monitoring sites ----- Monitoring sites drinking water abstraction points from surface water ----- Investigative monitoring sites ----- Reference monitoring sites	12/2006 (RBD) 12/2009 (CEC)
<b>7: Ecological Status and Ecological Potential of Surface Water Bodies</b>		
	Ecological status ----- Ecological potential ----- Bad status or potential causes by (non-) synthetic pollutants	12/2009 (RBD) 12/2009 (CEC)
<b>8: Chemical Status of Surface Water Bodies</b>		
	Chemical status	12/2009 (RBD) 12/2009 (CEC)
<b>9: Groundwater Status</b>		
	Quantative status of groundwater bodies ----- Chemical status of groundwater bodies ----- Pollutant trend	12/2009 (RBD) 12/2009 (CEC)
<b>10: Groundwater Monitoring Network</b>		
	Groundwater level monitoring network ----- Operational monitoring network chemical ----- Surveillance monitoring network chemical	12/2006 (RBD) 12/2009 (CEC)
<b>11: Protected Areas</b>		
	Drinking water protection areas ----- Economically significant aquatic species protection areas ----- Recreational waters ----- Nutrition-sensitive areas ----- Habitat protection areas (FFH) ----- Bird protection areas	12/2004 (RBD) 12/2009 (CEC)
<b>12: Status of Protected Areas</b>		
	Status of protected areas	12/2009 (RBD) 12/2009 (CEC)

RBD: The date when the map or layer needs to be available within the River Basin District.

CEC: The date when the map needs to be reported to the European Commission. Note: The date of December 2009 is the publication date of the River Basin Management Plans. They should be reported to the Commission within 3 months of their publication.

(\*) Date of reporting for maps No. 3 and 5 might change to 2004, depending on whether maps are to be included in the Summary Report to be delivered in March 2005. This issue will be resolved by the EAF on Reporting.

## 4. Specifications for the GIS Layers to be Reported

The GIS guidance document gives detailed technical specifications with respect to the requested maps and GIS layers, of which the most important issues are summarised here.

### Content, Positional Accuracy and Recommended Mapping Scale

The technical specification of the GIS-layers needed for WFD reporting obligations is based on a detailed analysis of the content of the WFD and as far as possible on the documents of the other working groups. The GIS-layers to be reported can be grouped in three categories:

1. **Basic Information** (surface water bodies, groundwater bodies, protected areas, river basin districts, river basins, areas of competent authorities and characteristics of the river basin district);
2. **Monitoring Network** (surface water, groundwater, protected areas, biological reference conditions, drinking water abstraction);
3. **Status Information** of surface- and groundwater bodies and protected areas (classification of the ecological and chemical status of water bodies, status of ecological potential of artificial or heavily modified surface water bodies, quantitative and chemical status of groundwater bodies, status of protected areas).

Considering the technically desired and the practically feasible positional accuracy for the GIS layers, the GIS Working Group considers a positional accuracy of minimum 1000 metres as acceptable in the short-term, while at the same time it is strongly recommended to strive for a positional accuracy of 125 metres in the long-term. In line with this, the recommended scale of the maps to be reported is 1:250,000 (recommended) or 1:1,000,000 (minimum) in the short term and 1:250,000 in the long term.

### Definition of the Data Model

Data modelling is the first step in database design. By modelling, complexity is reduced so that all actors should be able to understand the essence of the GIS system. This provides the basis for developing a common understanding on the objects that should feature in the geographic database, and how they should be represented. The defined data model aims to encourage consistency in data structures in order to facilitate data sharing. The overview of the logical data model is complemented with a detailed data dictionary, describing the attributes of the tables to be created from the model.

### Feature Coding

It was considered to be of importance to agree on a European feature coding system for river basins, water bodies, monitoring stations, and pressures. The GIS Working Group proposes the short-term implementation of a system that ensures unique feature identifiers across Europe, allowing to maintain national systems and to link them up to the European level. In the long-term, this system should be developed towards a more

intelligent system, actively supporting the spatial analysis of pressures and impacts across Europe.

### **Data Validation**

Data validation is seen as an important issue for quality assurance, the framework of which is set by various draft ISO standards. Every GIS layer should be complemented with overview information on data quality, which consists of descriptions of the purpose, the usage and the history of the GIS layer. In addition, each GIS layer should include information on selected data quality elements, to be reported as part of the metadata.

### **Reference System**

The adoption of a common reference system will enable the maintenance of seamless distributed geographic data across Europe. It will simplify the work of geometric harmonisation and will minimise edge or boundary-related discontinuities. The GIS Working Group gives specific recommendations for the reference system to use for reporting, which are in line with generally accepted standards at the European level and conform to INSPIRE recommendations.

In addition, three projection systems are recommended for map production. The choice on which projection to use will depend both on the type of application and the on the scale of the map.

### **Metadata**

Metadata is the information and documentation, which makes data understandable and shareable for users over time. The Working Group proposes to adopt the final draft international standard ISO/FDIS 19115 *Geographic Information - Metadata* and suggests measures for the transition phase in order to minimise the impact on those countries using National or CEN pre-standards.

Until the ISO 19115 standard is available officially and translated in all European languages, existing standards or pre-standards are acceptable. The countries deciding not to adopt ISO 19115 in the FDIS status should adapt their metadata to ISO when the official standard is available or at least provide the mapping of the used standards to ISO 19115.

In addition, it is considered necessary to create a specific metadata profile for the WFD. This profile shall be developed by mid 2003 in order to provide the necessary information in time for the first reporting phase.

### **Standards for Data Exchange and Access**

The way data are collected and stored, as well as their quality and coverage will vary from organisation to organisation. In order to reduce the likelihood of data being unusable by the Commission, common exchange formats need to be agreed. This further facilitates quality assurance and makes the data readily available to other Member States.

With respect to current data transfer and storage options, the GIS Working Group has analysed two possibilities: a centralised and a de-centralised system. Given the limited time available to prepare the first GIS layers that need to be reported to the Commission in 2004, the GIS guidance document gives specifications for the short-term implementation of a centralised system and recommends the long-term implementation

of a de-centralised system. The latter will enable the data to stay at their place of origin and to guarantee access to these data through common standards and protocols.

The best practice will be data exchange using Geography Markup Language (GML). GML is a dedicated language for the transport and storage of geographic information, including both the geometry and properties of geographic features. In the short term, the minimum data exchange standard for vector data will be in a recognised openly published file format, such as the *shape file* format. The exchange format will need to support points, lines and area features. In the long-term, the use of Web Mapping is recommended as best practice.

### **Harmonisation, Co-ordination and Organisational Issues**

Following the INSPIRE approach, the GIS Working Group recommends to guarantee the access to information collected and disseminated at the most appropriate level (i.e. local, regional, national and European). For the successful implementation of this vision a stepwise approach is proposed. All steps involve actions of standardisation, harmonisation and integration of data and services. Co-ordination at all levels and during all steps is a key issue for the implementation of the WFD.

### **Prototype**

In order to test the feasibility of the distributed structure proposed for the long-term, the GIS Working Group further implemented a prototype GIS. This prototype was conceived as a testbed for verifying individual aspects of the practical implementation. Under this activity, issues such as emerging ISO and OpenGIS standards or the proposed feature coding system have been tested.



## 5. Conclusions and Recommendations

Based on the experiences gained during the lifetime of the GIS Working Group, the following recommendations could be formulated:

1. It is recommended to quickly install the office in charge of short-term receiving, handling and validating the maps and GIS layers requested under the reporting scheme of the WFD (Data Custodian). Only this body will be able to further co-ordinate the preparation of the requested data;
2. It is recommended to install an office in charge of investigating the user requirements and of supporting the long-term implementation and maintenance of a de-centralised reporting system. This office should enable the further development of the data model and of a European GIS for reporting;
3. It is recommended that a dedicated Thematic Working Group be installed under the INSPIRE initiative. This working group should:
  - (a) Follow the developments in the horizontal working groups under INSPIRE and should translate them into further guidance for the implementation of the WFD;
  - (b) Ensure a close liaison with the upcoming Framework Directive on Reporting;
  - (c) Contribute to the development of a dedicated metadata profile;
  - (d) Propose details for the data harmonisation process;
  - (e) Follow emerging standards for data exchange and access;
  - (f) Ensure a link to the Pilot River Basins and integrate the feedback from these case studies into the guidance document;
  - (g) Prepare for the long-term implementation of a European hydrological coding system, including a link to marine waters;
  - (h) Investigate problems related to the analysis of impacts and pressures and the analysis of underlying data, if so requested by the Strategic Co-ordination Group.

It is important to note that different aspects related to the reporting under the WFD could not yet be definitely resolved. An example is the development of a specific metadata profile for GIS layers. This is due to the fact that a number of international standards, which should be respected, are still under development. However, clear indications have been given for resolving this limitation in due time.

In addition, information technology develops at a very fast pace. As a consequence the long-term options could only be roughly outlined. As time progresses these options (e.g., the set-up of a distributed system for data reporting) will have to be further specified in accordance with evolving technical capabilities and standards.

Finally, it should be noted that the specifications given here should be seen in the larger context of both the INSPIRE (Infrastructure for Spatial Information in Europe) initiative and the emerging Framework Directive on Reporting.