



INSPIRE Infrastructure for Spatial Information in Europe

D2.8.I.8 INSPIRE Data Specification on Hydrography – Guidelines

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Foreword – How to read the document?

This guideline describes the INSPIRE Data Specification on *Hydrography* as developed by the Thematic Working Group Hydrography using both natural and a conceptual schema languages. The data specification is based on the agreed common INSPIRE data specification template.

The guideline contains detailed technical documentation of the data specification highlighting the mandatory and the recommended elements related to the implementation of INSPIRE. The technical provisions and the underlying concepts are often illustrated by examples. Smaller examples are within the text of the specification, while longer explanatory examples are attached in the annexes. The technical details are expected to be of prime interest to those organisations that are/will be responsible for implementing INSPIRE within the field of *Hydrography*.

At the beginning of the document, two executive summaries are included that provide a quick overview of the INSPIRE data specification process in general, and the content of the data specification on *Hydrography* in particular. We highly recommend that managers, decision makers, and all those new to the INSPIRE process and/or information modelling should read these executive summaries first.

The UML diagrams (in Chapter 5) offer a rapid way to see the main elements of the specifications and their relationships. Chapter 5 also contains the Feature Catalogue including the definition of the spatial object types, attributes, and relationships. People having thematic expertise but not familiar with UML can fully understand the content of the data model focusing on the Feature Catalogue. Users might also find the Feature Catalogue especially useful to check if it contains the data necessary for the applications that they run.

The document will be publicly available as a 'non-paper'. It does not represent an official position of the European Commission, and as such can not be invoked in the context of legal procedures.

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Interoperability of Spatial Data Sets and Services – General Executive Summary

The challenges regarding the lack of availability, quality, organisation, accessibility, and sharing of spatial information are common to a large number of policies and activities and are experienced across the various levels of public authority in Europe. In order to solve these problems it is necessary to take measures of coordination between the users and providers of spatial information. The Directive 2007/2/EC of the European Parliament and of the Council adopted on 14 March 2007 aims at establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment.

INSPIRE will be based on the infrastructures for spatial information that are created and maintained by the Member States. To support the establishment of a European infrastructure, Implementing Rules addressing the following components of the infrastructure are being specified: metadata, interoperability of spatial data themes (as described in Annexes I, II, III of the Directive) and spatial data services, network services and technologies, data and service sharing, and monitoring and reporting procedures.

INSPIRE does not require collection of new data. However, after the period specified in the Directive¹ Member States have to make their data available according to the Implementing Rules.

Interoperability in INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way without involving specific efforts of humans or machines. It is important to note that “interoperability” is understood as providing access to spatial data sets through network services, typically via Internet. Interoperability may be achieved by either changing (harmonising) and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure. It is expected that users will spend less time and efforts on understanding and integrating data when they build their applications based on data delivered within INSPIRE.

In order to benefit from the endeavours of international standardisation bodies and organisations established under international law their standards and technical means have been referenced, whenever possible.

To facilitate the implementation of INSPIRE, it is important that all stakeholders have the opportunity to participate its specification and development. For this reason, the Commission has put in place a consensus building process involving data users and providers together with representatives of industry, research, and government. These stakeholders, organised through Spatial Data Interest Communities (SDIC) and Legally Mandated Organisations (LMO)², have provided reference materials, participated in the user requirement and technical³ surveys, proposed experts for the Data Specification Drafting Team⁴ and Thematic Working Groups⁵, expressed their views on the drafts of the technical documents of the data specification development framework⁶; they have reviewed and tested the draft data specifications and have been invited to comment the draft structure of the implementing rule on interoperability of spatial data sets and services.

¹ For Annex I data: within two years of the adoption of the corresponding Implementing Rules for newly collected and extensively restructured data and within 7 years for other data in electronic format still in use.

² The number of SDICs and LMOs on 21/08/2009 was 301 and 176 respectively

³ Surveys on unique identifiers and usage of the elements of the spatial and temporal schema,

⁴ The Data Specification Drafting Team has been composed of experts from Austria, Belgium, Czech Republic, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Switzerland, UK, and the European Environmental Agency

⁵ The Thematic Working Groups of Annex I themes have been composed of experts from Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, UK, the European Commission, and the European Environmental Agency

⁶ Four documents describing common principles for data specifications across all spatial data themes. See further details in the text.

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The development framework elaborated by the Data Specification Drafting Team aims at keeping the data specifications of the different themes coherent. It summarises the methodology to be used for the data specifications and provides a coherent set of requirements and recommendations to achieve interoperability. The pillars of the framework are four technical documents:

- The Definition of Annex Themes and Scope⁷ describes in greater detail the spatial data themes defined in the Directive, and thus provides a sound starting point for the thematic aspects of the data specification development.
- The Generic Conceptual Model⁸ defines the elements necessary for interoperability and data harmonisation including cross-theme issues. It specifies requirements and recommendations with regard to data specification elements of common use, like the spatial and temporal schema, unique identifier management, object referencing, a generic network model, some common code lists, etc. Those requirements of the Generic Conceptual Model that are directly implementable will be included in the Implementing Rule on Interoperability of Spatial Data Sets and Services.
- The Methodology for the Development of Data Specifications⁹ defines a repeatable methodology enabling to arrive from user requirements to a data specification through a number of steps including use-case development, initial specification development and analysis of analogies and gaps for further specification refinement.
- The “Guidelines for the Encoding of Spatial Data”¹⁰ defines how geographic information can be encoded to enable transfer processes between the systems of the data providers in the Member States. Even though it does not specify a mandatory encoding rule it sets GML (ISO 19136) as the default encoding for INSPIRE.

Based on the data specification development framework, the Thematic Working Groups have created the INSPIRE data specification for each Annex I theme. The data specifications follow the structure of “ISO 19131 Geographic information - Data product specifications” standard. They include the technical documentation of the application schema, the spatial object types with their properties, and other specifics of the spatial data themes using natural language as well as a formal conceptual schema language¹¹.

A consolidated model repository, feature concept dictionary, and glossary are being maintained to support the consistent specification development process and potential further reuse of specification elements. The consolidated model consists of the harmonised models of the relevant standards from the ISO 19100 series, the INSPIRE Generic Conceptual Model, and the application schemas¹² developed for each spatial data theme. The multilingual INSPIRE Feature Concept Dictionary contains the definition and description of the INSPIRE themes together with the definition of the spatial object types present in the specification. The INSPIRE Glossary defines all the terms (beyond the spatial object types) necessary for understanding the INSPIRE documentation including the terminology of other components (metadata, network services, data sharing, and monitoring).

By listing a number of requirements and making the necessary recommendations, the data specifications enable full system interoperability across the Member States, within the scope of the application areas targeted by the Directive. They are published as technical guidelines and provide the basis for the content of the Implementing Rule on Interoperability of Spatial Data Sets and Services for data themes included in Annex I of the Directive. The Implementing Rule will be extracted from the data specifications keeping in mind the technical feasibility as well as cost-benefit considerations. The Implementing Rule will be legally binding for the Member States.

⁷ http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf

⁸ http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.5_v3.1.pdf

⁹ http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf

¹⁰ http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.7_v3.0.pdf

¹¹ UML – Unified Modelling Language

¹² Conceptual models related to specific areas (e.g. INSPIRE themes)

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In addition to providing a basis for the interoperability of spatial data in INSPIRE, the data specification development framework and the thematic data specifications can be reused in other environments at local, regional, national and global level contributing to improvements in the coherence and interoperability of data in spatial data infrastructures.

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Hydrography – Executive Summary

The data specification for *Hydrography* is required to facilitate the interoperability of hydrographic information between member states. Hydrography in the context of this data specification is involved with the description of the sea, lakes, rivers and other waters, with their phenomena.

This data specification is limited in both thematic as well as geographic scope. Geographically all inland surface waters are subject to this data specification. Coastal waters are also a subject of this specification as far as geographically defined in the context of the Water Framework Directive (2006/60/EC): “surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters”. The remaining part of the waters will be subject to the appropriate Annex III themes *Sea regions* and *Oceanographic geographical features*.

This data specification does not include information on navigation or navigability as this is handled by the Annex I theme *Transport Networks* nor does it include depth information, as this will be handled by the Annex II theme *Elevation*. Groundwater is covered by Annex II theme *Geology* with the exception of e.g. rivers running underground that form part of the hydrographic network; these are considered as within scope of this data specification since these are essential to forming a closed hydrographic network.

The thematic scope of this data specification is towards providing a solid framework for mapping, reporting and modelling purposes. This is necessary to improve policy formulation through better reporting and aid management of pan European initiatives, such as flood risk analyses, where hydrographic data fulfils a function in relating information to real world objects.

The *Hydrography* theme is concerned with the network of bodies of water and relating structures and objects. It does not define attributes that should be reported upon and as a consequence it should not be considered in isolation from other INSPIRE themes or reporting obligations as described by other legislation. Where work on such themes has yet to be initiated placeholders have been left to allow for associations to be defined more fully in the future. It is also acknowledged that the model may need to be extended should further user requirements be identified in the future.

Considering the importance of the Water Framework Directive, the thematic working group (TWG) has decided to include the geographic description of water bodies in this data specification in addition to the physical objects and structures. Although these are essentially part of the Annex III theme *Area Management / restriction / regulation zones and reporting units*; TWG *Hydrography* deemed these to be of such importance that it has decided to include the geographical aspects and classification of water bodies as an integral part of this data specification. It is expected that relevant developments such as the European WISE and SEIS projects will use this specification as a base for further extension with reporting obligations within the EU. More information on this subject can be found in Annex B.

The data specification has been prepared by the thematic working group on *Hydrography*, a multi-national team of experts in the field drawn from all parts of the European Union (Germany, the Netherlands, Spain, Sweden, United Kingdom). Their brief has been to create a specification, which requires no additional data capture by member states, and is additionally, easily understood and as flexible as possible. In this way it is designed to minimise the effort required to supply conformant data.

The data specification has been based, as far as possible, on existing standards. Apart from ISO standards, the TWG has, amongst others, also used ideas from specifications published by DGIWG, EuroGeographics and the International Hydrographic Organisation. It is documented using “best of breed” ICT techniques such as the Unified Modeling Language (UML), Geographical Markup Language (GML) and Object Constraint Language (OCL).

Comments on earlier versions of this document delivered by SDICs and LMOs have been used to update those versions into this version after extensive discussion with stakeholders such as WISE and selected participants to the Comments Resolution Workshop where the previous version of this specification has been discussed.

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1 Scope

This document specifies a harmonised data specification for the spatial data theme *Hydrography* as defined in Annex I of the INSPIRE Directive.

This data specification provides the basis for the drafting of Implementing Rules according to Article 7 (1) of the INSPIRE Directive [Directive 2007/2/EC]. The entire data specification will be published as implementation guidelines accompanying these Implementing Rules.

2 Overview

2.1 Name and acronyms

INSPIRE data specification for the theme *Hydrography*

2.2 Informal description

Definition:

Hydrographic elements, including marine areas and all other water bodies and items related to them, including river basins and sub-basins. Where appropriate, according to the definitions set out in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy *, and in the form of networks.

* OJ L 327, 22.12.2000, p.1. Directive as amended by Decision No. 2455/2001/EC (OJ L 331, 15.12.2001, p.1.).

[Directive 2007/2/EC]

Description:

The theme “Hydrography” is a basic reference component and, therefore, of interest for many users and uses.

For mapping purposes (to provide a map background for orientation and to understand place relationships), it includes the representation of all main hydrographic elements – both natural and artificial. To fulfill reporting requirements of EC water-related directives it includes the river and channel network; surface water bodies within river basin districts are categorised as rivers, lakes, transitional waters or coastal waters, or as artificial surface water bodies or heavily modified surface water bodies. Furthermore, a topologically-sound river network is necessary for GIS-based spatial analysis and modelling.

Geographically, the theme “Hydrography” covers all inland water and marine areas covered by river basin districts as defined by WFD.

Further themes of annex I, II and III deal with additional hydrographic elements. The main relations with other themes are found within:

- Annex I
 - Geographical Names - names of water features
 - Administrative Units - administrative borders defined by hydrographic elements
 - Transportation - water navigation
- Annex II
 - Elevation - concerning geometric consistency

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- Land cover - wetlands, water bodies, snow, ice and glaciers
- Geology - ground water bodies and geomorphology
- Annex III
 - Utility and governmental services - water supply and discharge points
 - Environmental monitoring facilities - hydrometric stations (water level, discharge, etc.) plus monitoring of water quality
 - Production and industrial facilities - water abstraction facilities
 - Agricultural and aquaculture facilities - irrigation systems
 - Area management/restriction/regulation zones and reporting units - WFD sub-units and River Basin Districts
 - Natural risk zones - flood risk zones, erosion zones
 - Sea regions - concerning the limit between land and sea
 - Oceanographic geographical features - marine areas

2.3 Normative References

[Directive 2007/2/EC] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

[ISO 19107] EN ISO 19107:2005, Geographic Information – Spatial Schema

[ISO 19108] EN ISO 19108:2005, Geographic Information – Temporal Schema

[ISO 19108-c] ISO 19108:2002/Cor 1:2006, Geographic Information – Temporal Schema, Technical Corrigendum 1

[ISO 19111] EN ISO 19111:2007 Geographic information - Spatial referencing by coordinates (ISO 19111:2007)

[ISO 19113] EN ISO 19113:2005, Geographic Information – Quality principles

[ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)

[ISO 19118] EN ISO 19118:2006, Geographic information – Encoding (ISO 19118:2005)

[ISO 19135] EN ISO 19135:2007 Geographic information – Procedures for item registration (ISO 19135:2005)

[ISO 19138] ISO/TS 19138:2006, Geographic Information – Data quality measures

[ISO 19139] ISO/TS 19139:2007, Geographic information – Metadata – XML schema implementation

[OGC 06-103r3] Implementation Specification for Geographic Information - Simple feature access – Part 1: Common Architecture v1.2.0

NOTE This is an updated version of "EN ISO 19125-1:2006, Geographic information – Simple feature access – Part 1: Common architecture". A revision of the EN ISO standard has been proposed.

[Regulation 1205/2008/EC] Regulation 1205/2008/EC implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

2.4 Information about the creation of the specification

Document title: INSPIRE Data Specification *Hydrography*
Reference date: 2010-04-26
Responsible party: INSPIRE TWG *Hydrography*
Language: English

2.5 Terms and definitions

Terms and definitions necessary for understanding this document are defined in the INSPIRE Glossary¹³.

2.6 Symbols and abbreviations

EC	European Commission
HY	Hydrography
WFD	Water Framework Directive
RISE	Reference Information System for Europe
TWG	Thematic Working Group
IHO	International Hydrographic Organization
UNCLOS	United Nations Convention on the Law of the Sea
EEZ	Exclusive Economic Zone
SEIS	Shared Environmental Information System
WISE	Water Information System for Europe
EU	European Union
GML	Geographic Markup Language
INSPIRE	Infrastructure for Spatial Information in Europe
SLD	Styled Layer Descriptor
TWG	Thematic Working Group
UML	Unified Modeling Language
URI	Unified Resource Identifier

2.7 Notation of requirements and recommendations

To make it easier to identify the mandatory requirements and the recommendations for spatial data sets in the text, they are highlighted and numbered.

Requirement X	Requirements are shown using this style.
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Recommendation X	Recommendations are shown using this style.
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2.8 Conformance

Requirement 1	Any dataset claiming conformance with this INSPIRE data specification shall pass the requirements described in the abstract test suite presented in Annex A.
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¹³ The INSPIRE Glossary is available from <http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY>

3 Specification scopes

This data specification has only one scope, the general scope.

4 Identification information

Table 1 – Information identifying the INSPIRE data specification *Hydrography*

Title	INSPIRE data specification <i>Hydrography</i>
Abstract	<p>Hydrography in the context of this data specification is involved with the description of the sea, lakes, rivers and other waters, with their phenomena and all hydrographic-related elements.</p> <p>For mapping purposes, it includes a representation of physical elements – both natural and artificial. For reporting requirements of EC water-related directives it includes WFD surface water bodies. For spatial analysis and modelling, it includes a topologically-sound network of rivers and canals.</p>
Topic categories	inlandWaters
Geographic description	<p>This INSPIRE data specification covers spatial data sets which relate to an area where a Member State has and/or exercises jurisdictional rights.</p> <p>This INSPIRE data specification covers all inland surface waters. Coastal waters are also a subject of this specification as far as geographically defined in the context of the Water Framework Directive (2006/60/EC): “surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters”.</p>
Purpose	<p>The purpose of this document is to specify a harmonised data specification for the spatial data theme <i>Hydrography</i> as defined in Annex I of the INSPIRE Directive.</p> <p>The thematic scope of this data specification is towards providing a solid framework for mapping, reporting and modelling purposes. It is concerned with the network of bodies of water and relating structures and objects.</p> <p>However, each organisation will have different responsibilities from the next and this will influence the kind of data they collect and manage and use. In turn some organisations may use simple models, others by necessity will have complex data arrangements. This data specification is provided as a basic framework which users can adopt and if required – extend for themselves. The model is structured to maximise reuse and the sharing of organisational data.</p> <p><i>Spatial Objects (core – application specific)</i> This specification is mainly focussed on the “widely reused – widely referenced” segment of spatial objects. It does not attempt to try and incorporate every spatial object that might be used by any application. Such objects may include buoys, piers and other constructions etc. These are all “application specific” – and will be used/referenced by at least one organisation.</p> <p><i>Associated “non-Geographic” data</i> Any “non geographic data” (the majority of the data holdings in any organisation) – is also out of scope of this specification – such records may include “water quality”, “water quantity”, “state of the environment” and so on. While associated with the spatial objects defined here, all these examples are closer to the application end of the spectrum than generic use by a wide community, whether they represent a geographic entity or non-geographic data.</p>

	<p>To maximise reuse, the linkage of such organisational data with the spatial objects should be “loose” in the sense that these are ideally defined as different data objects in a database. Configured correctly such data may then be reused in several different applications and any associated information shared and exchanged as desired.</p> <p><i>Extensibility</i> Users can extend the schema and add their own spatial objects to support an application. Data architects should use the GCM as the basis for any such extension. To illustrate this, objects that are primarily of an application need (rather than generic) may be added to the specification for the network, e.g.:</p> <ul style="list-style-type: none"> • Linear – discharge rate • Point – hydraulic resistance
Spatial representation type	Vector
Spatial resolution	<p>The datasets in scope are used extensively at the Local level and extend to Regional, National and European levels. Usage can change with levels of operation or within an organisation.</p> <p><i>Alternative representations at the local level</i> For example at the local level both area (topographic objects) may be used as well as centreline / point representations. In other domains lower resolution representations may be preferred. Where applicable this data specification supports alternative representation.</p> <p><i>Multiple representations at regional, national and European levels.</i> Ideally the data would be scalable for such purposes but technology and datasets are not yet sufficiently mature to support this and several “levels of detail” are usually stored for representation at different operational levels. Unfortunately today there is very little correspondence between each level. Ideally it would be easy to seamlessly move from the highest to the lowest resolution with corresponding scaling and aggregation of the associated information and application data e.g. for reporting purposes or trans European analysis, planning and policy making.</p> <p><i>Level of detail</i> This data specification is suitable for all levels of detail but requires that, for certain features, an indication is given of the scale or resolution at which the feature was collected.</p>
Network	<p>The <i>Hydrography</i> specification is extensive and has therefore been broken into three application schemas: Mapping; Reporting; Network.</p> <p>In turn, these are each based on the INSPIRE Generic Conceptual Model. The Network application schema is furthermore based on the Generic Network Model which is shared by any network theme (e.g. Transport Networks). The Generic Network Model (GNM) was developed to ensure a consistent approach across all network themes. It relies on several ISO standards and provides the basic structure for network nodes, links, aggregated links and areas and basic mechanisms for:</p> <p><i>Linear Referencing</i> Linear referencing is incorporated in the specification. This uses an approach aligned with the current draft standard ISO 19148; which establishes linear referencing within a spatial environment (rather than a traditional standalone approach). The aim of this is to better support data sharing through referencing mechanisms, and to offer coordinates for any object referenced linearly, in the same national coordinate system.</p>

	<p><i>Logical networks</i></p> <p>Logical networks can be used within the model but their spatial value is very limited or in some cases may be non-existent. Therefore caution is required. Where these are in operation alongside the above forms of representation it is suggested that any corresponding nodes are reused or at least cross referenced to provide a relationship between the systems to preserve the potential for data sharing and exchange where that is both relevant and appropriate.</p> <p><i>Network Interconnections</i></p> <p>There are several cases where networks need to be joined up. For example at national, regional or dataset boundaries and at intermodal points within networks. This is provided by the Network Connection component which is defined in the Generic Network Model.</p> <p><i>Topology</i></p> <p>Topology is handled implicitly rather than explicitly; this is to keep the model as simple as possible. Generally systems will build topology in a form that best meets the user's application. <i>It is expected that most applications will use the network data within a topological environment.</i></p> <p>There is therefore a prerequisite for "implicit topology". This means that the data provided must be sufficiently clean and capable of automated topological construction within a user's application. There are therefore specific data capture requirements and these are described in Chapter 7 on Data Quality and in Chapter 10 on Data Capture.</p>
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5 Data content and structure

The Hydrography application schema is divided into three separate application schemas (Figure 1), roughly corresponding to spatial objects needed to satisfy the three main Use Cases:

1. Physical Waters (primarily for mapping purposes)
2. Network model (primarily for spatial analysis and modelling)
3. Management and Reporting units (primarily for WFD reporting)

Each of the three main application schemas depend on an abstract base hydrographic object type, contained in a separate 'base' application schema.

The Physical Waters application schema includes man-made objects and hydrographic points of interest. For more information on the structure and its intended use; see Annex B.

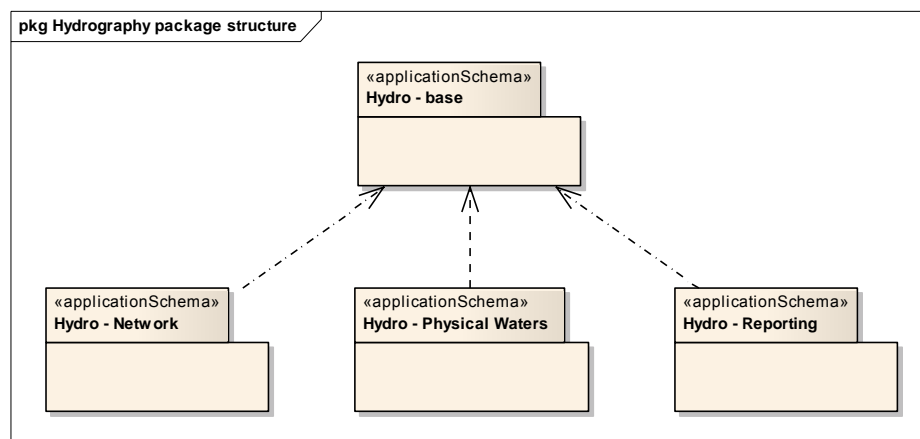


Figure 1 - Package structure of the Hydrography application schemas

The Hydrography application schemas are not self-contained – they have dependencies with spatial object types (including both ‘placeholders’ and ‘preliminary’ specifications, see 5.1.1) defined in other INSPIRE themes. These relationships are illustrated at package level in Figure 2:

- the Network model is based on the Generic Network Model defined in the INSPIRE Generic Conceptual Model
- the Physical Waters spatial object types are used by a number of Annex II and III themes
- the Reporting package uses spatial object types defined in a preliminary ‘Water Framework Directive’ application schema from the Annex III theme ‘Area management/restriction/regulation zones and reporting units’
- The ‘Base Types’ application schema from the Generic Conceptual Model, and the Annex I theme ‘Geographical Names’ are used in various places

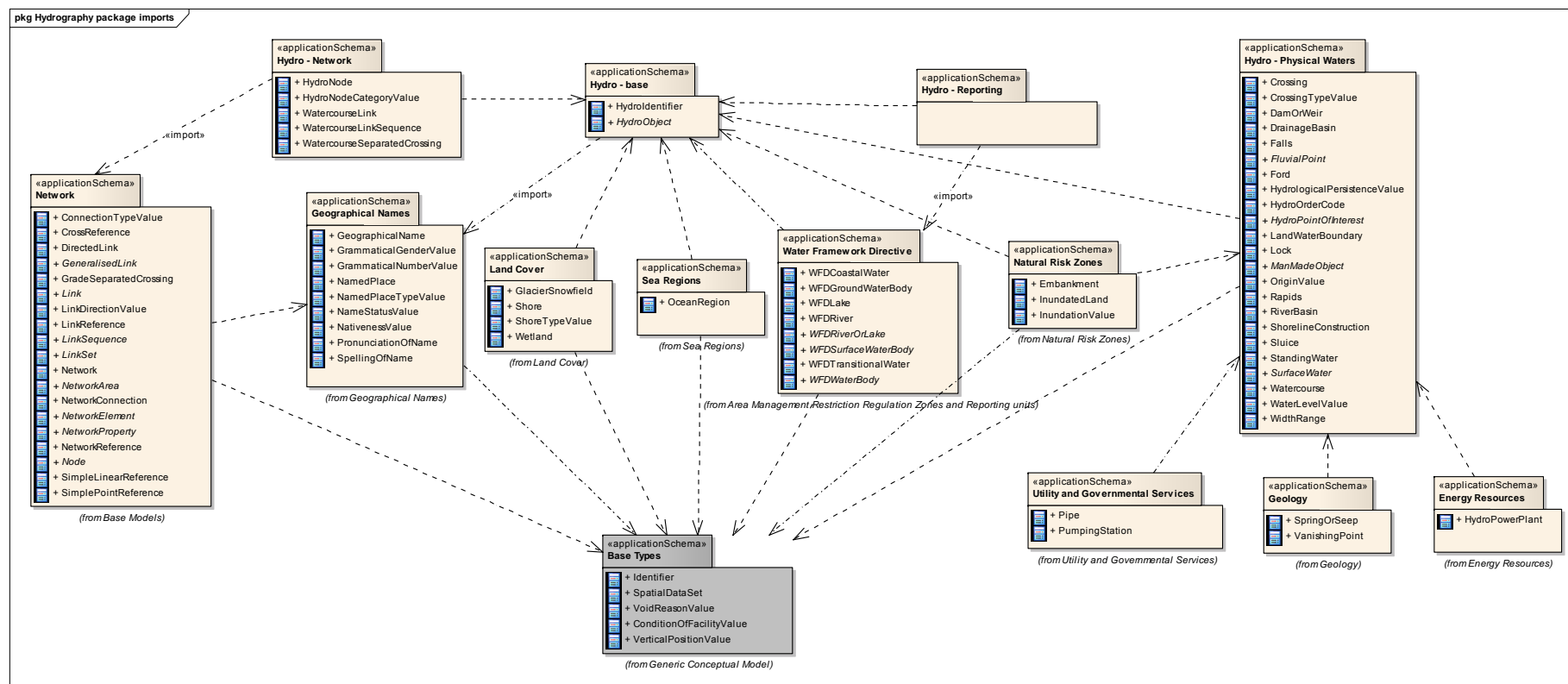


Figure 2 – Package relationships in the Hydrography application schemas

Requirement 2 Spatial data sets related to the theme *Hydrography* shall be provided using the spatial object types and data types specified in the application schemas in this section.

Requirement 3 Each spatial object shall comply with all constraints specified for its spatial object type or data types used in values of its properties, respectively.

Recommendation 1 The reason for a void value should be provided where possible using a listed value from the VoidReasonValue code list to indicate the reason for the missing value.

NOTE The application schema specifies requirements on the properties of each spatial object including its multiplicity, domain of valid values, constraints, etc. All properties have to be reported, if the relevant information is part of the data set. Most properties may be reported as “void”, if the data set does not include relevant information. See the Generic Conceptual Model [INSPIRE DS-D2.5] for more details.

5.1 Basic notions

This section explains some of the basic notions used in the INSPIRE application schemas. These explanations are based on the GCM [DS-D2.5].

5.1.1 Placeholder and candidate types

This data specification may include types (typically spatial object types) that will be fully specified as part of an Annex II or III spatial data theme, but is already used as a value type of an attribute or association role of a type included in this data specification. Two kinds of such types are distinguished:

- A *placeholder type* acts as a placeholder for a spatial object type for which only a definition is specified (based on the requirements of the Annex I theme). It receives the stereotype «placeholder».
- A *candidate type* already has a preliminary specification comprising the definition as well as attributes and associations to other types. It does not receive a specific stereotype.

Both placeholder and candidate types are placed in the application schema package of the thematically related Annex II or III spatial data theme. Their specifications will be revisited during the specification work of the Annex II or III theme.

If the existing preliminary specification elements of such types fulfil the requirements of the spatial data themes of Annex II or III they are kept and, if necessary, are complemented with further attributes or association roles.

If the existing preliminary specifications of a placeholder or candidate type do not fulfil the requirements of the spatial data theme of Annex II or III the placeholder or the candidate type will be moved into the application schema of the Annex I theme, and, if necessary, their specification will be completed. For the Annex II or III spatial data theme a new spatial object will be created.

Placeholders and candidate types are listed in a separate subsection of the Feature Catalogue.

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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5.1.2 Voidable characteristics

If a characteristic of a spatial object is not present in the spatial data set, but may be present or applicable in the real world, the property shall receive this stereotype.

If and only if a property receives this stereotype, the value of *void* may be used as a value of the property. A *void* value shall imply that no corresponding value is contained in the spatial data set maintained by the data provider or no corresponding value can be derived from existing values at reasonable costs, even though the characteristic may be present or applicable in the real world.

It is possible to qualify a value of void in the data with a reason using the VoidReasonValue type. The VoidReasonValue type is a code list, which includes the following pre-defined values:

- *Unpopulated*: The characteristic is not part of the dataset maintained by the data provider. However, the characteristic may exist in the real world. For example when the “elevation of the water body above the sea level” has not been included in a dataset containing lake spatial objects, then the reason for a void value of this property would be ‘Unpopulated’. The characteristic receives this value for all objects in the spatial data set.
- *Unknown*: The correct value for the specific spatial object is not known to, and not computable by, the data provider. However, a correct value may exist. For example when the “elevation of the water body above the sea level” of a *certain lake* has not been measured, then the reason for a void value of this property would be ‘Unknown’. This value is applied on an object-by-object basis in a spatial data set.

NOTE It is expected that additional reasons will be identified in the future, in particular to support reasons / special values in coverage ranges.

The «voidable» stereotype does not give any information on whether or not a characteristic exists in the real world. This is expressed using the multiplicity:

- If a characteristic may or may not exist in the real world, its minimum cardinality shall be defined as 0. For example, an if an Address may or may not have a house number, the multiplicity of the corresponding property shall be 0..1.
- If at least one value for a certain characteristic exists in the real world, the minimum cardinality shall be defined as 1. For example, if an Administrative Unit always has at least one name, the multiplicity of the corresponding property shall be 1..*.

In both cases, the «voidable» stereotype can be applied. A value (the real value or void) only needs to be made available for properties that have a minimum cardinality of 1.

5.1.3 Code lists and Enumerations

5.1.3.1 Style

All code lists and enumerations use the following modelling style:

- No initial value is specified; only the attribute name part is used.
- The attribute name conforms to the usual rules for attribute names, i.e. is a lowerCamelCase name. Exceptions are words that consist of all uppercase letters (acronyms).

5.1.3.2 Governance

Two types of code list can be distinguished:

- code lists that shall be managed centrally in the INSPIRE code list register and only values from that register may be used, and
- code lists that may be extended by data providers.

All code lists that are centrally managed receive the tagged value "codeList" with the preliminary value "urn:x-inspire:def:codeList:INSPIRE:<name of the class>".

5.1.4 Stereotypes

In the application schemas in this section several stereotypes are used that have been defined as part of a UML profile for use in INSPIRE [INSPIRE DS-D2.5]. These are explained in Table 2 below.

Table 2 – Stereotypes (adapted from [INSPIRE DS-D2.5])

Stereotype	Model element	Description
applicationSchema	Package	An INSPIRE application schema according to ISO 19109 and the Generic Conceptual Model.
featureType	Class	A spatial object type.
type	Class	A conceptual, abstract type that is not a spatial object type.
dataType	Class	A structured data type without identity.
union	Class	A structured data type without identity where exactly one of the properties of the type is present in any instance.
enumeration	Class	A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list.
codeList	Class	A flexible enumeration that uses string values for expressing a list of potential values.
placeholder	Class	A placeholder class (see definition in section 5.1.1).
voidable	Attribute, association role	A voidable attribute or association role (see definition in section 5.1.2).
lifeCycleInfo	Attribute, association role	If in an application schema a property is considered to be part of the life-cycle information of a spatial object type, the property shall receive this stereotype.
version	Association role	If in an application schema an association role ends at a spatial object type, this stereotype denotes that the value of the property is meant to be a specific version of the spatial object, not the spatial object in general.

5.2 Application schema ‘Hydro – base’

5.2.1 Description

5.2.1.1 Narrative description

The ‘Hydro – base’ application schema provides a foundation for defining different ‘views’ of hydrography. While there is only a single real world of hydrographic objects, it may have many representations. The INSPIRE Hydrography theme identifies ‘mapping’, ‘network’, and ‘reporting’ views as different representations of the real world, with three corresponding application schemas. In order to reconcile spatial objects in these different views, a common base class provides the ability for different views of a real-world feature to share a common name or identifier. These inherited attributes are provided by the abstract base HydroObject spatial object type, the sole element of the ‘Hydro – base’ application schema.

5.2.1.2 UML Overview

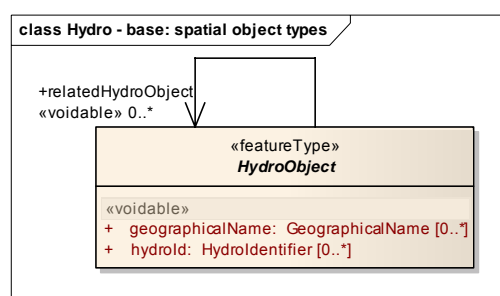


Figure 3 – UML class diagram: Overview of the ‘Hydro – base’ application schema

This application schema contains just a single abstract class, *HydroObject*, the purpose of which is to provide a base for defining specialised ‘views’ of hydrographic features in other application schemas. The class provides properties that enable associations to be made between different spatial object instances representing the same real world feature. Three mechanisms are provided for this:

- a shared ‘geographicalName’ attribute allows an implicit association between spatial objects representing the same *named* real-world feature
- a shared ‘hydrold’ attribute allows an implicit association between spatial objects representing the same *identifiable* real-world feature
- the ‘relatedHydroObject’ association allows an explicit association between spatial objects representing the same real-world feature, but where a shared name or identifier is not applicable

As an example, a real-world named river may be represented by different spatial objects in both a ‘mapping’ view and a ‘reporting’ view e.g. through the ‘Watercourse’ and ‘WFDRiver’ spatial objects, respectively; by sharing the same value for the inherited ‘geographicalName’ attribute, an implicit association is established between the two spatial objects. Similarly a ‘mapping’ view and ‘network’ view of a real-world lock (i.e. the spatial object types ‘Lock’ and ‘WatercourseNode’ respectively) may be reconciled through sharing a common hydrographic identifier assigned by a national management authority.

5.2.1.3 Consistency between spatial data sets

As described in D2.6 A.18 there are three topic areas regarding consistency between spatial data sets, these are:

- a) Coherence between spatial objects of the same theme at different levels of detail
- b) Coherence between different spatial objects within the same area
- c) Coherence at state boundaries.

[a] For *Hydrography* the specification incorporates two alternative forms of representation:

- Physical topographic area objects (usually surveyed to a high accuracy)
- Centreline representations (often an approximation of the centreline)

At any level of detail, data integrity demands that these two forms need to be consistent with each other both positionally and logically. For example, where both exist, a watercourse link or centreline will always fall within the limits of the corresponding watercourse area. Similarly, nodes representing constructions in the watercourse will always fall inside the watercourse area where the node occurs.

Requirement 4 <i>Hydrography</i> links, centrelines and nodes shall always be located within the extent of the area representation of the same object.

- [b] Both forms of representation will often be combined with other themes in a wide variety of applications. Again data integrity demands that these should be positionally consistent to ensure both a faithful representation of the real world and a professional appearance that will provide the user with confidence.

Recommendation 2 The objects in the *Hydrography* theme should be positionally consistent with spatial objects from other themes (e.g. with buildings and waterways)

- [c] It is essential that continuity of hydrographic network information is preserved positionally, logically and semantically across state borders and – where applicable – also across regional borders within member states. This is vital to interoperable pan-European spatial information. The methods to support this are outlined in D2.6 Annex B.

Recommendation 3 In considering reconciliation across borders the respective authorities should seek to fully resolve the positional alignment that minimises positional deficiencies that would require repeated manual intervention in updates or detract from the use of the data in applications.

5.2.1.4 Identifier management

As is required by the GCM, all spatial objects must have a unique identifier. This must be persistent and will usually be supported by a defined lifecycle to ensure that users understand the conditions under which the identifier may be created, modified (in terms of its relationship with the spatial object) and deleted.

The unique object identifier will be modelled on the form described in D2.5 9.8.2 and 9.7, and D2.7 Chapter 7 where a country code and namespace is applied as a prefix to the existing local identifier used by the authority responsible for the data. This will both ensure that the identifier is:

- Unique in the European spatial data infrastructure
- The object is traceable in that infrastructure

All spatial objects in Hydrography will have a unique object identifier – this includes those spatial objects that contain geometry and those that may not. The pragmatic approach to making it internationally unique is to add a prefix of the Member State identifier. How member states maintain their database is up to them, as INSPIRE is only concerned with data exchange, not its management.

Requirement 5 All spatial objects in the Hydrography theme shall have a persistent unique identifier as defined in the INSPIRE documents D2.5 and D2.7.

Ideally, all objects should be supported by a defined lifecycle model and a method of versioning (see D2.5 9.7) that assists the user in distinguishing between current objects and previous versions.

Recommendation 4 The spatial object unique identifier should be supported by a documented lifecycle to provide users with a defined behaviour pattern as conditions which affect the object change over time.

Recommendation 5 The spatial object unique identifier should be supported by a defined form of versioning to ensure that users refer to the correct version in applications.

Unique hydrographic identifier

In addition all spatial object types are derived from a base object that can have either a unique geographical name or a hydrologic ID. This identifier is used to identify objects in (a) dataset(s) that refer to the same real world phenomenon, and acts as an implicit association between the objects.

This identifier can be a local ID as given in the hydrological database of the data provider, but should preferably be derived from the highest authoritative source available. The structure of this identifier is based on the ISO 3166 code of the country to which the spatial object belongs and on a national / hydrological ID.

Requirement 6	If a geographical name is used as a unique hydrologic ID for an object in this specification then it shall be derived, where possible, from a pan-European Gazetteer or another authoritative, pan-European source.
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Recommendation 6	The hydrologic ID should be derived from the highest level authority defining unique IDs for objects in this specification e.g. the use of European or National hydrologic identifiers is preferred above those of a regional nature.
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5.2.1.5 Modelling of object references

The INSPIRE Directive promotes the reuse of information. Object referencing is designed to support that aim whereby an existing object e.g. a watercourse is used by several other objects, which may be collected by different organisations. Such objects would normally inherit geometry from underlying referenced objects.

Recommendation 7	If the same real world object in a dataset is exchanged using more than one of the <i>Hydrography</i> application schemas then they shall carry the same, unique, geographical name or the same Hydrological ID or shall have a 'relatedObject' association to that object.
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NOTE Recommendation 7 has been included by mistake as a *requirement* in the Regulation on spatial data sets and services – with a slightly different wording (“If the same real world object in a data set is exchanged using more than one of the *Hydrography* application schemas then they shall carry either the same, unique, geographical name or the same Hydrological ID.”). It is planned to correct this mistake in a future update (amendment or corrigendum) of the Regulation.

5.2.1.6 Geometry representation

The following types of geometry are included in this specification:

- a) (topographic) Area objects in physical waters and reporting
- b) (topographic) Linear objects in physical waters
- c) Centreline objects in hydrographic networks
- d) (topographic) Point objects in physical waters
- e) Point objects in hydrographic networks

Various types may be alternative representations of the same real world phenomena (e.g. (a) and (c)) about which the user can associate their own information (objects) – See Annex B for more background.

Type (d) is only used for nodes. However users may wish to collect such data and associate it with the network (e.g. monitoring points, specific obstructions etc).

Levels of detail: The specification addresses the highest resolution of data capture in hydrography and is also applicable to any derived lower resolution levels of detail where the number of coordinates is reduced and the geometry simplified to support viewing and reporting at regional, national and European levels.

INSPIRE	Reference: INSPIRE_DataSpecification_HY_v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 8

This specification cannot advise on the form of representation at the highest resolution nor the accuracy since this will be driven by member state needs. Ideally, derived lower resolution datasets will use the approach outlined in D2.6 A.19 where all the objects are related from lowest to highest resolution and any user information collected about the network can be simply aggregated at the lower resolution level or disaggregated as the user increases the resolution.

Recommendation 8 All spatial objects should be provided at the source accuracy where possible

Recommendation 9 Where more than one geometry is available at the source, the provided geometry should be that with the highest spatial detail; i.e. a surface geometry is provided where both surface and point geometry is available or where both surface and linear geometry is available.

Requirement 7 The value domain of spatial properties used in this specification shall be restricted to the Simple Feature spatial schema as defined by EN ISO 19125-1.

Recommendation 10 If associated objects are exchanged then the geometry of the source object should be referenced by the associated objects in the encoding (for example, using a GML 'by-reference' xlink) rather than duplicate the geometry.

NOTE The specification restricts the spatial schema to 0-, 1-, 2-, and 2.5-dimensional geometries where all curve interpolations are linear.

NOTE The topological relations of two spatial objects based on their specific geometry and topology properties can in principle be investigated by invoking the operations of the types defined in ISO 19107 (or the methods specified in OGC 06-103r3).

5.2.1.7 Temporality representation

The application schemas use the derived attributes "beginLifespanObject" and "endLifespanObject" to record the lifespan of a spatial object.

The attribute "beginLifespanVersion" specifies the date and time at which this version of the spatial object was inserted or changed in the spatial data set. The attribute "endLifespanVersion" specifies the date and time at which this version of the spatial object was superseded or retired in the spatial data set.

NOTE 1 The attributes specify the beginning of the lifespan of the version in the spatial data set itself, which is different from the temporal characteristics of the real-world phenomenon described by the spatial object. This lifespan information, if available, supports mainly two requirements: First, knowledge about the spatial data set content at a specific time; second, knowledge about changes to a data set in a specific time frame. The lifespan information should be as detailed as in the data set (i.e., if the lifespan information in the data set includes seconds, the seconds should be represented in data published in INSPIRE) and include time zone information.

NOTE 2 Changes to the attribute "endLifespanVersion" does not trigger a change in the attribute "beginLifespanVersion".

Recommendation 11 If life-cycle information is not maintained as part of the spatial data set, all spatial objects belonging to this data set should provide a void value with a reason of "unpopulated".

5.2.2 Feature catalogue

Table 3 – Feature catalogue metadata

Feature catalogue name	INSPIRE feature catalogue Hydrography
Scope	Hydrography - base
Version number	3.0.1
Version date	2010-04-26
Definition source	INSPIRE data specification Hydrography

Table 4 – Types defined in the feature catalogue

Type	Package	Stereotypes	Section
HydroIdentifier	Hydro - base	«dataType»	5.2.2.2.1
HydroObject	Hydro - base	«featureType»	5.2.2.1.1

5.2.2.1 Spatial object types

5.2.2.1.1 *HydroObject*

HydroObject (abstract)	
Definition:	An identity base for hydrographic (including man-made) objects in the real world.
Description:	NOTE Derived 'views' of real-world hydrographic objects are represented through specialisations in other application schemas; all representations of the same real-world object share a common geographic name or hydrographic identifier.
Status:	Proposed
Stereotypes:	«featureType»
Attribute: geographicalName	
Value type:	GeographicalName
Definition:	A geographical name that is used to identify a hydrographic object in the real world. It provides a 'key' for implicitly associating different representations of the object.
Description:	EXAMPLE A standing water in a mapping view may share the same geographical name as a WFD lake in a reporting view, implying they are both representations of the same real world object.
Multiplicity:	0..*
Stereotypes:	«voidable»
Attribute: hydroId	
Value type:	HydroIdentifier
Definition:	An identifier that is used to identify a hydrographic object in the real world. It provides a 'key' for implicitly associating different representations of the object.
Description:	NOTE 1 The identifier may be a national hydrological identification code. NOTE 2 More than one identifier may be required, for instance a watercourse may be assigned different identifying codes under national and European schemes. EXAMPLE A lock in a mapping view may share the same identifier as a hydro node in a network view, implying they are both representations of the same real world object.
Multiplicity:	0..*
Association role: relatedHydroObject	
Value type:	HydroObject
Definition:	A related hydrographic object representing the same real-world entity.
Multiplicity:	0..*

HydroObject (abstract)

Stereotypes: «voidable»

5.2.2.2 Data types

5.2.2.2.1 HydroIdentifier

HydroIdentifier

Definition: A hydrographic thematic identifier.
 Description: NOTE May be used to hold a national hydrological identification code.
 Status: Proposed
 Stereotypes: «dataType»

Attribute: classificationScheme

Value type: CharacterString
 Definition: A description of the identification scheme (National, European, etc.) being used.
 Multiplicity: 0..1

Attribute: localId

Value type: CharacterString
 Definition: A local identifier, assigned by some authority.
 Description: NOTE It will often be a national hydrographic identifier.
 Multiplicity: 1

Attribute: namespace

Value type: CharacterString
 Definition: An indicator of the scope for the local identifier.
 Description: NOTE In the case of a national hydrographic identifier it should be a two-letter country code as per ISO 3166-1-Alpha-2.
 Multiplicity: 1

5.2.2.3 Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.2.2.3.1 GeographicalName

GeographicalName

Package: Geographical Names [see DS-D2.8.1.3]
 Definition: Proper noun applied to a real world entity.

5.3 Application schema 'Hydro – Physical Waters'

5.3.1 Description

5.3.1.1 Narrative description

The Physical Waters application schema primarily is for creating base maps relating to hydrography. The selection of feature classes in this package is based on both the requirements for mapping specific objects as well as the need for distinction between certain objects from a modelling point of view. As a result certain 'real world' features are combined in a single class when there was found to be no need of distinction from either a mapping or modelling point of view.

The following groups of objects can be distinguished:

- Physical water objects that form part of the hydrological network such as watercourses, standing water, wetlands etc.

- Objects delineating the physical water objects (shore, land-water boundary)
- Areas where the water is collected (River Basin / Drainage Basin)
- Hydrographic points of interest. Points that influence the flow of water in the network and appear on maps but are not artificial objects (e.g. falls, springs and seeps etc).
- Manmade objects. All objects that are important to specify on the map and have a relation to the water network (e.g. embankment, locks, sluices, dams and weirs).



Figure 4 – Some elements of the physical waters and related objects (1)

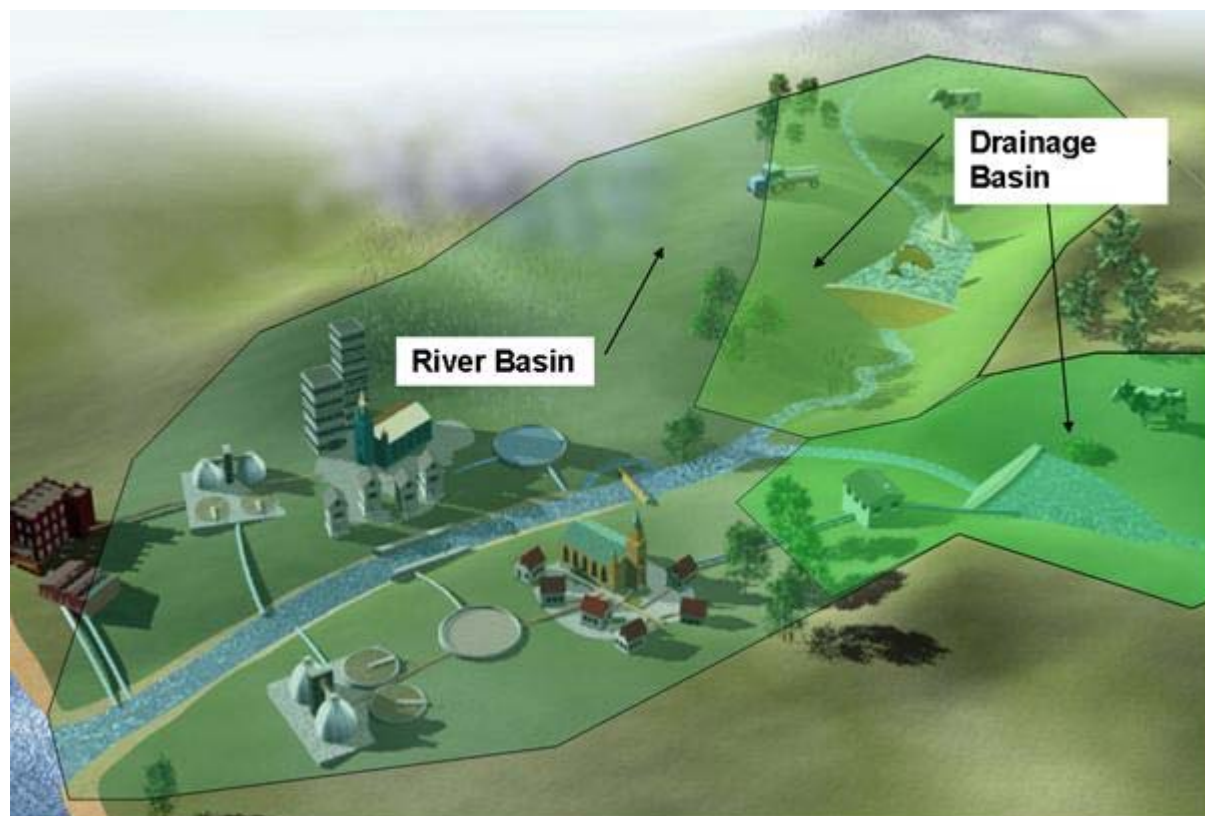


Figure 5 – River Basin and Drainage Basins

The UML diagrams below (Figure 7 - Figure 9) include each of these categories separately.

5.3.1.2 UML Overview

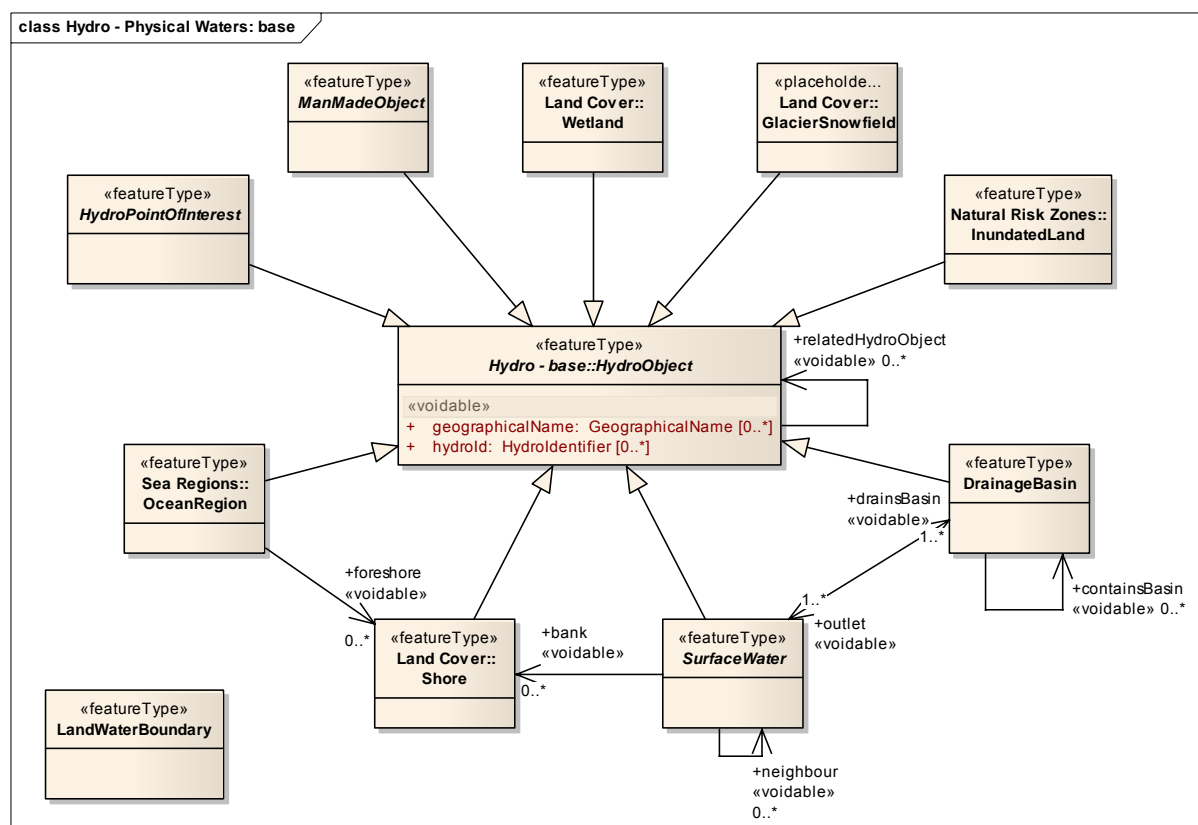


Figure 6 – UML class diagram: Overview of the ‘Hydro – Physical Waters’ application schema

The Physical Waters application schema defines spatial object types for a range of real-world physical feature classes having a strong relationship to hydrography, and provides a base for some spatial object types in other themes:

- physical SurfaceWaters: Watercourse, StandingWater
- landcover types (from the Annex II theme ‘Land cover’) having a significant hydrographic influence: Wetland, GlacierSnowfield, Shore
- InundatedLand from the Annex III theme ‘Natural risk zones’
- catchment areas: DrainageBasin and RiverBasin
- OceanRegion (from the Annex III theme ‘Sea Regions’) and LandWaterBoundary
- ManMadeObject types: Embankment, Ford, Lock, Sluice, DamOrWeir, ShorelineConstruction, Crossing, HydroPowerPlant, PumpingStation, Pipe
- HydroPointOfInterest types: SpringOrSeep, VanishingPoint, Rapids, Falls

A number of these spatial object types belong thematically in themes from INSPIRE Annex II or III, and so are included in the Hydrography data specification as either placeholder or preliminary type specifications (5.1.1).

The abstract spatial object HydroObject is used as a base for all Physical Waters classes except LandWaterBoundary (it does not normally have a name or identifier, nor is related to reporting or a network view).

5.3.1.3 Consistency between spatial data sets

No additional requirements and / or recommendations are required beyond those stated for the base application schema.

5.3.1.4 Identifier management

No additional requirements and / or recommendations are required beyond those stated for the base application schema.

5.3.1.5 Modelling of object references

No additional requirements and / or recommendations are required beyond those stated for the base application schema.

5.3.1.6 Geometry representation

Besides the requirements and / or recommendations stated for the base application schema the following applies to this application schema.

Requirement 8 If spatial objects are provided at different spatial resolutions, the spatial resolution must be specified for each spatial object using the levelOfDetail where applicable.

5.3.1.7 Temporality representation

No additional requirements and / or recommendations are required beyond those stated for the base application schema.

5.3.2 Feature catalogue

Table 5 – Feature catalogue metadata

Feature catalogue name	INSPIRE feature catalogue <i>Hydrography</i>
Scope	<i>Hydrography – Physical Waters</i>
Version number	3.0.1
Version date	2010-04-26
Definition source	INSPIRE Data specification <i>Hydrography</i>

Table 6 – Types defined in the feature catalogue

Type	Package	Stereotypes	Section
Crossing	Hydro - Physical Waters	«featureType»	5.3.2.1.1
CrossingTypeValue	Hydro - Physical Waters	«codeList»	5.3.2.3.2
DamOrWeir	Hydro - Physical Waters	«featureType»	5.3.2.1.2
DrainageBasin	Hydro - Physical Waters	«featureType»	5.3.2.1.3
Embankment	Natural Risk Zones	«featureType»	5.3.2.4.1
Falls	Hydro - Physical Waters	«featureType»	5.3.2.1.4
FluvialPoint	Hydro - Physical Waters	«featureType»	5.3.2.1.5
Ford	Hydro - Physical Waters	«featureType»	5.3.2.1.6
GlacierSnowfield	Land Cover	«placeholder,featureType»	5.3.2.4.2
HydrologicalPersistenceValue	Hydro - Physical Waters	«codeList»	5.3.2.3.3
HydroOrderCode	Hydro - Physical Waters	«dataType»	5.3.2.2.1
HydroPointOfInterest	Hydro - Physical Waters	«featureType»	5.3.2.1.7
HydroPowerPlant	Energy Resources	«featureType»	5.3.2.4.3
InundatedLand	Natural Risk Zones	«featureType»	5.3.2.4.4
InundationValue	Natural Risk Zones	«codeList»	5.3.2.4.5
LandWaterBoundary	Hydro - Physical Waters	«featureType»	5.3.2.1.8
Lock	Hydro - Physical Waters	«featureType»	5.3.2.1.9

Type	Package	Stereotypes	Section
ManMadeObject	Hydro - Physical Waters	«featureType»	5.3.2.1.10
OceanRegion	Sea Regions	«featureType»	5.3.2.4.6
OriginValue	Hydro - Physical Waters	«enumeration»	5.3.2.3.1
Pipe	Utility and Governmental Services	«featureType»	5.3.2.4.7
PumpingStation	Utility and Governmental Services	«featureType»	5.3.2.4.8
Rapids	Hydro - Physical Waters	«featureType»	5.3.2.1.11
RiverBasin	Hydro - Physical Waters	«featureType»	5.3.2.1.12
Shore	LandCover	«featureType»	5.3.2.4.1
ShorelineConstruction	Hydro - Physical Waters	«featureType»	5.3.2.1.13
ShoreTypeValue	Land Cover	«codeList»	5.3.2.4.10
Sluice	Hydro - Physical Waters	«featureType»	5.3.2.1.14
SpringOrSeep	Geology	«placeholder,featureType»	5.3.2.4.11
StandingWater	Hydro - Physical Waters	«featureType»	5.3.2.1.15
SurfaceWater	Hydro - Physical Waters	«featureType»	5.3.2.1.16
VanishingPoint	Geology	«placeholder,featureType»	5.3.2.4.12
Watercourse	Hydro - Physical Waters	«featureType»	0
WaterLevelValue	Hydro - Physical Waters	«codeList»	5.3.2.3.4
Wetland	Land Cover	«featureType»	5.3.2.4.13
WidthRange	Hydro - Physical Waters	«dataType»	5.3.2.2.2

5.3.2.1 Spatial object types

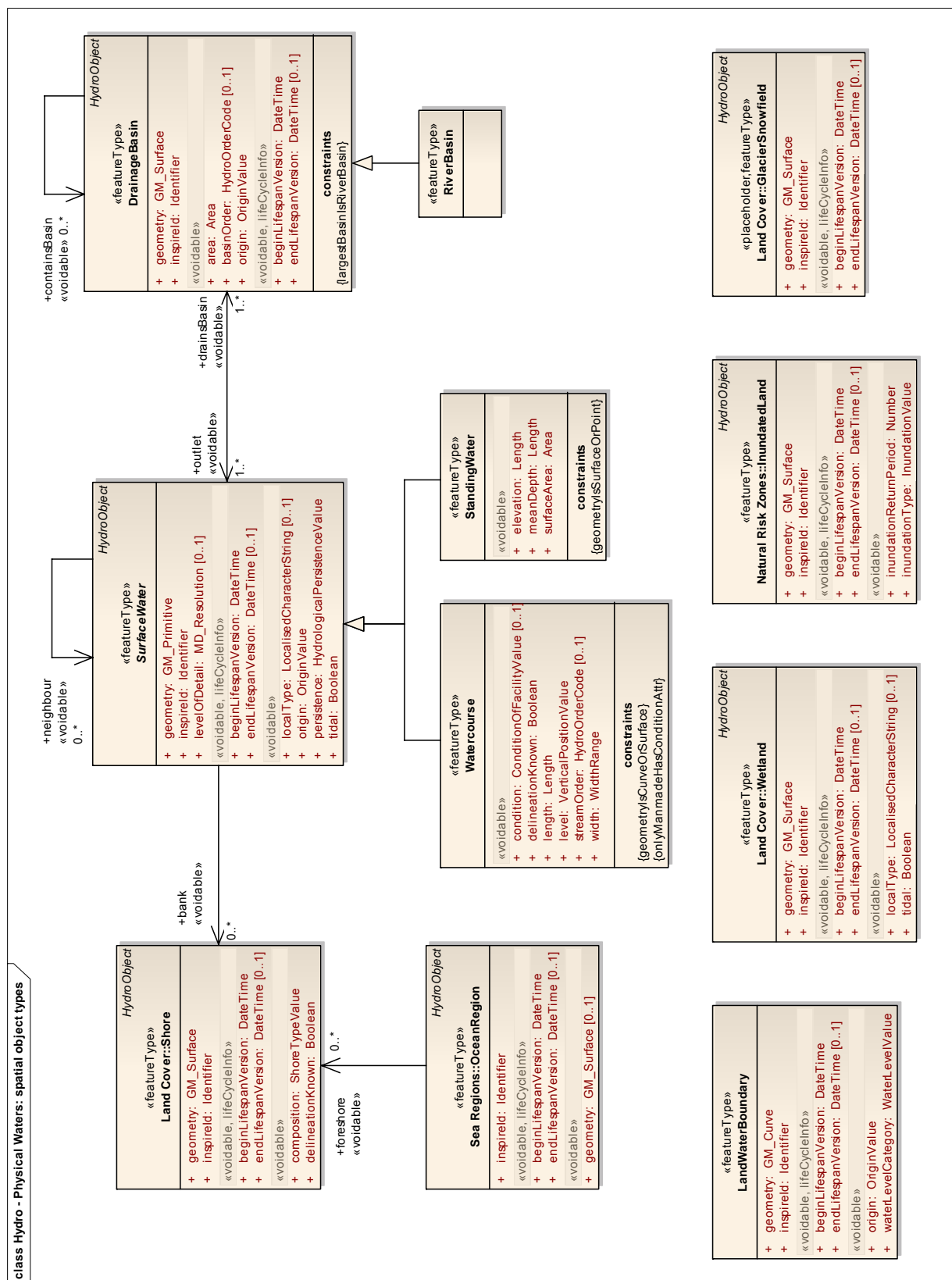


Figure 7 – UML class diagram: ‘Physical Waters’ spatial object types (including related classes from other themes)

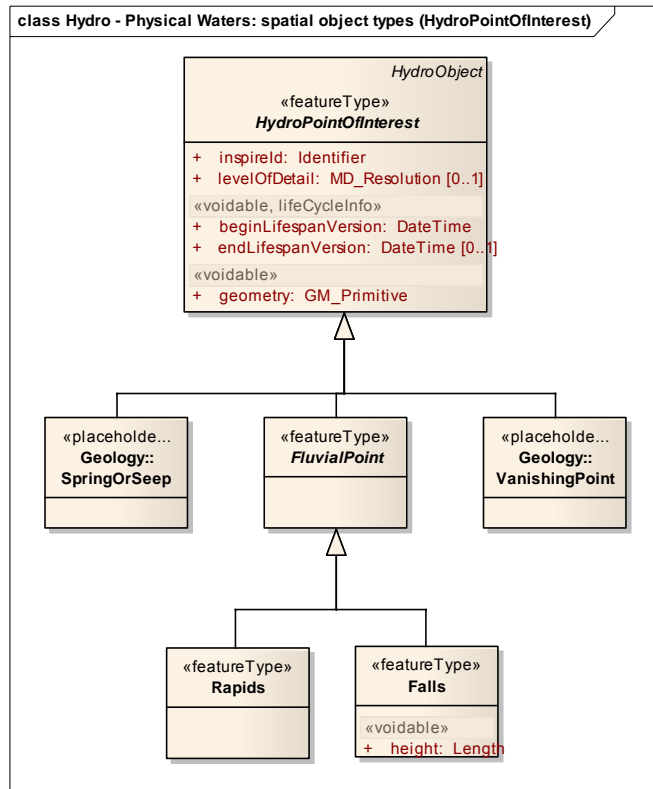


Figure 8 – UML class diagram: ‘Physical Waters (HydroPointOfInterest)’ spatial object types (including related classes from other themes)

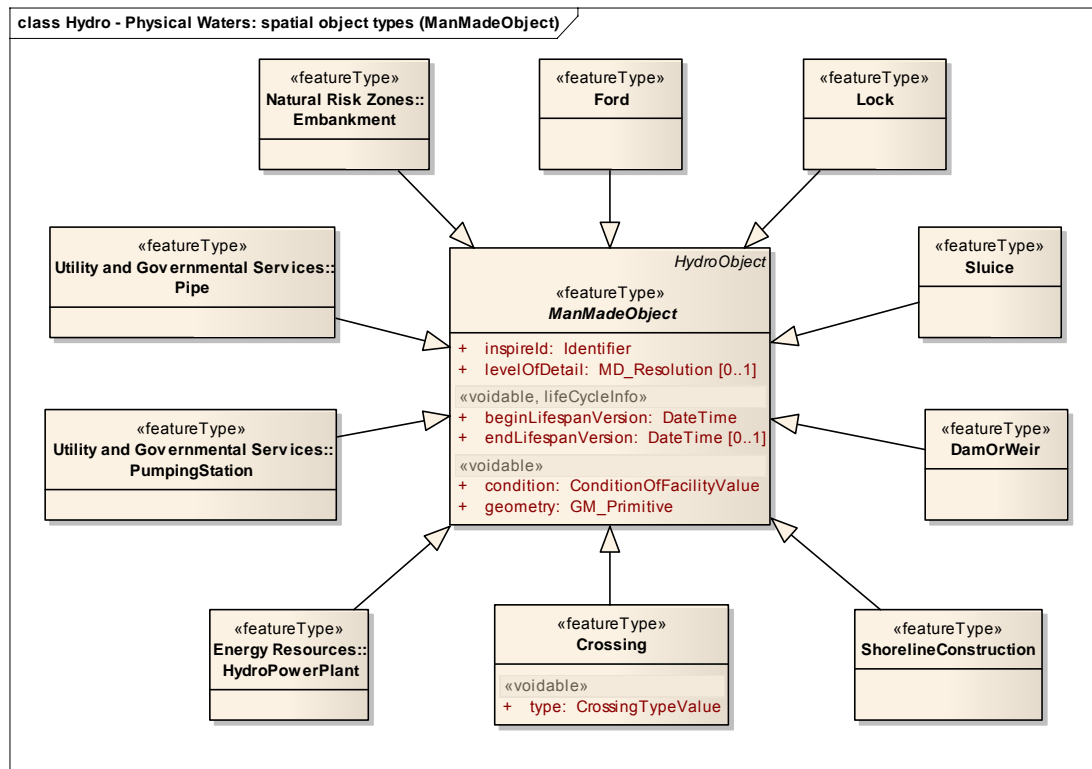


Figure 9 – UML class diagram: ‘Physical Waters (ManMadeObject)’ spatial object types (including related classes from other themes)

5.3.2.1.1 Crossing

Crossing	
Subtype of:	ManMadeObject
Definition:	A man-made object allowing the passage of water above or below an obstacle.
Description:	EXAMPLE Aqueduct, bridge, culvert, siphon.
Status:	Proposed
Stereotypes:	«featureType»
Attribute: type	
Value type:	CrossingTypeValue
Definition:	The type of physical crossing.
Multiplicity:	1
Stereotypes:	«voidable»

5.3.2.1.2 DamOrWeir

DamOrWeir	
Subtype of:	ManMadeObject
Definition:	A permanent barrier across a watercourse used to impound water or to control its flow.
Description:	SOURCE [EuroRegionalMap].
Status:	Proposed
Stereotypes:	«featureType»

5.3.2.1.3 DrainageBasin

DrainageBasin	
Subtype of:	HydroObject
Definition:	Area having a common outlet for its surface runoff.
Description:	SOURCE [UNESCO/WMO International Glossary of Hydrology].
	NOTE 1 Regarding the different classifications of drainage basins, no distinction is made between drainage basins / sub-basins since this will vary with application. It is possible to build basins from other basins.
	NOTE 2 The outlet of a drainage basin may be a canal or a lake.
	NOTE 3 Synonyms for drainage basin include: catchment; catchment area; drainage area; river basin; watershed.
Status:	Proposed
Stereotypes:	«featureType»
Attribute: area	
Value type:	Area
Definition:	Size of the drainage basin area.
Multiplicity:	1
Stereotypes:	«voidable»
Attribute: basinOrder	
Value type:	HydroOrderCode
Definition:	Number (or code) expressing the degree of branching/dividing in a drainage basin system.
Multiplicity:	0..1
Stereotypes:	«voidable»
Attribute: beginLifespanVersion	
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity:	1

DrainageBasin

Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.

Multiplicity: 0..1

Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Surface

Definition: The geometry of the drainage basin, as a surface.

Multiplicity: 1

Attribute: inspireId

Value type: Identifier

Definition: External object identifier of the spatial object.

Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.

Multiplicity: 1

Attribute: origin

Value type: OriginValue

Definition: Origin of the drainage basin.

Description: EXAMPLE Natural, man-made, etc.

NOTE A polder is a drainage basin of man-made origin.

Multiplicity: 1

Stereotypes: «voidable»

Association role: containsBasin

Value type: DrainageBasin

Definition: A smaller sub-basin contained within a larger basin.

Multiplicity: 0..*

Stereotypes: «voidable»

Association role: outlet

Value type: SurfaceWater

Definition: The surface water outlet(s) of a drainage basin.

Multiplicity: 1..*

Stereotypes: «voidable»

Constraint: largestBasinIsRiverBasin

Natural language: A river basin may not be contained in any other basin

OCL: inv: self.containsBasin->forall(c | not c.oclIsTypeOf(RiverBasin))

5.3.2.1.4 Falls

Falls

Subtype of: FluvialPoint

Definition: A vertically descending part of a watercourse where it falls from a height.

Description: SOURCE [Based on DFDD].

EXAMPLE Waterfalls over a rock or a precipice.

Status: Proposed

Stereotypes: «featureType»

Falls

Attribute: height

Value type:	Length
Definition:	Distance measured from the lowest point of the base at ground or water level (downhill side/downstream side) to the tallest point of the spatial object.
Description:	SOURCE [DFDD].
Multiplicity:	1
Stereotypes:	«voidable»

5.3.2.1.5 FluvialPoint

FluvialPoint (abstract)

Subtype of:	HydroPointOfInterest
Definition:	A hydro point of interest that affects the flow of a watercourse.
Status:	Proposed
Stereotypes:	«featureType»

5.3.2.1.6 Ford

Ford

Subtype of:	ManMadeObject
Definition:	A shallow part of a watercourse used as a road crossing.
Description:	SOURCE [DFDD].
Status:	Proposed
Stereotypes:	«featureType»

5.3.2.1.7 HydroPointOfInterest

HydroPointOfInterest (abstract)

Subtype of:	HydroObject
Definition:	A natural place where water appears, disappears or changes its flow.
Description:	EXAMPLE Fluvial points (waterfall, cascade, rapids, breaker), spring/water hole (spring, source, geyser, thermal spring, natural fountain, well, also fumarole, artesian), sinkhole (sinkhole, drainage loss).
	NOTE A hydro point of interest may create a flow constriction in the network.
Status:	Proposed
Stereotypes:	«featureType»

Attribute: levelOfDetail

Value type:	MD_Resolution
Definition:	Resolution, expressed as the inverse of an indicative scale or a ground distance.
Description:	NOTE The object is captured at a scale of this level of detail; rules apply for portrayal and visualisation.
Multiplicity:	0..1

Attribute: beginLifespanVersion

Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity:	0..1
Stereotypes:	«voidable,lifeCycleInfo»

HydroPointOfInterest (abstract)

Attribute: geometry

Value type: GM_Primitive
Definition: The geometry of the hydro point of interest, as a point, curve or surface.
Multiplicity: 1
Stereotypes: «voidable»

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 1

5.3.2.1.8 LandWaterBoundary

LandWaterBoundary

Definition: The line where a land mass is in contact with a body of water.
Description: SOURCE [DFDD].
NOTE The plane of reference for the land-water boundary should be a high water datum, such as 'Mean High Water Springs', 'High Water' or 'Mean Higher High Water'. Where there is little appreciable change in waterlevels / tide at the adjacent shore, then 'Mean Sea Level' or 'Local Datum' may be used.
Status: Proposed
Stereotypes: «featureType»

Attribute: beginLifespanVersion

Value type: DateTime
Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity: 1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime
Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity: 0..1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Curve
Definition: The geometry of the land-water boundary, as a curve.
Multiplicity: 1

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 1

Attribute: origin

Value type: OriginValue
Definition: Origin of the land-water boundary.

LandWaterBoundary

Description: EXAMPLE Natural, man-made, etc.; a sea defence is a land-water boundary of man-made origin.
 Multiplicity: 1
 Stereotypes: «voidable»

Attribute: waterLevelCategory

Value type: WaterLevelValue
 Definition: Water-level defining the land-water boundary.
 Description: EXAMPLE High water, low water, etc.
 Multiplicity: 1
 Stereotypes: «voidable»

5.3.2.1.9 Lock

Lock

Subtype of: ManMadeObject
 Definition: An enclosure with a pair or series of gates used for raising or lowering vessels as they pass from one water level to another.
 Description: SOURCE [DFDD].
 Status: Proposed
 Stereotypes: «featureType»

5.3.2.1.10 ManMadeObject

ManMadeObject (abstract)

Subtype of: HydroObject
 Definition: An artificial object which lies inside a body of water and has one of the following types of function: - Retains the water; - Regulates the quantity of water; - Alters the course of the water; - Allows watercourses to cross each other.
 Status: Proposed
 Stereotypes: «featureType»

Attribute: beginLifespanVersion

Value type: DateTime
 Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
 Multiplicity: 1
 Stereotypes: «voidable,lifeCycleInfo»

Attribute: condition

Value type: ConditionOfFacilityValue
 Definition: The state of planning, construction, repair, and/or maintenance of the structures and/or equipment comprising a facility and/or located at a site, as a whole.
 Description: SOURCE [DFDD].
 Multiplicity: 1
 Stereotypes: «voidable»

Attribute: endLifespanVersion

Value type: DateTime
 Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
 Multiplicity: 0..1
 Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Primitive
 Definition: The geometry of the man-made object, as a point, curve or surface.
 Multiplicity: 1
 Stereotypes: «voidable»

ManMadeObject (abstract)

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 1

Attribute: levelOfDetail

Value type: MD_Resolution
Definition: Resolution, expressed as the inverse of an indicative scale or a ground distance.
Description: NOTE The object is captured at a scale of this level of detail; rules apply for portrayal and visualisation.
Multiplicity: 0..1

5.3.2.1.11 Rapids

Rapids

Subtype of: FluvialPoint
Definition: Portions of a stream with accelerated current where it descends rapidly but without a break in the slope of the bed sufficient to form a waterfall.
Description: SOURCE [DFDD].
Status: Proposed
Stereotypes: «featureType»

5.3.2.1.12 RiverBasin

RiverBasin

Subtype of: DrainageBasin
Definition: The area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta.
Description: SOURCE [2000/60/EC Art. 2(13)].
Status: Proposed
Stereotypes: «featureType»

5.3.2.1.13 ShorelineConstruction

ShorelineConstruction

Subtype of: ManMadeObject
Definition: An artificial structure attached to land bordering a body of water and fixed in position.
Description: SOURCE [DFDD].

NOTE 1 It is usually fixed to the waterbody bottom (for example: a mole) but may occasionally be fixed in position (for example: attached to the shore at one end and held between pilings at the other) but floating. Shoreline constructions are normally used for berthing and/or protection.

NOTE 2 Includes breakwater/groynes/wharf; but has more flexibility - also applies to inland waters.
Status: Proposed
Stereotypes: «featureType»

5.3.2.1.14 Sluice

Sluice

Subtype of: ManMadeObject

Sluice

Definition: An open, inclined conduit fitted with a gate for regulating water flow.
 Description: SOURCE [DFDD].
 Status: Proposed
 Stereotypes: «featureType»

5.3.2.1.15 StandingWater

StandingWater

Subtype of: SurfaceWater
 Definition: A body of water that is entirely surrounded by land.
 Description: SOURCE [DFDD].

 NOTE It may occur in a natural terrain depression in which water collects, or may be impounded by a dam, or formed by its bed being hollowed out of the soil, or formed by embanking and/or damming up a natural hollow (for example: by a beaver dam). It may be connected to inflowing / outflowing watercourses or other standing waters.
 Status: Proposed
 Stereotypes: «featureType»

Attribute: elevation

Value type: Length
 Definition: Elevation above mean sea level.
 Description: SOURCE [Based on EuroRegionalMap].
 Multiplicity: 1
 Stereotypes: «voidable»

Attribute: meanDepth

Value type: Length
 Definition: Average depth of the body of water.
 Multiplicity: 1
 Stereotypes: «voidable»

Attribute: surfaceArea

Value type: Area
 Definition: Surface area of the body of water.
 Multiplicity: 1
 Stereotypes: «voidable»

Constraint: geometryIsSurfaceOrPoint

Natural language: Standing water geometry may be a surface or point
 OCL: inv: self.geometry.ocllsTypeOf(GM_Surface) or self.geometry.ocllsTypeOf(GM_Point)

5.3.2.1.16 SurfaceWater

SurfaceWater (abstract)

Subtype of: HydroObject
 Definition: Any known inland waterway body.
 Description: SOURCE [Based on DFDD].

 EXAMPLE Lake/pond, reservoir, river/stream, etc.

 NOTE May include islands, represented as 'holes' in its geometry. Islands may be surrounded by a shore and / or land-ware boundary.
 Status: Proposed
 Stereotypes: «featureType»

SurfaceWater (abstract)

Attribute: beginLifespanVersion

Value type: DateTime
Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity: 1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime
Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity: 0..1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Primitive
Definition: The geometry of the surface water: - either a curve or surface for a watercourse; - either a point or surface for a standing water.
Multiplicity: 1

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 1

Attribute: levelOfDetail

Value type: MD_Resolution
Definition: Resolution, expressed as the inverse of an indicative scale or a ground distance.
Description: NOTE The object is captured at a scale of this level of detail; rules apply for portrayal and visualisation.
Multiplicity: 0..1

Attribute: localType

Value type: LocalisedCharacterString
Definition: Provides 'local' name for the type of surface water.
Description: EXAMPLE Canal, channel, ditch, etc.
Multiplicity: 0..1
Stereotypes: «voidable»

Attribute: origin

Value type: OriginValue
Definition: Origin of the surface water.
Description: SOURCE [Based on EuroRegionalMap].

EXAMPLE Natural, man-made, etc.

NOTE 1 Natural surface waters are natural watercourses (e.g. rivers, streams) and standing waters (e.g. pools, lakes) naturally preserved and that have been canalised and / or dammed either for navigation or for preventing flood disaster.

NOTE 2 A man-made surface water is a surface water entirely created by man for drainage, storage or transportation purpose, this includes canals, ditches and reservoirs.

Multiplicity: 1

SurfaceWater (abstract)	
Stereotypes:	«voidable»
Attribute: persistence	
Value type:	HydrologicalPersistenceValue
Definition:	The degree of persistence of water.
Description:	SOURCE [Based on DFDD].
Multiplicity:	1
Stereotypes:	«voidable»
Attribute: tidal	
Value type:	Boolean
Definition:	Identifies whether the surface water is affected by tidal water.
Multiplicity:	1
Stereotypes:	«voidable»
Association role: drainsBasin	
Value type:	DrainageBasin
Definition:	The basin(s) drained by a surface water.
Multiplicity:	1..*
Stereotypes:	«voidable»
Association role: neighbour	
Value type:	SurfaceWater
Definition:	An association to another instance of the same real-world surface water in another data set.
Multiplicity:	0..*
Stereotypes:	«voidable»
Association role: bank	
Value type:	Shore
Definition:	The bank(s) associated to a surface water.
Multiplicity:	0..*
Stereotypes:	«voidable»

The association role 'neighbour' may be used to explicitly associate two spatial objects in different datasets that represent the same real-world object. See D2.5 'Generic Conceptual Model' §9.4.2.3 ('Multiple spatial objects may represent the same real-world phenomena').

5.3.2.1.17 Watercourse

Watercourse	
Subtype of:	SurfaceWater
Definition:	A natural or man-made flowing watercourse or stream.
Description:	SOURCE [EuroRegionalMap].
Status:	Proposed
Stereotypes:	«featureType»
Attribute: condition	
Value type:	ConditionOfFacilityValue
Definition:	The state of planning, construction, repair, and/or maintenance of a watercourse.
Description:	SOURCE [Based on DFDD].
	NOTE Only relevant for a man-made watercourse.
Multiplicity:	0..1
Stereotypes:	«voidable»
Attribute: delineationKnown	
Value type:	Boolean

Watercourse

Definition: An indication that the delineation (for example: limits and information) of a spatial object is known.

Description: SOURCE [DFDD].

EXAMPLE The delineation may not be known in the following situations:

- an underground watercourse
- real underground network segment (pipeline or natural network section)
- transition area between a broad river and a smaller tributary

Multiplicity: 1

Stereotypes: «voidable»

Attribute: length

Value type: Length

Definition: Length of the watercourse.

Multiplicity: 1

Stereotypes: «voidable»

Attribute: level

Value type: VerticalPositionValue

Definition: Vertical location of watercourse relative to ground.

Multiplicity: 1

Stereotypes: «voidable»

Attribute: streamOrder

Value type: HydroOrderCode

Definition: Number (or code) expressing the degree of branching in a stream system.

Description: SOURCE [Based on UNESCO/WMO International Glossary of Hydrology].

Multiplicity: 0..1

Stereotypes: «voidable»

Attribute: width

Value type: WidthRange

Definition: Width of watercourse (as a range) along its length.

Multiplicity: 1

Stereotypes: «voidable»

Constraint: geometryIsCurveOrSurface

Natural language: Watercourse geometry may be a curve or surface

OCL: inv: self.geometry.ocllsTypeOf(GM_Curve) or self.geometry.ocllsTypeOf(GM_Surface)

Constraint: onlyManmadeHasConditionAttr

Natural language: A condition attribute may be specified only for a man-made watercourse

OCL: inv: (self->count(condition)=1) implies (self.origin=OriginType::manMade)

Requirement 9	The attribute Watercourse.delineationKnown shall not be used to indicate that the accuracy / precision of a certain geometry is low; this indication should be given using the appropriate data quality element(s).
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5.3.2.2 Data types

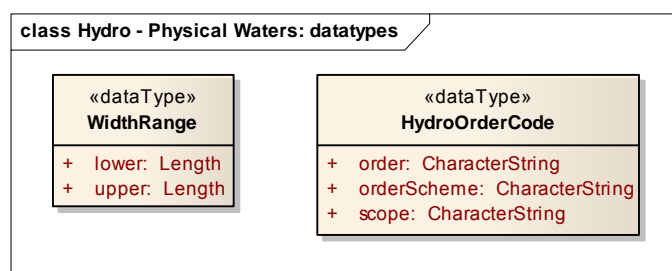


Figure 10 – UML class diagram: ‘Physical Waters’ data types

5.3.2.2.1 *HydroOrderCode*

HydroOrderCode	
Definition:	A hydrologically meaningful 'order code' for ordering hierarchies of watercourses and drainage basins.
Status:	Proposed
Stereotypes:	«dataType»
Attribute: order	
Value type:	CharacterString
Definition:	Number (or code) expressing the degree of branching or dividing in a stream or drainage basin system.
Description:	SOURCE [Based on UNESCO/WMO International Glossary of Hydrology].
Multiplicity:	1
Attribute: orderScheme	
Value type:	CharacterString
Definition:	A description of the concept for ordering.
Description:	EXAMPLE Strahler, Horton, Pfaffstetter etc.
Multiplicity:	1
Attribute: scope	
Value type:	CharacterString
Definition:	An indicator of the scope or origin for an order code (including whether it is national, supranational or European).
Description:	NOTE In the case of a national hydrographic identifier it may start with a two-letter country code as per ISO 3166-1-Alpha-2.
Multiplicity:	1

5.3.2.2.2 *WidthRange*

WidthRange	
Definition:	The range of a watercourse's horizontal width along its length.
Status:	Proposed
Stereotypes:	«dataType»
Attribute: lower	
Value type:	Length
Definition:	Lower bound of width.
Multiplicity:	1
Attribute: upper	
Value type:	Length
Definition:	Upper bound of width.
Multiplicity:	1

5.3.2.3 Enumerations and code lists

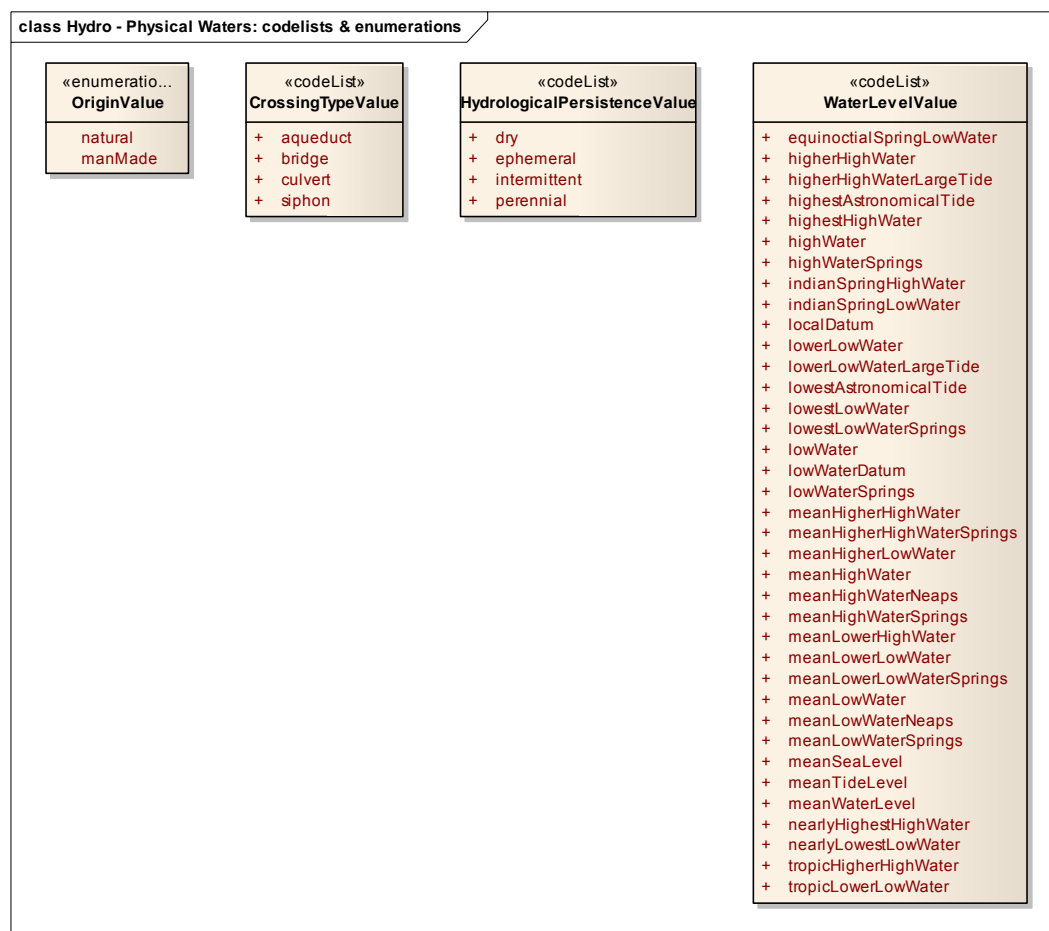


Figure 11 – UML class diagram: ‘Physical Waters’ enumerations and code lists

5.3.2.3.1 OriginValue

OriginValue	
Definition:	An enumeration type specifying a set of hydrographic 'origin' categories (natural, man-made) for various hydrographic objects.
Status:	Proposed
Stereotypes:	«enumeration»
Governance:	May be extended by data providers.
Value: natural	
Definition:	An indication that a spatial object is natural.
Value: manMade	
Definition:	An indication that a spatial object is man-made.
Description:	SOURCE [DFDD].

5.3.2.3.2 CrossingTypeValue

CrossingTypeValue	
Definition:	Man-made physical watercourse crossing types.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	Centrally managed in INSPIRE code list register. URN: urn:x-inspire:def:codeList:INSPIRE:CrossingTypeValue
Value: aqueduct	

CrossingTypeValue

Definition:	A pipe or artificial channel that is designed to transport water from a remote source, usually by gravity, for freshwater supply, agricultural, and/or industrial use.
Description:	SOURCE [DFDD].
Value: bridge	
Definition:	A structure that connects two locations and provides for the passage of a transportation route over a terrain obstacle.
Description:	SOURCE [Based on DFDD].
	EXAMPLE 1 (Transportation route) A road or a railway.
	EXAMPLE 2 (Terrain obstacle) A waterbody, a gully, and/or a road.
Value: culvert	
Definition:	An enclosed channel for carrying a watercourse under a route.
Description:	SOURCE [Based on DFDD].
	EXAMPLE 1 (Watercourse carried in an enclosed channel) A stream, a sewer, or a drain.
	EXAMPLE 2 (Route over a culvert) A road, a railway, or an embankment.
Value: siphon	
Definition:	A pipe used for conveying liquid from one level to a lower level, using the liquid pressure differential to force a column of the liquid up to a higher level before it falls to the outlet.
Description:	SOURCE [DFDD].

5.3.2.3.3 HydrologicalPersistenceValue

HydrologicalPersistenceValue

Definition:	Categories of hydrological persistence of a body of water.
Description:	SOURCE [Codelist values based on DFDD].
Status:	Proposed
Stereotypes:	«codeList»
Governance:	Centrally managed in INSPIRE code list register. URN: urn:x-inspire:def:codeList:INSPIRE:HydrologicalPersistenceValue
Value: dry	
Definition:	Filled and/or flowing infrequently, generally only during and/or immediately after heavy precipitation.
Description:	SOURCE [DFDD].
	NOTE The waterbody is often vegetated (for example: with shrubs); such a streambed in the Southwestern United States is termed a 'derramadero'.
Value: ephemeral	
Definition:	Filled and/or flowing during and immediately after precipitation.
Description:	SOURCE [DFDD].
Value: intermittent	
Definition:	Filled and/or flowing for part of the year.
Description:	SOURCE [DFDD].
Value: perennial	
Definition:	Filled and/or flowing continuously throughout the year as its bed lies below the water table.
Description:	SOURCE [DFDD].

5.3.2.3.4 WaterLevelValue

WaterLevelValue	
Definition:	The tidal datum / waterlevel to which depths and heights are referenced.
Description:	SOURCE [Codelist values based on DFDD].
Status:	Proposed
Stereotypes:	«codeList»
Governance:	Centrally managed in INSPIRE code list register. URN: urn:x-inspire:def:codeList:INSPIRE:WaterLevelValue
Value: equinoctialSpringLowWater	
Definition:	The level of low water springs near the time of an equinox.
Description:	SOURCE [DFDD].
Value: higherHighWater	
Definition:	The highest of the high waters (or single high water) of any specified tidal day due to the declination A1 effects of the moon and sun.
Description:	SOURCE [DFDD].
Value: higherHighWaterLargeTide	
Definition:	The average of the highest high waters, one from each of 19 years of observations.
Description:	SOURCE [DFDD].
Value: highestAstronomicalTide	
Definition:	The highest tidal level, which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.
Description:	SOURCE [DFDD].
Value: highestHighWater	
Definition:	The highest water level observed at a location.
Description:	SOURCE [DFDD].
Value: highWater	
Definition:	The highest level reached at a location by the water surface in one tidal cycle.
Description:	SOURCE [DFDD].
	NOTE When used on inland waters it is generally defined as a level that the daily mean water level exceeds less than 5 percent of the time.
Value: highWaterSprings	
Definition:	An arbitrary level, approximating that of mean high water springs.
Description:	SOURCE [DFDD].
Value: indianSpringHighWater	
Definition:	A tidal surface datum approximating the level of the mean of the higher high water at spring tides.
Description:	SOURCE [DFDD].
	NOTE This tidal datum approximates the highest water level observed at a location and is usually above that of the higher high water at spring tides.
Value: indianSpringLowWater	
Definition:	A tidal surface datum approximating the level of the mean of the lower low water at spring tides.
Description:	SOURCE [DFDD].
	NOTE This tidal datum approximates the lowest water level observed at a location and is usually below that of the lower low water at spring tides.
Value: localDatum	
Definition:	An arbitrary datum defined by an authority of a local harbour, from which levels and tidal heights are measured by that authority.
Description:	SOURCE [DFDD].

WaterLevelValue

Value: lowerLowWater

Definition: The lowest of the low waters (or single low water) of any specified tidal day due to the declination A1 effects of the moon and sun.

Description: SOURCE [DFDD].

Value: lowerLowWaterLargeTide

Definition: The average of the lowest low waters, one from each of 19 years of observations.

Description: SOURCE [DFDD].

Value: lowestAstronomicalTide

Definition: The lowest tide level that can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.

Description: SOURCE [DFDD].

Value: lowestLowWater

Definition: An arbitrary level conforming to the lowest tide observed at a location, or somewhat lower.

Description: SOURCE [DFDD].

Value: lowestLowWaterSprings

Definition: An arbitrary level conforming to the lowest water level observed at a location at spring tides during a period shorter than 19 years.

Description: SOURCE [DFDD].

Value: lowWater

Definition: An approximation of mean low water adopted as the reference level for a limited region, irrespective of better determinations later.

Description: SOURCE [DFDD].

NOTE Used mostly in harbour and river engineering. Used in inland waters. It is generally defined as a level which the daily mean water level would fall below less than 5 percent of the time and by no more than 0.2 metres during the navigation season. A single level surface is usually chosen as the low water datum for a whole lake. On a river, low water datum is a sloping surface, which approximates the surface of the river at a low state.

Value: lowWaterDatum

Definition: An approximation of mean low water that has been adopted as a standard reference for a limited area.

Description: SOURCE [Based on DFDD].

NOTE 1 It is retained for an indefinite period regardless of the fact that it may differ slightly from a better determination of mean low water from a subsequent series of observations.

NOTE 2 Used primarily for river and harbor engineering purposes.

Value: lowWaterSprings

Definition: A level approximating that of mean low water springs.

Description: SOURCE [DFDD].

Value: meanHigherHighWater

Definition: The average height of higher high waters at a location over a 19-year period.

Description: SOURCE [DFDD].

Value: meanHigherHighWaterSprings

Definition: The average height of higher high water at spring tides at a location.

Description: SOURCE [DFDD].

Value: meanHigherLowWater

WaterLevelValue

Definition: The average of the higher low water height of each tidal day observed over a National Tidal Datum Epoch.

Description: SOURCE [DFDD].

NOTE For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.

Value: meanHighWater

Definition: The average height of all high waters at a location over a 19-year period.

Description: SOURCE [DFDD].

Value: meanHighWaterNeaps

Definition: The average height of the high waters of the neap tide.

Description: SOURCE [DFDD].

Value: meanHighWaterSprings

Definition: The average height of the high waters of spring tides.

Description: SOURCE [DFDD].

Value: meanLowerHighWater

Definition: The average of the lower high water height of each tidal day observed over a National Tidal Datum Epoch.

Description: SOURCE [DFDD].

NOTE For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.

Value: meanLowerLowWater

Definition: The average height of the lower low waters at a location over a 19-year period.

Description: SOURCE [DFDD].

Value: meanLowerLowWaterSprings

Definition: The average height of lower low water at spring tides at a location.

Description: SOURCE [DFDD].

Value: meanLowWater

Definition: The average height of all low waters at a location over a 19-year period.

Description: SOURCE [DFDD].

Value: meanLowWaterNeaps

Definition: The average height of the low waters of the neap tide.

Description: SOURCE [DFDD].

Value: meanLowWaterSprings

Definition: The average height of the low waters of spring tides.

Description: SOURCE [DFDD].

Value: meanSeaLevel

Definition: The average height of the sea at a tide station measured from a fixed predetermined reference level.

Description: SOURCE [DFDD].

NOTE Usually determined from hourly height readings, for all stages of the tide, over a 19-year period.

Value: meanTideLevel

Definition: The arithmetic mean of mean high water and mean low water.

Description: SOURCE [DFDD].

Value: meanWaterLevel

Definition: The average of all hourly water levels over the available period of record.

WaterLevelValue	
Description:	SOURCE [DFDD].
Value: nearlyHighestHighWater	
Definition:	An arbitrary level approximating the highest water level observed at a location, usually equivalent to the high water springs.
Description:	SOURCE [DFDD].
Value: nearlyLowestLowWater	
Definition:	A level approximating the lowest water level observed at a location, usually equivalent to Indian spring low water.
Description:	SOURCE [DFDD].
Value: tropicHigherHighWater	
Definition:	The highest of the high waters (or single high water) of the tides occurring semimonthly when the effect of the Moon's maximum declination is greatest.
Description:	SOURCE [DFDD].
NOTE At these times there is a tendency for an increase in the diurnal range.	
Value: tropicLowerLowWater	
Definition:	The lowest of the low waters (or single low water) of the tides occurring semimonthly when the effect of the Moon's maximum declination is greatest.
Description:	SOURCE [DFDD].
NOTE At these times there is a tendency for an increase in the diurnal range.	

5.3.2.4 Candidate types and placeholders

5.3.2.4.1 Embankment

Embankment	
Package:	Natural Risk Zones [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Definition:	A man-made raised long mound of earth or other material.
Description:	SOURCE [DFDD].
NOTE 1 Includes retaining walls, harbours, dikes.	
NOTE 2 Regarded as a candidate spatial object in Annex III theme 'Natural risk zones' due to its role in limiting flooding.	
Status:	Proposed
Stereotypes:	«featureType»

5.3.2.4.2 GlacierSnowfield

GlacierSnowfield	
Package:	Land Cover [Placeholder to be fully specified in Annex II INSPIRE data specification]
Definition:	A large mass or river of ice formed by accumulation and compaction of snow on higher ground that is moving slowly down a slope or valley form above the snowline (glacier) or a large area permanently covered by snow and/or ice (snow field and/or ice-field).
Description:	SOURCE [DFDD].
NOTE Regarded as a placeholder in Annex II theme 'Land cover' due its usual inclusion in land-cover classification schemes.	
Status:	Proposed
Stereotypes:	«placeholder,featureType»
Attribute: beginLifespanVersion	

GlacierSnowfield

Value type: DateTime
Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity: 1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime
Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity: 0..1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Surface
Definition: The geometry of the glacier/snowfield, as a surface.
Multiplicity: 1

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 1

5.3.2.4.3 HydroPowerPlant

HydroPowerPlant

Package: Energy Resources [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Definition: A facility for the generation of power from moving water.
Description: NOTE Regarded as a candidate spatial object in Annex III theme 'Energy resources' due to its primary energy-production role.
Status: Proposed
Stereotypes: «featureType»

5.3.2.4.4 InundatedLand

InundatedLand

Package: Natural Risk Zones [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Definition: A tract periodically covered by flood water, excluding tidal waters.
Description: SOURCE [DFDD].
NOTE 1 It may be caused by either uncontrolled inundation (for example: flooding due to a river overflowing its banks or low-lying regions accumulating standing water following severe rainfall) or controlled inundation (for example: flooded by the regulation of the level of a reservoir). [DFDD].
NOTE 2 Inundation for irrigation purposes is excluded.
NOTE 3 Regarded as a candidate spatial object in Annex III theme 'Natural risk zones' due to the relationship (by definition) with flooding.
Status: Proposed

InundatedLand

Stereotypes: «featureType»

Attribute: beginLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.

Multiplicity: 1

Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.

Multiplicity: 0..1

Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Surface

Definition: The geometry of the inundated land, as a surface.

Multiplicity: 1

Attribute: inspireId

Value type: Identifier

Definition: External object identifier of the spatial object.

Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.

Multiplicity: 1

Attribute: inundationReturnPeriod

Value type: Number

Definition: The average period (in years) between the occurrences of an inundation event.

Multiplicity: 1

Stereotypes: «voidable»

Attribute: inundationType

Value type: InundationValue

Definition: The type of a land subject to inundation based on the cause of its flooding.

Description: SOURCE [DFDD].

Multiplicity: 1

Stereotypes: «voidable»

5.3.2.4.5 InundationValue

InundationValue

Package: Natural Risk Zones [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Status: Proposed

Stereotypes: «codeList»

Governance: Centrally managed in INSPIRE code list register. URN: urn:x-inspire:def:codeList:INSPIRE:InundationValue

Value: controlled

Definition: A tract periodically flooded by the regulation of the level of water impounded by a dam.

Description: SOURCE [Based on DFDD].

Value: natural

InundationValue

Definition: A tract periodically covered by flood water, excluding tidal waters.

5.3.2.4.6 OceanRegion

OceanRegion

Package: Sea Regions [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: One of the three large regions of the world-wide ocean, each with associated sub- and marginal areas and subject to an independent flow-regime.

Description: SOURCE [DFDD].

NOTE Regarded as a candidate spatial object in Annex II theme 'Sea Regions' due to the close fit to the definition in 2007/2/EC Ann III. 16.

Status: Proposed

Stereotypes: «featureType»

Attribute: beginLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.

Multiplicity: 1

Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.

Multiplicity: 0..1

Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Surface

Definition: The geometry of the ocean region, as a surface.

Multiplicity: 0..1

Stereotypes: «voidable»

Attribute: inspireId

Value type: Identifier

Definition: External object identifier of the spatial object.

Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.

Multiplicity: 1

Association role: foreshore

Value type: Shore

Definition: The part of the shore or beach which lies between the low water mark and the upper limit of normal wave action.

Description: SOURCE [DFDD].

Multiplicity: 0..*

Stereotypes: «voidable»

5.3.2.4.7 Pipe

Pipe

Package: Utility and Governmental Services [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Pipe

Definition:	A tube for the conveyance of solids, liquids or gases.
Description:	NOTE Regarded as a candidate spatial object in Annex III theme 'Utility and governmental services' due to its role in water supply, which is mentioned in the definition 2007/2/EC Ann III. 6.
Status:	Proposed
Stereotypes:	«featureType»

5.3.2.4.8 PumpingStation

PumpingStation

Package:	Utility and Governmental Services [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Definition:	A facility to move solids, liquids or gases by means of pressure or suction.
Description:	SOURCE [EuroRegionalMap]. NOTE Regarded as a candidate spatial object in Annex III theme 'Utility and governmental services' due to its role in water supply/waste management/etc., which are mentioned in the definition 2007/2/EC Ann III. 6.
Status:	Proposed
Stereotypes:	«featureType»

5.3.2.4.9 Shore

Shore

Package:	LandCover [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Subtype of:	HydroObject
Definition:	The narrow strip of land in immediate contact with any body of water including the area between high and low water lines.
Description:	SOURCE [IHO S-32]. NOTE Regarded as a candidate spatial object in Annex II theme 'Land cover' due to unconsolidated shore inclusion in coastal land-cover classification schemes.
Status:	Proposed
Stereotypes:	«featureType»

Attribute: beginLifespanVersion

Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»

Attribute: composition

Value type:	ShoreTypeValue
Definition:	The primary type(s) of material composing a spatial object, exclusive of the surface.
Description:	SOURCE Adapted from [DFDD]. NOTE The basis for 'primary' may be, for example, compositional dominance or structural organization.
Multiplicity:	1
Stereotypes:	«voidable»

Attribute: delineationKnown

Shore

Value type: Boolean
Definition: An indication that the delineation (for example: limits and information) of a spatial object is known.
Description: SOURCE Adapted from [DFDD].
Multiplicity: 1
Stereotypes: «voidable»

Attribute: endLifespanVersion

Value type: DateTime
Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity: 0..1
Stereotypes: «voidable,lifeCycleInfo»

Attribute: geometry

Value type: GM_Surface
Definition: The geometry of the shore, as a surface.
Multiplicity: 1

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 1

Requirement 10 The attribute Shore.delineationKnown shall not be used to indicate that the accuracy / precision of a certain geometry is low; this indication should be given using the appropriate data quality element(s).

5.3.2.4.10 ShoreTypeValue

ShoreTypeValue

Package: LandCover [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Description: SOURCE [Codelist items based on DFDD].
Status: Proposed
Stereotypes: «codeList»
Governance: Centrally managed in INSPIRE code list register. URN: urn:x-inspire:def:codeList:INSPIRE:ShoreTypeValue

Value: boulders

Definition: Large water- or weather-worn stones.
Description: SOURCE [DFDD].

Value: clay

Definition: A stiff tenacious fine-grained earth consisting mainly of hydrated aluminosilicates, which become more plastic when water is added and can be moulded and dried.
Description: SOURCE [DFDD].

Value: gravel

Definition: Small water-worn or pounded stones.
Description: SOURCE [DFDD].

Value: mud

ShoreTypeValue

Definition:	Soft wet soil, sand, dust, and/or other earthy matter.
Description:	SOURCE [DFDD].
Value: rock	
Definition:	Stones of any size.
Description:	SOURCE [DFDD].
Value: sand	
Definition:	Granular material consisting of small eroded fragments of (mainly siliceous) rocks, finer than gravel and larger than a coarse silt grain.
Description:	SOURCE [DFDD].
Value: shingle	
Definition:	Small, loose, rounded waterworn pebbles, especially as accumulated on a seashore.
Description:	SOURCE [DFDD].
Value: stone	
Definition:	Pieces of rock or mineral substance (other than metal) of definite form and size, usually artificially shaped, and used for some special purpose.
Description:	SOURCE [DFDD].

5.3.2.4.11 SpringOrSeep

SpringOrSeep	
Package:	Geology [Placeholder to be fully specified in Annex II INSPIRE data specification]
Subtype of:	HydroPointOfInterest
Definition:	A natural outflow of water from below the ground surface.
Description:	NOTE 1 Corresponds to a 'source' node in a network view.
	NOTE 2 Regarded as a placeholder in Annex II theme 'Geology' due to the connection with groundwater.

5.3.2.4.12 VanishingPoint

VanishingPoint	
Package:	Geology [Placeholder to be fully specified in Annex II INSPIRE data specification]
Definition:	Location where a watercourse disappears into the terrain or vanishes due to anthropization.
Description:	NOTE 1 Corresponds to an 'outlet' node in a network view.
	NOTE 2 Regarded as a placeholder in Annex II theme 'Geology' due to the connection with groundwater.

5.3.2.4.13 Wetland

Wetland	
Package:	LandCover [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Definition:	A poorly drained or periodically flooded area where the soil is saturated with water, and vegetation is supported.

Wetland

Description: SOURCE [EuroRegionalMap].

EXAMPLE Marsh/swamp, bog/moor.

NOTE Regarded as a candidate spatial object in Annex II theme 'Land cover' due to explicit mention in 2007/2/EC Ann. II 2.

Status: Proposed

Stereotypes: «featureType»

Attribute: geometry

Value type: GM_Surface

Definition: The geometry of the wetland, as a surface.

Multiplicity: 1

Attribute: inspireId

Value type: Identifier

Definition: External object identifier of the spatial object.

Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.

Multiplicity: 1

Attribute: localType

Value type: LocalisedCharacterString

Definition: Provides 'local' name for the type of wetland.

Description: EXAMPLE Bog, swamp.

Multiplicity: 0..1

Stereotypes: «voidable»

Attribute: tidal

Value type: Boolean

Definition: Identifies whether the wetland is affected by tidal water.

Multiplicity: 1

Stereotypes: «voidable»

Attribute: beginLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.

Multiplicity: 1

Stereotypes: «voidable,lifeCycleInfo»

Attribute: endLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.

Multiplicity: 0..1

Stereotypes: «voidable,lifeCycleInfo»

5.3.2.5 Imported types

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

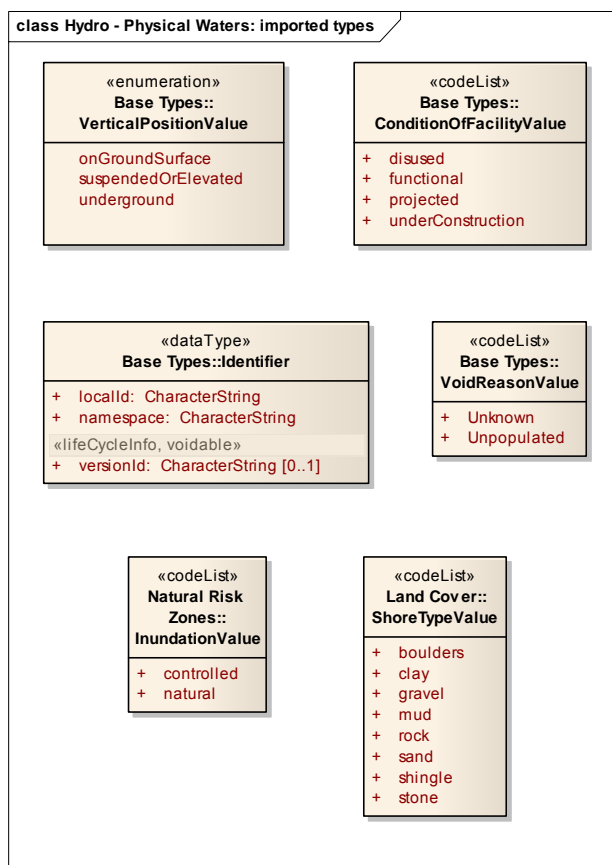


Figure 12 – UML class diagram: ‘Physical Waters’ additional imported types

5.3.2.6 Imported Types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.3.2.6.1 Boolean

Boolean	
Package:	Truth [see ISO/TS 19103]
Definition:	Most valuable in the predicate calculus, where items are either True or False, unless they are ill formed.

5.3.2.6.2 ConditionOfFacilityValue

ConditionOfFacilityValue	
Package:	Base Types [see DS-D2.5]
Definition:	The status of a facility with regards to its completion and use.

5.3.2.6.3 HydroObject

HydroObject (abstract)	
Package:	Hydro - base [See section 5.2.2.1.1]
Definition:	An identity base for hydrographic (including man-made) objects in the real world.

HydroObject (abstract)

Description: NOTE Derived 'views' of real-world hydrographic objects are represented through specialisations in other application schemas; all representations of the same real-world object share a common geographic name or hydrographic identifier.

5.3.2.6.4 Identifier

Identifier

Package: Base Types [see DS-D2.5]
 Definition: Unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object.
 Description: NOTE1 External object identifiers are distinct from thematic object identifiers.

 NOTE 2 The voidable version identifier attribute is not part of the unique identifier of a spatial object and may be used to distinguish two versions of the same spatial object.

 NOTE 3 The unique identifier will not change during the life-time of a spatial object.

5.3.2.6.5 VerticalPositionValue

VerticalPositionValue

Package: Base Types [see DS-D2.5]
 Definition: The relative vertical position of a spatial object.

5.4 Application schema 'Hydro – Network'

5.4.1 Description

5.4.1.1 Narrative description

For modelling, additional information (e.g. closed network, certain attributes) is needed that is not necessarily needed for a background map. This additional information, as well as the network model itself, is therefore contained in a separate application schema that can be regarded as an extension to the physical waters. If only a network model is available at the data provider, it is possible to describe the network without directly referring to physical objects. For this reason, spatial objects in both the network model and the physical waters application schemas contain their own geometries.



Figure 13 - Elements of the network model

5.4.1.2 UML Overview

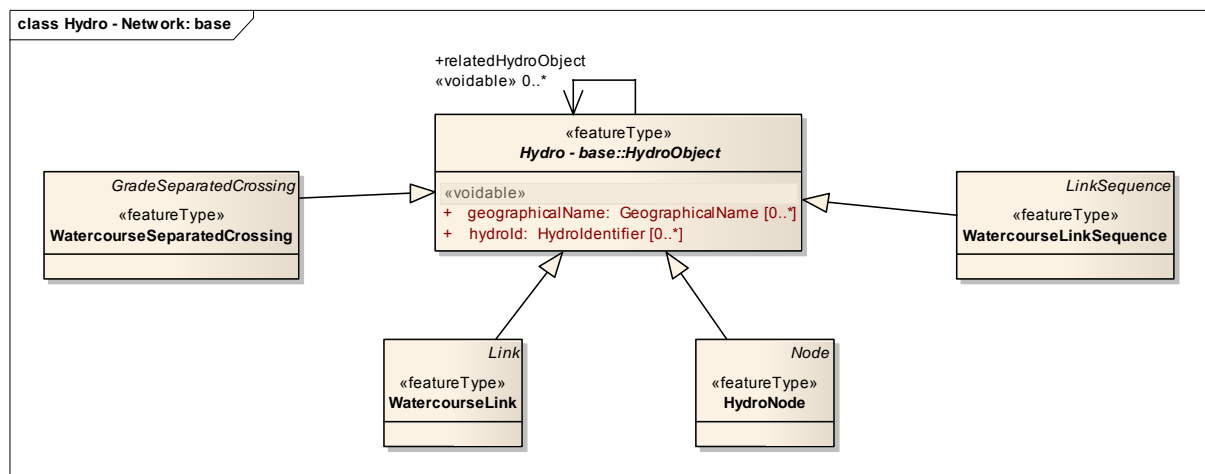


Figure 14 – UML class diagram: Overview of the 'Hydro – Network' application schema

The Network application schema presents a network view of hydrographic elements, with real-world features modelled as links and nodes. It is based on the Generic Network Model (GNM) defined in the INSPIRE Generic Conceptual Model. The 'Hydro – Network' application schema specialises the GNM by providing four hydrography-specific spatial object types:

- **WatercourseLink** and **HydroNode**: these provide the core links and nodes in a network view
- **WatercourseLinkSequence**: for identifying an aggregated sequence of connected links
- **WatercourseSeparatedCrossing**: for non-interacting link crossings (e.g. an aqueduct passing over a canal)

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 45

In addition to these specialised hydrography spatial objects, a number of concrete classes from the Generic Network Model are imported and available to be used (Figure 17):

- Network: a collection of network elements
- CrossReference: for cross-referencing elements in the same network
- NetworkConnection: a logical connection between elements in different networks

Hydrographic network elements have minimal attribution, and it is for user applications to extend the model as necessary. Attribution in the GNM is based on linear referencing, with the following types available to facilitate this (Figure 17):

- SimplePointReference: a datatype indicating a specific location along a network link or link sequence
- SimpleLinearReference: a datatype indicating a segment of the network between two locations along a network link or link sequence
- NetworkProperty: an abstract spatial object type representing a real-world phenomena located at or along a network element

5.4.1.3 Consistency between spatial data sets

Besides the requirements and / or recommendations stated for the base application scheme the following applies to this application schema.

The GNM provides a simple cross-referencing system to establish cross-border connections between hydrographic networks. In practice, this is done by linking a hydrographic network element in a data set on one side of the border and the connected or corresponding network element in a data set on the other side of the border to a Network Connection object which has been qualified as cross-border connected (when the linked network elements connect to each other) or as cross-border identical (when the linked network elements are representations in each data set of the same real world object). The Network Connection class is defined in the GNM.

For *Hydrography* the use of a Network Connection to establish cross-border connectivity is mandatory. Furthermore, it is recommended that the respective authorities seek to fully resolve the positional alignment of **all** connected elements of hydrographic networks in accordance to the rules for network connectivity outlined in section 7.2.3 (Topological consistency).

Requirement 11 Connectivity between hydrographic networks across state borders and – where applicable – also across regional borders (and data sets) within Member States shall be established and maintained by the respective authorities, using the cross-border connectivity mechanisms provided by the NetworkConnection type.

5.4.1.4 Identifier management

No additional requirements and / or recommendations are required beyond those stated for the base application scheme.

5.4.1.5 Modelling of object references

Besides the requirements and / or recommendations stated for the base application scheme the following applies to this application schema.

Linear referencing should be adopted to support the location of changes in condition or other phenomena along a link or link sequence where there is no requirement to disturb the link and node structure.

Linear referencing is used to position phenomena along a linear object, using a distance from the beginning of the linear object. Some systems disconnect the linear reference from the geometry of the linear object in the dataset, adding a calibrated linear coordinate to the object, corresponding to the distance measured along the real world object or interpolated between fixed marker posts (which themselves may not be exactly located at the distance they indicate).

For hydrographic Networks, all supplied linear references will use the distance along the geometry of the linear object in the database.

Requirement 12 When linear referencing is used in hydrographic Network data, the position of referenced properties on links and link sequences shall be expressed as distances measured along the supplied geometry of the underlying link object(s).

5.4.1.6 Geometry representation

Besides the requirements and / or recommendations stated for the base application scheme the following applies to this application schema.

The geometric basis of a hydrographic network consists of a number of **connected** linear elements (Watercourse Links) with optional point elements (Watercourse Nodes) at the ends of the lines (at sources, boundaries, etc).

Section 7.2.3 (Topological consistency) contains the necessary rules for ensuring connectivity within hydrographic networks. Connections between hydrographic networks are established by using the cross-border connection mechanisms present in the GNM and further explained in sections 5.4.1.3 (Consistency between spatial data sets) and 5.4.2.3 (Imported types (informative)).

Requirement 13 Watercourse links shall intersect wherever a connection exists between the real world phenomena they represent. No intersections shall be created at crossing network elements when it is not possible for water to pass from one element to another.

NOTE: Grade separated crossings can be modelled using the WatercourseSeparatedCrossing (derived from the GNM GradeSeparatedCrossing class). This class enables the ordered linking of two (Watercourse) Links. In this ordered relationship, the first Link is always the lower of the two.

Recommendation 12 In hydrographic network data, Watercourse Nodes should be present wherever Watercourse Links connect or end with the potential exception of discharges / abstractions from the network – See Annex B for more background.

If a hydrographic network data set contains nodes, they can only occur where a connection exists between two Watercourse Links or where a Watercourse Link ends (end or dangle node). Nodes shall not occur where two links cross but not intersect, for instance at grade separated crossings.

Requirement 14 In a hydrographic network data set which contains nodes, these nodes shall only be present where Watercourse Links connect or end.

The individual Watercourse Links can be combined to form Watercourse Link Sequences, derived from the mechanism provided by the GNM. As an ordered sequence of Watercourse Links, Watercourse Link Sequences have no geometry of their own. Their position is defined by the comprised Watercourse Links.

5.4.1.7 Temporality representation

No additional requirements and / or recommendations are required beyond those stated for the base application scheme.

5.4.2 Feature catalogue

Table 7 – Feature catalogue metadata

Feature catalogue name	INSPIRE feature catalogue <i>Hydrography</i>
Scope	<i>Hydrography – Network</i>
Version number	3.0
Version date	2009-09-07
Definition source	INSPIRE Data specification <i>Hydrography</i>

Table 8 – Types defined in the feature catalogue

Type	Package	Stereotypes	Section
HydroNode	Hydro - Network	«featureType»	5.4.2.1.1
HydroNodeCategoryValue	Hydro - Network	«codeList»	5.4.2.2.1
WatercourseLink	Hydro - Network	«featureType»	5.4.2.1.2
WatercourseLinkSequence	Hydro - Network	«featureType»	5.4.2.1.3
WatercourseSeparatedCrossing	Hydro - Network	«featureType»	5.4.2.1.4

5.4.2.1 Spatial object types

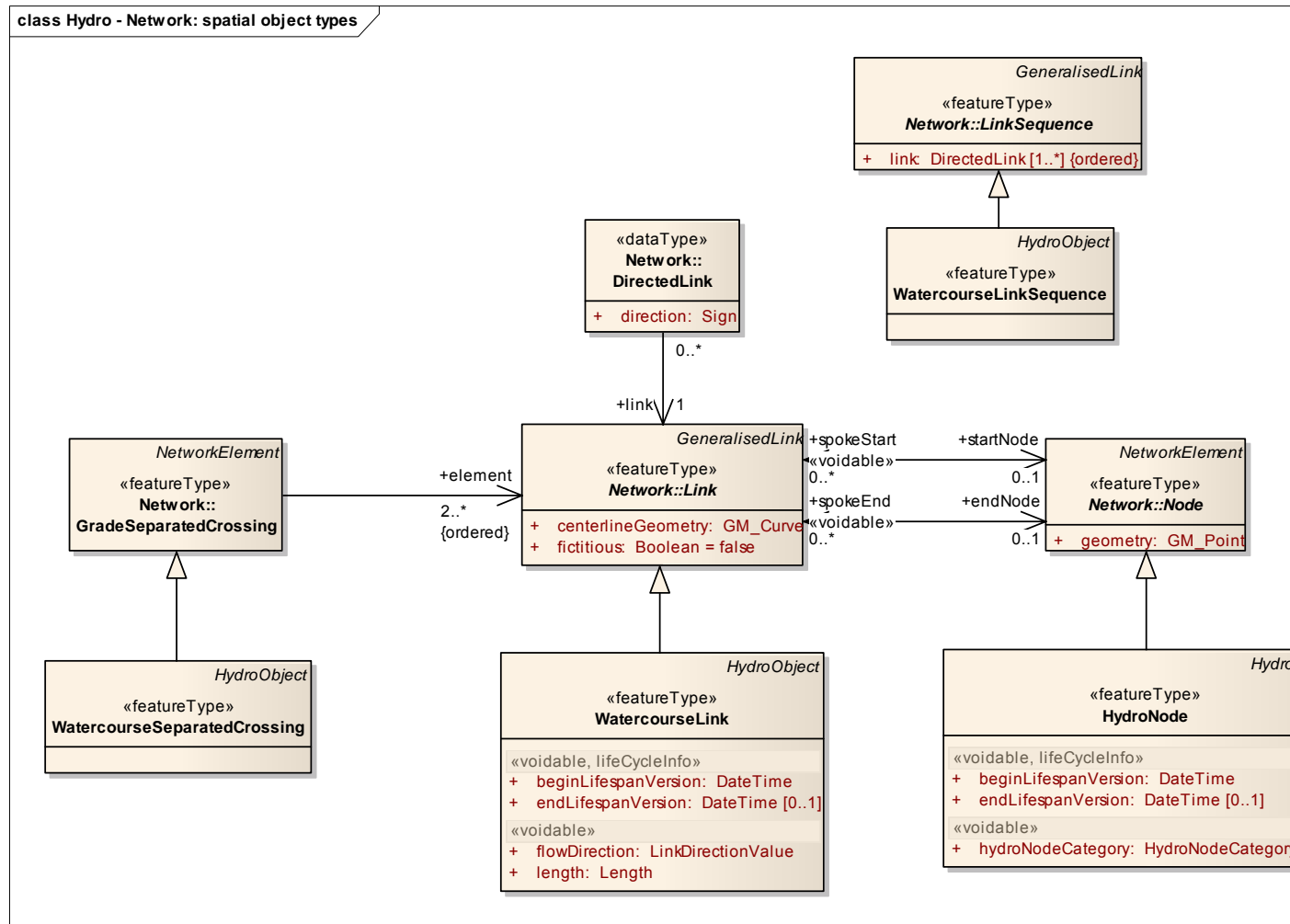


Figure 15 – UML class diagram: 'Hydro – Network' spatial object types

5.4.2.1.1 *HydroNode*

HydroNode	
Subtype of:	Node, HydroObject
Definition:	A node within the hydrographic network.
Description:	NOTE May represent a physical confluence, bifurcation/confluence/vanishing point etc, or it may be associated with a hydrographic point of interest or facility.
Status:	Proposed
Stereotypes:	«featureType»
Attribute: beginLifespanVersion	
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»
Attribute: endLifespanVersion	
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity:	0..1
Stereotypes:	«voidable,lifeCycleInfo»
Attribute: hydroNodeCategory	
Value type:	HydroNodeCategoryValue
Definition:	Nature of the hydro node.
Multiplicity:	1
Stereotypes:	«voidable»

5.4.2.1.2 *WatercourseLink*

WatercourseLink	
Subtype of:	HydroObject, Link
Definition:	A segment of a watercourse within a hydrographic network.
Description:	NOTE A watercourse link may be fictitious, with no direct correspondence to a real-world object and included only to ensure a closed network. EXAMPLE Fictitious examples: - virtual network segment in coastal water area - virtual network segment in lake area - virtual network segment in river to connect tributary - virtual network segment in transitional water area
Status:	Proposed
Stereotypes:	«featureType»
Attribute: beginLifespanVersion	
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»
Attribute: endLifespanVersion	
Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Multiplicity:	0..1
Stereotypes:	«voidable,lifeCycleInfo»

WatercourseLink

Attribute: flowDirection

Value type:	LinkDirectionValue
Definition:	Direction of water flow in the segment relative to digitisation of segment geometry.
Multiplicity:	1
Stereotypes:	«voidable»

Attribute: length

Value type:	Length
Definition:	Length of network segment.
Multiplicity:	1
Stereotypes:	«voidable»

5.4.2.1.3 WatercourseLinkSequence

WatercourseLinkSequence

Subtype of:	LinkSequence, HydroObject
Definition:	A sequence of watercourse links representing a non-branching path through a hydrographic network.
Status:	Proposed
Stereotypes:	«featureType»

5.4.2.1.4 WatercourseSeparatedCrossing

WatercourseSeparatedCrossing

Subtype of:	GradeSeparatedCrossing, HydroObject
Definition:	An element in the hydrographic network used to indicate non-interacting crossing of watercourse links separated by level.
Description:	NOTE The crossing may legitimately break a no-intersection quality rule.
Status:	Proposed
Stereotypes:	«featureType»

5.4.2.2 Enumerations and code lists

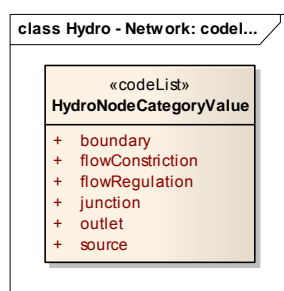


Figure 16 – UML class diagram: ‘Hydro – Network’ enumerations and code lists

5.4.2.2.1 HydroNodeCategoryValue

HydroNodeCategoryValue

Definition:	Defines categories for different types of hydrographic network nodes.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	Centrally managed in INSPIRE code list register. URN: urn:x-inspire:def:codeList:INSPIRE:HydroNodeCategoryValue

Value: boundary

Definition:	Node used to connect different networks.
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HydroNodeCategoryValue

Description:	NOTE Can be used to connect cross border networks or adjacent networks together. Differs from source / outlet in that in the real world there is an adjacent link that is not present in the dataset supplied.
Value: flowConstriction	
Definition:	A network node unrelated to the network topology per se, but associated with a hydrographic point of interest or facility, or a man-made object, that affects the network flow.
Description:	NOTE May include dams, widenings and other obstructions in the watercourse.
Value: flowRegulation	
Definition:	A network node unrelated to the network topology per se, but associated with a hydrographic point of interest or facility, or a man-made object, that regulates the network flow.
Description:	NOTE May include weirs, pumping stations and hydro power plants as well as abstraction and discharge into / from the watercourse.
Value: junction	
Definition:	Node where three or more links are coincident.
Description:	NOTE Includes all nodes at which different watercourses or watercourse branches merge into one (confluence) and where watercourses fork and divide (bifurcations).
Value: outlet	
Definition:	Ending node of a series of interconnected links.
Description:	NOTE Does not have an downstream output link. Includes sinks and watercourse mouths.
Value: source	
Definition:	Starting node of a series of interconnected links.
Description:	NOTE Does not have an upstream input link. Includes springs and seeps.

5.4.2.3 Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

Specifically, this section lists types imported from the Generic Network Model defined in the INSPIRE Generic Conceptual Model.

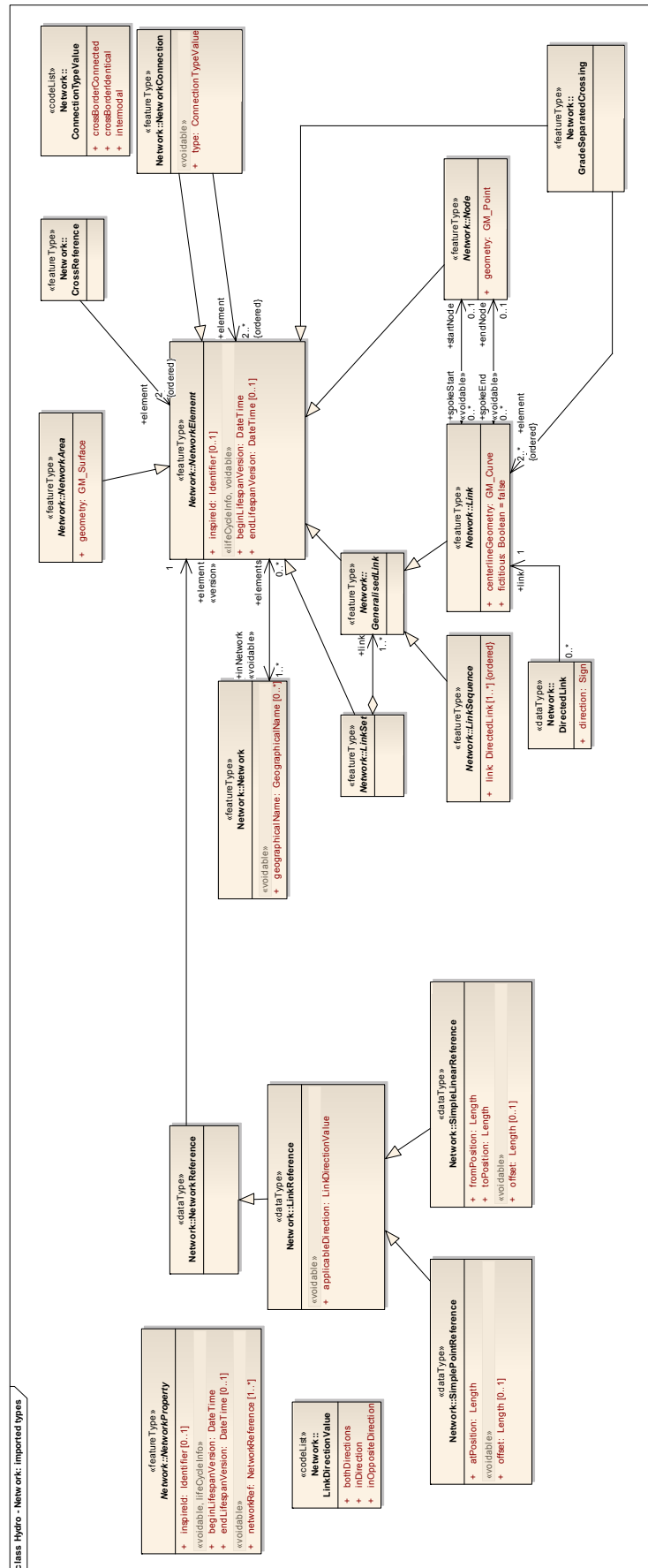


Figure 17 – UML class diagram: 'Generic Network Model'

5.4.2.3.1 *GradeSeparatedCrossing*

GradeSeparatedCrossing

Package:	Network [see DS-D2.5]
Definition:	Indicator which of two or more intersecting elements is/are above and which is/are below, to be used if elevation coordinates are not present or cannot be trusted.
Description:	NOTE 1 In most cases, the number of elements will be two. NOTE 2 In the normal case this is when elements intersect in the x/y-plane when the z coordinate is not present or is not accurate enough.

5.4.2.3.2 *HydroObject*

HydroObject (abstract)

Package:	Hydro - base [see section 5.2.2.1.1]
Definition:	An identity base for hydrographic (including man-made) objects in the real world.
Description:	NOTE Derived 'views' of real-world hydrographic objects are represented through specialisations in other application schemas; all representations of the same real-world object share a common geographic name or hydrographic identifier.

5.4.2.3.3 *Link*

Link (abstract)

Package:	Network [see DS-D2.5]
Definition:	Curvilinear network element that connects two positions and represents a homogeneous path in the network. The connected positions may be represented as nodes.

5.4.2.3.4 *LinkDirectionValue*

LinkDirectionValue

Package:	Network [see DS-D2.5]
Definition:	List of values for directions relative to a link

5.4.2.3.5 *LinkSequence*

LinkSequence (abstract)

Package:	Network [see DS-D2.5]
Definition:	A network element which represents a continuous path in the network without any branches. The element has a defined beginning and end and every position on the link sequence is identifiable with one single parameter such as length.
Description:	EXAMPLE A link sequence may represent a route.

5.4.2.3.6 *Node*

Node (abstract)

Package:	Network [see DS-D2.5]
Definition:	Represents a significant position in the network that always occurs at the beginning or the end of a link.
Description:	NOTE if a topological representation of the network is used the road node is either a topological connection between two or more links or the termination of a link. If a geometric representation of the network is used road nodes are represented by points or alternatively another geometric shape. [EuroRoadS]

5.5 Application schema 'Hydro – Reporting'

5.5.1 Description

5.5.1.1 Narrative description

Reporting units are not part of the Annex I theme *Hydrography* but belong in Annex III, *Area management/restriction/regulation zones and reporting units*. Since there is an important relation between the physical waters and water related reporting units, certain reporting units were included because of the strong relation between the objects. Strong relations are defined by fully identical geometries within both themes *Hydrography* and *Area management/restriction/regulation zones and reporting units*, e.g. a part of a river serves directly the geometry for a river water body in terms of WFD.

Reporting units that are only related on an attributive basis or partly identical geometry to the hydrographic geometries (not strong related, e.g. restricted areas around drinking water sources) will not be covered by the *Hydrography* data specification. This issue will remain open for Annex II and III. As a result of the above only the water bodies for the WFD have been included in this data specification.

Recommendation 13 Reports using one or more of the feature classes as defined in this data specification should be extended from this specification without any alteration of this specification.

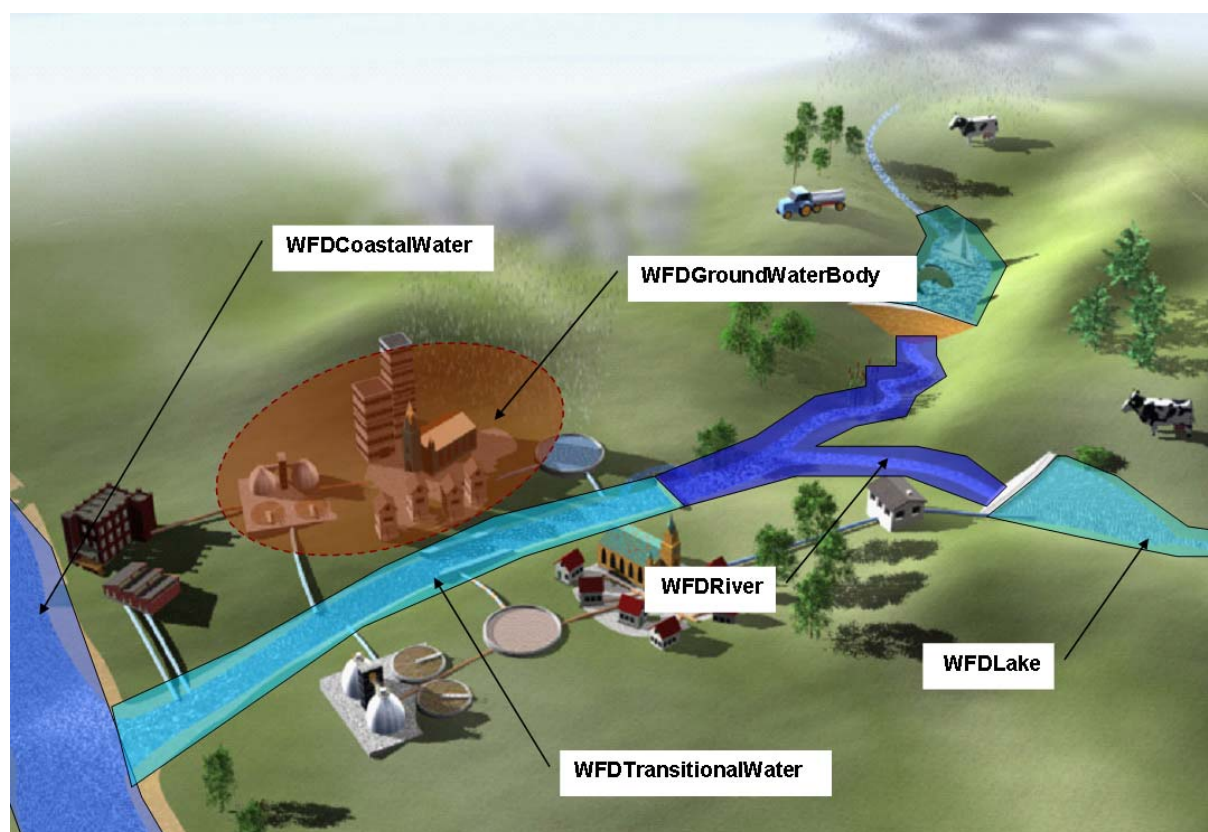


Figure 18 - Elements of reporting

5.5.1.2 UML Overview

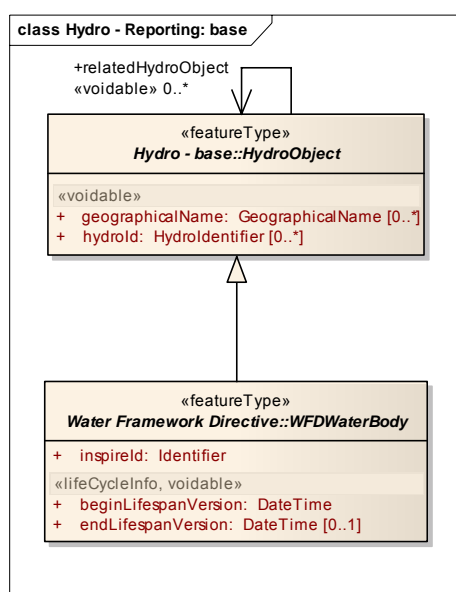


Figure 19 – UML class diagram: Overview of the ‘Hydro – Reporting’ application schema base

While the Reporting application schema is defined in Annex III theme ‘Area management/restriction/regulation zones and reporting units’, the only spatial object types with preliminary specifications arising from Annex I specification development are those concerning the Water Framework Directive (WFD, 2000/60/EC). These have been developed as part of the Hydrography specification development work, and are based (as with other Hydrography application schemas) on the base abstract HydroObject spatial object type (Figure 19). This provides the important ability to relate WFD reporting objects to related hydrographic objects in other application schemas (mapping or network views), using the mechanism described in 5.2.1.1. Thus a WFDRiver may be related to a mapped Watercourse, or a WatercourseLink in a network model through a shared geographic name or hydrographic identifier.

The base WFD class WFDWaterBody is the base for a number of concrete derived WFD reporting spatial object types:

- WFDGroundWaterBody: for WFD groundwater bodies
- WFDCoastalWater: for WFD coastal water bodies
- WFDTransitionalWater: for WFD transitional waters
- WFDRiver: for WFD rivers
- WFDLake: for WFD lakes

5.5.1.3 Consistency between spatial data sets

Besides the requirements and / or recommendations stated for the base application scheme the following applies to this application schema.

The Reporting schema provides a framework for water related reporting (more specifically the Water Framework Directive). European water reporting is expected to extend specific reporting obligation formats from this application scheme. Therefore there must be compatibility with information reported under these directives (specifically the Water Framework Directive [2000/60/EC]).

Requirement 15	All attribution of objects in this schema shall be the same as the equivalent property of that object used for reporting obligations under Directive [2000/60/EC].
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5.5.1.4 Identifier management

Besides the requirements and / or recommendations stated for the base application scheme the following applies to this application schema.

Requirement 16 The localId attribute of the external object identifier of a spatial object shall be the same as the ID used for reporting obligations under the Water Framework Directive [2000/60/EC].

5.5.1.5 Modelling of object references

No additional requirements and / or recommendations are required beyond those stated for the base application scheme.

5.5.1.6 Geometry representation

Besides the requirements and / or recommendations stated for the base application scheme the following applies to this application schema.

Requirement 17 The geometry shall be the same as the geometry used for reporting obligations under the Water Framework Directive [2000/60/EC]

5.5.1.7 Temporality representation

No additional requirements and / or recommendations are required over and on top of those stated for the base application scheme.

5.5.2 Feature catalogue

Table 9 – Feature catalogue metadata

Feature catalogue name	INSPIRE feature catalogue <i>Hydrography</i>
Scope	<i>Hydrography – Reporting</i>
Version number	3.0.1
Version date	2010-04-26
Definition source	INSPIRE Data specification <i>Hydrography</i>

Table 10 – Types defined in the feature catalogue

Type	Package	Stereotypes	Section
WFDCoastalWater	Water Framework Directive	«featureType»	5.5.2.1.1
WFDGroundWaterBody	Water Framework Directive	«featureType»	5.5.2.1.2
WFDLake	Water Framework Directive	«featureType»	5.5.2.1.3
WFDRiver	Water Framework Directive	«featureType»	5.5.2.1.4
WFDRiverOrLake	Water Framework Directive	«featureType»	5.5.2.1.5
WFDSurfaceWaterBody	Water Framework Directive	«featureType»	5.5.2.1.6
WFDTransitionalWater	Water Framework Directive	«featureType»	5.5.2.1.7
WFDWaterBody	Water Framework Directive	«featureType»	5.5.2.1.8

Note that no types are defined in the 'Hydro – Reporting' application schema beyond the candidate types from the WFD package of the Annex III theme 'Area management/restriction/regulation zones and reporting units'.

5.5.2.1 Candidate types and placeholders

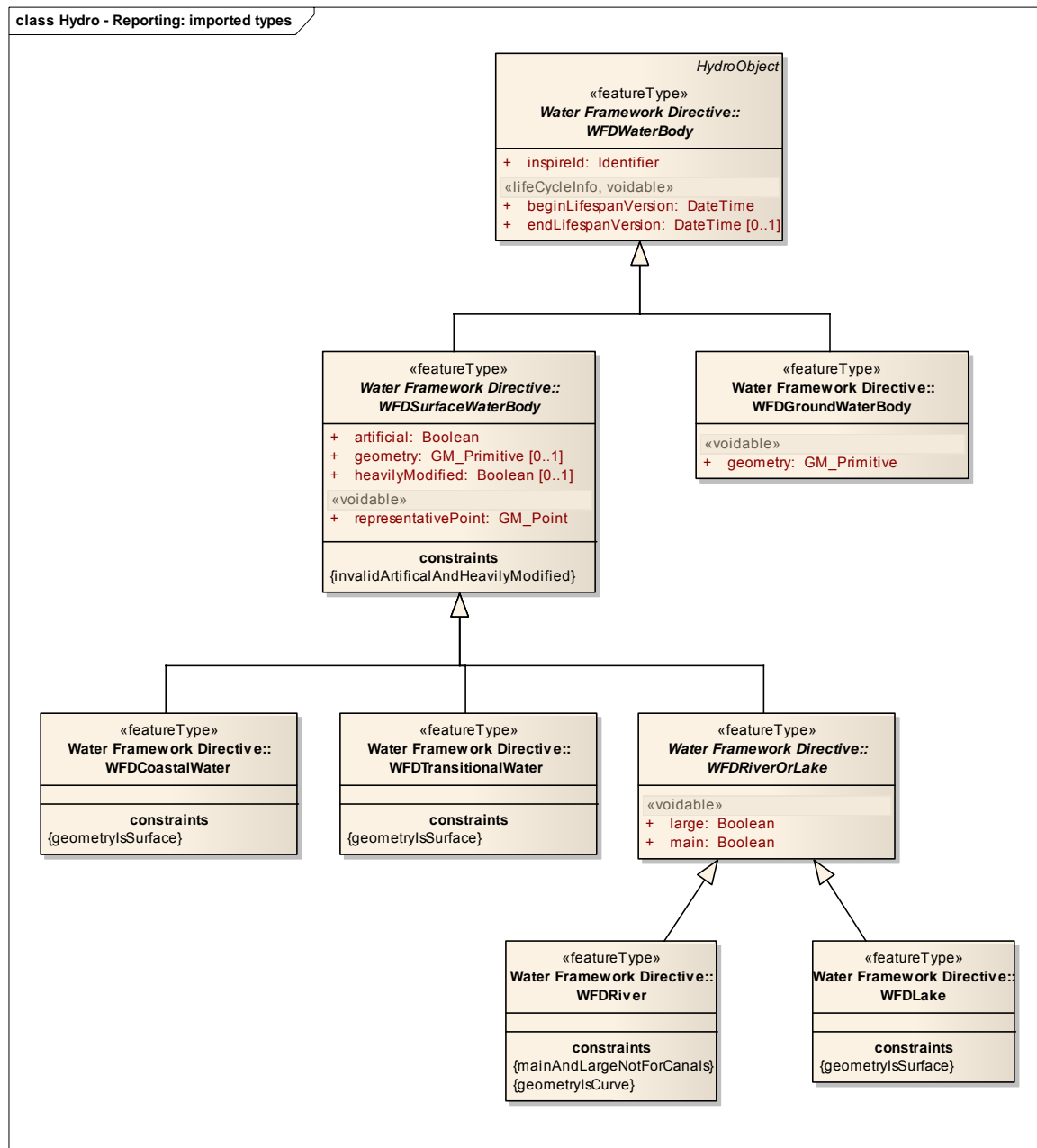


Figure 20 – UML class diagram: Annex III ‘Water Framework Directive’ application schema spatial object types

5.5.2.1.1 WFDCoastalWater

WFDCoastalWater	
Package:	Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]
Definition:	Surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.

WFDCoastalWater

Description: SOURCE [2000/60/EC Art. 2(7)].

NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Constraint: geometryIsSurface

Natural language: Coastal water geometry must be a surface

OCL: inv: self->count(geometry)=1 and self.geometry.ocIsTypeOf(GM_Surface)

5.5.2.1.2 WFDGroundWaterBody

WFDGroundWaterBody

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: A distinct volume of groundwater within an aquifer or aquifers.

Description: SOURCE [2000/60/EC Art. 2(12)].

NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Attribute: geometry

Value type: GM_Primitive

Definition: The geometry of the WFDGroundWaterBody.

Multiplicity: 1

Stereotypes: «voidable»

5.5.2.1.3 WFDLake

WFDLake

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: A body of standing inland surface water.

Description: SOURCE [2000/60/EC Art. 2(5)].

NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Constraint: geometryIsSurface

Natural language: Lake geometry must be a surface

OCL: inv: self->count(geometry)=1 and self.geometry.ocIsTypeOf(GM_Surface)

5.5.2.1.4 WFDRiver

WFDRiver

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: A body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course.

WFDRiver

Description: SOURCE [2000/60/EC Art. 2(4)].

NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Constraint: geometryIsCurve

Natural River geometry must be a curve

language:

OCL: inv: self->count(geometry)=1 and self.geometry.ocIsTypeOf(GM_Curve)

Constraint: mainAndLargeNotForCanals

Natural Main and large attributes may not be specified for canals

language:

OCL: inv: if ((self.artificial = True) or (self.heavilyModified = True)) then ((self->count(main)=0) and (self->count(large)=0))

5.5.2.1.5 WFDRiverOrLake

WFDRiverOrLake (abstract)

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: Abstract class containing common attributes for WFD River or Lake.

Description: NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Attribute: large

Value type: Boolean

Definition: Rivers with a catchment area > 50,000 km²; or rivers and main tributaries that have a catchment area between 5,000 km² and 50,000 km². Lakes that have a surface area > 500 km².

Description: SOURCE [WISE GIS Guidance].

Multiplicity: 1

Stereotypes: «voidable»

Attribute: main

Value type: Boolean

Definition: Rivers that have a catchment area > 500 km². Lakes that have a surface area > 10 km².

Description: SOURCE [WISE GIS Guidance].

Multiplicity: 1

Stereotypes: «voidable»

5.5.2.1.6 WFDSurfaceWaterBody

WFDSurfaceWaterBody (abstract)

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: A discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.

WFDSurfaceWaterBody (abstract)

Description: SOURCE [2000/60/EC Art. 2(10)].

NOTE 1 The surface water bodies shall be identified as falling within either one of the following surface water categories - rivers, lakes, transitional waters or coastal waters - or as artificial surface water bodies or heavily modified surface water bodies. [2000/60/EC Ann. II 1.1(ii)]

NOTE 2 All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Attribute: artificial

Value type: Boolean

Definition: 'Artificial water body' means a body of surface water created by human activity.

Description: SOURCE [2000/60/EC Art. 2(8)].

Multiplicity: 1

Attribute: geometry

Value type: GM_Primitive

Definition: The geometry of the WFDSurfaceWaterBody: - a surface for a WFDCoastalWater; - a surface for a WFDTransitionalWater; - a curve for a WFDRiver; - a surface for a WFDLake.

Description: NOTE A 'representative point' may be supplied instead of the geometry.

Multiplicity: 0..1

Attribute: heavilyModified

Value type: Boolean

Definition: 'Heavily modified water body' means a body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of WFD Annex II.

Description: SOURCE [2000/60/EC Art. 2(9)].

Multiplicity: 0..1

Attribute: representativePoint

Value type: GM_Point

Definition: Representative point of the WFD waterbody.

Multiplicity: 1

Stereotypes: «voidable»

Constraint: invalidArtificialAndHeavilyModified

Natural language: heavilyModified attribute allowed only if not artificial

OCL: inv: if (self.artificial = True) then (self->count(heavilyModified)=0)

5.5.2.1.7 WFDTransitionalWater

WFDTransitionalWater

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: Bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows.

WFDTransitionalWater

Description: SOURCE [2000/60/EC Art. 2(6)].

NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Constraint: geometryIsSurface

Natural language: Transitional water geometry must be a surface

OCL: inv: self->count(geometry)=1 and self.geometry.ocIsTypeOf(GM_Surface)

5.5.2.1.8 WFDWaterBody

WFDWaterBody (abstract)

Package: Water Framework Directive [Candidate type that might be extended in Annex II/III INSPIRE data specification]

Definition: Abstract class representing a WFD body of surface water or body of groundwater.

Description: NOTE All WFD spatial object types are regarded as candidate spatial objects in Annex III theme 'Area management/restriction/regulation zones and reporting units' due to their primary function for reporting under Directive 2000/60/EC.

Status: Proposed

Stereotypes: «featureType»

Attribute: beginLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was inserted or changed in the spatial data set.

Multiplicity: 1

Stereotypes: «lifeCycleInfo,voidable»

Attribute: endLifespanVersion

Value type: DateTime

Definition: Date and time at which this version of the spatial object was superseded or retired in the spatial data set.

Multiplicity: 0..1

Stereotypes: «lifeCycleInfo,voidable»

Attribute: inspireId

Value type: Identifier

Definition: External object identifier of the spatial object.

Description: NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.

Multiplicity: 1

5.5.2.2 Imported types

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.5.2.2.1 HydroObject

HydroObject (abstract)

HydroObject (abstract)

Package:	Hydro - base [see section 5.2]
Definition:	An identity base for hydrographic (including man-made) objects in the real world.
Description:	NOTE Derived 'views' of real-world hydrographic objects are represented through specialisations in other application schemas; all representations of the same real-world object share a common geographic name or hydrographic identifier.

5.5.2.2.2 Identifier

Identifier

Package:	Base Types [see DS-D2.5]
Definition:	Unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object.
Description:	NOTE1 External object identifiers are distinct from thematic object identifiers. NOTE 2 The voidable version identifier attribute is not part of the unique identifier of a spatial object and may be used to distinguish two versions of the same spatial object. NOTE 3 The unique identifier will not change during the life-time of a spatial object.

5.5.2.2.3 Boolean

Boolean

Package:	Truth [see ISO/TS 19103]
Definition:	Most valuable in the predicate calculus, where items are either True or False, unless they are ill formed.

6 Reference systems

6.1 Coordinate reference systems

6.1.1 Datum

Requirement 18	For the coordinate reference systems used for making available the INSPIRE spatial data sets, the datum shall be the datum of the European Terrestrial Reference System 1989 (ETRS89) in areas within its geographical scope, and the datum of the International Terrestrial Reference System (ITRS) or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. Compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well established and described relationship between both systems, according to EN ISO 19111.
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6.1.2 Coordinate reference systems

Requirement 19	INSPIRE spatial data sets shall be made available using one of the three-dimensional, two-dimensional or compound coordinate reference systems specified in the list below. Other coordinate reference systems than those listed below may only be used for regions outside of continental Europe. The geodetic codes and parameters for
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these coordinate reference systems shall be documented, and an identifier shall be created, according to EN ISO 19111 and ISO 19127.

1. Three-dimensional Coordinate Reference Systems
 - Three-dimensional Cartesian coordinates
 - Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height), using the parameters of the GRS80 ellipsoid
2. Two-dimensional Coordinate Reference Systems
 - Two-dimensional geodetic coordinates, using the parameters of the GRS80 ellipsoid
 - Plane coordinates using the Lambert Azimuthal Equal Area projection and the parameters of the GRS80 ellipsoid
 - Plane coordinates using the Lambert Conformal Conic projection and the parameters of the GRS80 ellipsoid
 - Plane coordinates using the Transverse Mercator projection and the parameters of the GRS80 ellipsoid
3. Compound Coordinate Reference Systems
 - For the horizontal component of the compound coordinate reference system, one of the two-dimensional coordinate reference systems specified above shall be used
 - For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope
 - Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS. The geodetic codes and parameters for these vertical reference systems shall be documented and an identifier shall be created, according to EN ISO 19111 and ISO 19127
 - For the vertical component measuring the depth of the sea floor, where there is an appreciable tidal range, the Lowest Astronomical Tide shall be used as reference surface. In marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 m, the depth of the sea floor shall be referenced to the Mean Sea Level
 - For the vertical component measuring depths above the sea floor in the free ocean, barometric pressure shall be used
 - For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere shall be used

6.1.3 Display

Requirement 20 For the display of the INSPIRE spatial data sets with the View Service specified in D003152/02 Draft Commission Regulation implementing Directive 2007/2/EC of the European Parliament and of the Council as regards Network Services, at least the two dimensional geodetic coordinate system shall be made available.

6.1.4 Identifiers for coordinate reference systems

Requirement 21 For referring to the non-compound coordinate reference systems listed in this Section, the identifiers listed below shall be used.

For referring to a compound coordinate reference system, an identifier composed of the identifier of the horizontal component, followed by a slash (/), followed by the identifier of the vertical component, shall be used.

- ETRS89-XYZ for Cartesian coordinates in ETRS89
- ETRS89-GRS80h for three-dimensional geodetic coordinates in ETRS89 on the GRS80 ellipsoid
- ETRS89-GRS80 for two-dimensional geodetic coordinates in ETRS89 on the GRS80
- EVRS for height in EVRS

- LAT for depth of the sea floor, where there is an appreciable tidal range
- MSL for depth of the sea floor, in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200m
- ISA for pressure coordinate in the free atmosphere
- PFO for Pressure coordinate in the free ocean
- ETRS89-LAEA for ETRS89 coordinates projected into plane coordinates by the Lambert Azimuthal Equal Area projection
- ETRS89-LCC for ETRS89 coordinates projected into plane coordinates by the Lambert Conformal Conic projection
- ETRS89-TMzn for ETRS89 coordinates projected into plane coordinates by the Transverse Mercator projection

6.2 Temporal reference system

Requirement 22 The Gregorian Calendar shall be used for as a reference system for date values, and the Universal Time Coordinated (UTC) or the local time including the time zone as an offset from UTC shall be used as a reference system for time values.

7 Data quality

This section includes a description of data quality elements and sub-elements as well as the associated basic data quality measures to be used to describe data related to the spatial data theme *Hydrography* (see Table 11).

NOTE Additional guidance documents on procedures and methods that can be used to implement the basic data quality measures introduced in this section will be provided at a later stage.

Data quality information can be described at the level of spatial object (feature), spatial object type (feature type), dataset or dataset series. Data quality information at spatial object level is modelled directly in the application schema (Chapter 5).

To ensure that a topologically-sound and closed hydrological network can be built, certain topological consistency rules need to be followed. If the hydrography dataset is going to be used to create a network (i.e. to do modelling and network analyses), it is recommended to follow the topological consistency measures described in this data specification. These measures can, of course, also be used to evaluate if a network in a dataset can be considered to be “clean” and closed. Table 11 describes the scope of the quality element, i.e. if the quality element ensures that a *network* can be built, or if it is used for *evaluation* only.

Recommendation 14 Aggregated data quality information should ideally be collected at the level of spatial object types and included in the dataset (series) metadata.

Chapter 8 describes the corresponding metadata elements to report about this data quality information.

Table 11 – List of all data quality elements used in the spatial data theme *Hydrography*

Section	Data quality element	Data quality sub-element	Scope(s)	Data quality scope
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7.1.1	Completeness	Commission	dataset series; dataset; spatial object type	evaluation
7.1.2	Completeness	Omission	dataset series; dataset; spatial object type	evaluation
7.2.1	Logical consistency	Conceptual consistency	dataset series; dataset; spatial object type	network
7.2.2	Logical consistency	Domain consistency	dataset series; dataset; spatial object type	evaluation
7.2.3	Logical consistency	Topological consistency	dataset series; dataset; spatial object type	network
7.3.1	Positional accuracy	Absolute or external accuracy	spatial object	evaluation
7.4.1	Thematic accuracy	Non-quantitative attribute correctness	dataset series; dataset; spatial object type	evaluation
7.4.2	Thematic accuracy	Quantitative attribute correctness	dataset series; dataset; spatial object type	evaluation

7.1 Completeness

This data quality element enables the assessment of the presence of features, their attributes and relationships

7.1.1 Commission

Commission should be documented using the rate of excess items.

Name	Rate of excess items
Alternative name	–
Data quality element	Completeness
Data quality sub-element	Commission
Data quality basic measure	Error rate
Definition	Number of excess items in the dataset in relation to the number of items that should have been present.
Description	–
Parameter	–
Data quality value type	Real, percentage, ratio
Data quality value structure	–
Source reference	–
Example	0,0189 ; 98,11% ; 11:582
Measure identifier	3 (ISO 19138)

7.1.2 Omission

Omission should be documented using the rate of missing items.

Name	Rate of missing items
Alternative name	–
Data quality element	Completeness
Data quality sub-element	Omission
Data quality basic measure	Error rate
Definition	Number of missing items in the dataset in relation to the number of items that should have been present.
Description	–
Parameter	–
Data quality value type	Real, percentage, ratio
Data quality value structure	–
Source reference	–
Example	0,0189 ; 98,11% ; 11:582
Measure identifier	7 (ISO 19138)

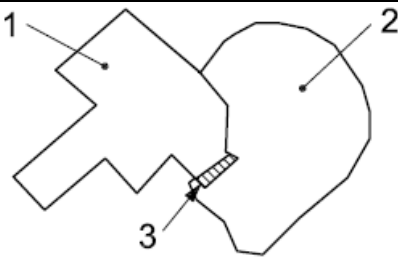
7.2 Logical Consistency

Logical consistency elements enable the assessment of the degree of adherence to logical rules of data structure, attribution and relationships

7.2.1 Conceptual consistency

Conceptual consistency should be documented using the number of invalid overlaps of surfaces.

Name	number of invalid overlaps of surfaces
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Alternative name	overlapping surfaces
Data quality element	logical consistency
Data quality sub-element	conceptual consistency
Data quality basic measure	error count
Definition	total number of erroneous overlaps within the data
Description	<p>Which surfaces may overlap and which shall not is application dependent. Not all overlapping surfaces are necessarily erroneous. When reporting this data quality measure, the types of feature classes corresponding to the illegal overlapping surfaces shall be reported as well.</p> <p>The following rules on how surfaces may not overlap applies to the INSPIRE Hydrography theme:</p> <ul style="list-style-type: none"> • DamOrWeir must not overlap between them and with SpringOrSeep, Rapids or Falls • SurfaceWater must not overlap between them and with OceanRegion, Watercourse or GlacierSnowfield. • GlacierSnowfield must not overlap between themselves and with OceanRegion, Watercourse or SurfaceWater • Wetland must not overlap between them and with OceanRegion, Watercourse, SurfaceWater, or GlacierSnowfield • Watercourse must not overlap between themselves and with OceanRegion, GlacierSnowfield or SurfaceWater.
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	 <p>Key 1 Surface 1 2 Surface 2 3 Overlapping Area</p>
Measure identifier	11 (ISO 19138)

7.2.2 Domain consistency

Domain consistency should be documented using the value domain conformance rate.

Name	value domain conformance rate
Alternative name	-
Data quality element	logical consistency
Data quality subelement	domain consistency
Data quality basic measure	correct items rate
Definition	number of items in the dataset that are in conformance with their value domain in relation to the total number of items in the dataset
Description	-
Parameter	-
Data quality value type	real, percentage, ratio
Data quality value structure	-
Source reference	-
Example	-

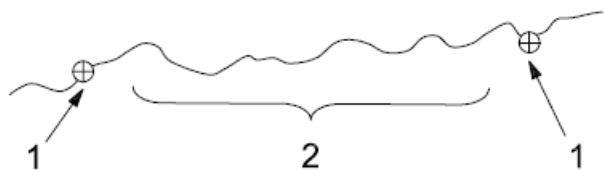
Measure identifier	17 (ISO 19138)
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7.2.3 Topological consistency

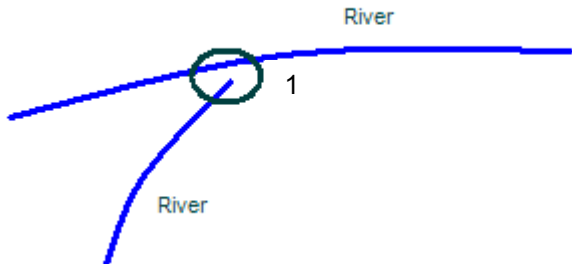

Topological consistency should be documented using:

- number of faulty point-curve connections
- number of missing connections due to undershoots
- number of missing connections due to crossing of bridge/road
- number of missing connections due to overshoots
- number of invalid self-intersect errors
- number of invalid self-overlap errors
- number of watercourse links below threshold length
- number of closed watercourse links
- number of multi-part watercourse links

These topological consistency quality sub-elements are recommended in order to build a “clean” and closed hydrological network.

Name	number of faulty point-curve connections
Alternative name	extraneous nodes
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	number of faulty point-curve connections in the dataset
Description	A point-curve connection exists where different curves touch. These curves have an intrinsic topological relationship that shall reflect the true constellation. If the point-curve connection contradicts the universe of discourse, the point-curve connection is faulty with respect to this data quality measure. The data quality measure counts the number of errors of this kind.
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	<p>Example: System automatically places point-curve based on vertices limitation built into software code where no spatial justification for point-curve exists</p>  <p>Key 1 Link-node 2 500 vertices limit</p>
Measure identifier	21 (ISO 19138)

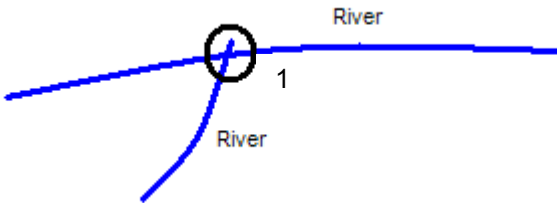
Name	number of missing connections due to undershoots
Alternative name	undershoots
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	Count of items in the dataset that are mismatched due to undershoots, given the parameter <i>Connectivity tolerance</i> .

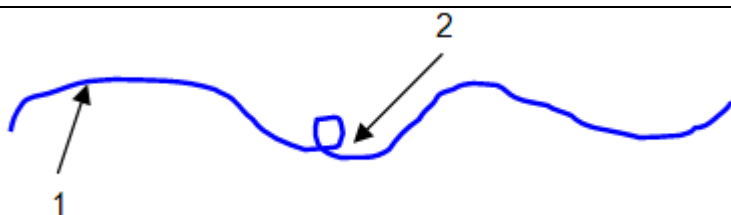
Description	Lacks of connectivity exceeding the <i>Connectivity tolerance</i> are considered as errors if the real features are connected in the hydrographic network.
Parameter	<ul style="list-style-type: none"> Name: <i>Connectivity tolerance</i> Definition: Search distance from the end of a dangling line. Description: This parameter is specific for each data provider's dataset and must be reported as metadata in order to ensure automatic and unambiguous creation of centreline topology – connectivity - for the hydrographic network. <p>Connectivity tolerance must be specified by the data provider using the following elements of the DQ_TopologicalConsistency metadata element for the current measure:</p> <ul style="list-style-type: none"> 102. measureDescription (type: free text): Defined as "<i>Description of the measure</i>". 107. Result (type DQ_Result): Defined as "<i>Value (or set of values) obtained from applying a data quality measure or the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level</i>". Specifically, the tolerance must be defined within the two elements: <ul style="list-style-type: none"> 130. specification 131. explanation from DQ_Result class. <p>Note: Metadata elements defined in ISO 19115.</p>
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example 1	 <p>Key 1 Connectivity tolerance = 3 m</p>
Example 2	<p>Watercourse links should be digitised so that nodes are snapped to nodes:</p>  <p>Watercourse links should not be disconnected but always meet another watercourse at a node. A common digitising error is to snap the end of a link to another link, but not to the node. These links are intersecting but they do not participate in the topology of the network.</p>

Measure identifier	23 (ISO 19138)
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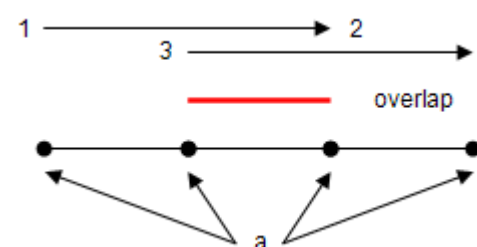
Name	number of missing connections due to crossing of bridge/road
Alternative name	
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	count of all river network items in the data that breaks due to the crossing of a road or a bridge
Description	-
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	There should not be any gaps/breaks in the network where bridges or roads cartographically 'break' the river. Where necessary these can be described as man-made objects and assigned to a node.
Measure identifier	-

Name	number of missing connections due to overshoots
Alternative name	overshoots
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	Count of items in the dataset that are mismatched due to overshoots, given the parameter <i>Connectivity tolerance</i> .
Description	Lacks of connectivity exceeding the <i>Connectivity tolerance</i> are considered as errors if the real features are connected in the hydrographic network.
Parameter	<ul style="list-style-type: none"> - Name: <i>Connectivity tolerance</i> - Definition: Search distance from the end of a dangling line. - Description: This parameter is specific for each data provider's dataset and must be reported as metadata in order to ensure automatic and unambiguous creation of centreline topology – connectivity - for the hydrographic network. <p>Connectivity tolerance must be specified by the data provider using the following elements of the DQ_TopologicalConsistency metadata element for the current measure:</p> <ul style="list-style-type: none"> - 102. measureDescription (type: free text): Defined as "<i>Description of the measure</i>". - 107. Result (type DQ_Result): Defined as "<i>Value (or set of values) obtained from applying a data quality measure or the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level</i>". Specifically, the tolerance must be defined within the two elements: <ul style="list-style-type: none"> - 130. specification - 131. explanation from DQ_Result class.

	Note: Metadata elements defined in ISO 19115.
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	 <p>Key 1 Connectivity tolerance = 3 m</p>
Measure identifier	24 (ISO 19138)

Name	number of invalid self-intersect errors
Alternative name	loops
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	count of all items in the data that illegally intersect with themselves
Description	-
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	 <p>Key 1 Watercourse 2 Illegal intersection (loop)</p>
Measure identifier	26 (ISO 19138)

Name	number of invalid self-overlap errors
Alternative name	kickbacks
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	count of all items in the data that illegally self overlap
Description	-
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-

Example 1	 <p>^a Vertices.</p>
Example 2	Links should not cross or occupy the same space of another link with the exception of the very rare occasion that a transfer channel crosses another channel and does not join.
Measure identifier	27 (ISO 19138)

Name	number of watercourse links below threshold length
Alternative name	-
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	Count of all watercourse link items in the data that are below the threshold length. The threshold length will vary depending on the level of detail: <ul style="list-style-type: none"> - Local – 1 m - Regional – 10 m - National – 100 m
Description	-
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	Links can occur as entries in the spatial dataset (FeatureClass) as a row in the table. An entry may have attributes associated to it but the polyline can be of zero length. To avoid this, Watercourse links must not be of zero length.
Measure identifier	-

Name	number of closed watercourse links
Alternative name	-
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	count of all watercourse link items in the data that are closed
Description	-
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	Watercourse links cannot be closed since a river flows from the source to the mouth. It may divide due to braiding or artificial side channels but a single link of channel does not loop. A line must not end where it started.
Measure identifier	-

Name	number of multi-part watercourse links
Alternative name	-
Data quality element	logical consistency
Data quality subelement	topological consistency
Data quality basic measure	error count
Definition	count of all watercourse link items in the data that are composed of multi-parts
Description	-
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	Links should be composed of single parts (must not be multi-part). Multi-part links are links composed of more than one link. They can appear to be connected but are invalid network elements
Measure identifier	-

7.3 Positional accuracy

7.3.1 Absolute or external accuracy

Absolute or external accuracy should be documented using the mean value of positional uncertainties.

Name	mean value of positional uncertainties (1D, 2D)
Alternative name	-
Data quality element	positional accuracy
Data quality subelement	absolute or external accuracy
Data quality basic measure	not applicable
Definition	mean value of the positional uncertainties for a set of positions where the positional uncertainties are defined as the distance between a measured position and what is considered as the corresponding true position
Description	See ISO 19138
Parameter	-
Data quality value type	measure
Data quality value structure	-
Source reference	-
Example	-
Measure identifier	28 (ISO 19138)

7.3.2 Relative or internal accuracy

Relative or internal accuracy should be documented using the relative horizontal error.

Name	relative horizontal error
Alternative name	Rel CE90
Data quality element	positional accuracy
Data quality subelement	relative or internal accuracy
Data quality basic measure	not applicable
Definition	evaluation of the random errors in the horizontal position of one feature to another in the same dataset or on the same map/chart
Description	see ISO 19138
Parameter	n = sample size

Data quality value type	measure
Data quality value structure	-
Source reference	Mapping, Charting and Geodesy Accuracy (Reference [5])
Example	-
Measure identifier	53 (ISO 19138)

7.4 Thematic accuracy

7.4.1 Non-quantitative attribute correctness

Non-quantitative attribute correctness should be documented using the number of incorrect attribute values.

Name	number of incorrect attribute values
Alternative name	-
Data quality element	thematic accuracy
Data quality subelement	non-quantitative attribute correctness
Data quality basic measure	error count
Definition	total number of erroneous attribute values within the relevant part of the dataset
Description	count of all attribute values where the value is incorrect
Parameter	-
Data quality value type	integer
Data quality value structure	-
Source reference	-
Example	-
Measure identifier	65 (ISO 19138)

7.4.2 Quantitative attribute correctness

Quantitative attribute correctness should be documented using the attribute value uncertainty at 95 % significance level.

Name	attribute value uncertainty at 95 % significance level
Alternative name	-
Data quality element	thematic accuracy
Data quality subelement	quantitative attribute correctness
Data quality basic measure	LE95 or LE95(r), depending on the evaluation procedure
Definition	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 95 %
Description	count of all attribute values where the value is incorrect
Parameter	-
Data quality value type	measure
Data quality value structure	-
Source reference	-
Example	-
Measure identifier	71 (ISO 19138)

8 Dataset-level metadata

Metadata can be reported for each individual spatial object (spatial object-level metadata) or once for a complete dataset or dataset series (dataset-level metadata). Spatial object-level metadata is fully described in the application schema (section 5). If data quality elements are used at spatial object

level, the documentation shall refer to the appropriate definition in section 7. This section only specifies dataset-level metadata elements.

For some dataset-level metadata elements, in particular on data quality and maintenance, a more specific scope can be specified. This allows the definition of metadata at sub-dataset level, e.g. separately for each spatial object type. When using ISO 19115/19139 to encode the metadata, the following rules should be followed:

- The scope element (of type DQ_Scope) of the DQ_DataQuality subtype should be used to encode the scope.
- Only the following values should be used for the level element of DQ_Scope: Series, Dataset, featureType.
- If the level is featureType the levelDescription/MDScopeDescription/features element (of type Set< GF_FeatureType>) shall be used to list the feature type names.

NOTE The value featureType is used to denote spatial object type.

Mandatory or conditional metadata elements are specified in Section 8.1. Optional metadata elements are specified in Section 8.2. The tables describing the metadata elements contain the following information:

- The first column provides a reference to a more detailed description.
- The second column specifies the name of the metadata element.
- The third column specifies the multiplicity.
- The fourth column specifies the condition, under which the given element becomes mandatory (only for Table 12 and Table 13).

8.1 Mandatory and conditional metadata elements

Requirement 23 The metadata describing a spatial data set or a spatial data set series related to the theme *Hydrography* shall comprise the metadata elements required by Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata) for spatial datasets and spatial dataset series (Table 12) as well as the metadata elements specified in Table 13.

Table 12 – Metadata for spatial datasets and spatial dataset series specified in Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata)

Metadata Regulation Section	Metadata element	Multiplicity	Condition
1.1	Resource title	1	
1.2	Resource abstract	1	
1.3	Resource type	1	
1.4	Resource locator	0..*	Mandatory if a URL is available to obtain more information on the resource, and/or access related services.
1.5	Unique resource identifier	1..*	

1.7	Resource language	0..*	Mandatory if the resource includes textual information.
2.1	Topic category	1..*	
3	Keyword	1..*	
4.1	Geographic bounding box	1..*	
5	Temporal reference	1..*	
6.1	Lineage	1	
6.2	Spatial resolution	0..*	Mandatory for data sets and data set series if an equivalent scale or a resolution distance can be specified.
7	Conformity	1..*	
8.1	Conditions for access and use	1..*	
8.2	Limitations on public access	1..*	
9	Responsible organisation	1..*	
10.1	Metadata point of contact	1..*	
10.2	Metadata date	1	
10.3	Metadata language	1	

Table 13 – Mandatory and conditional theme-specific metadata for the theme *Hydrography*

INSPIRE Data Specification <i>Hydrography</i> Section	Metadata element	Multiplicity	Condition
8.1.1	Coordinate Reference System	1	
8.1.2	Temporal Reference System	0..*	Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.
8.1.3	Encoding	1..*	
8.1.4	Character Encoding	0..1	Mandatory, if a non-XML-based encoding is used that does not support UTF-8
8.1.5	Data Quality – Logical Consistency – Topological Consistency	0..*	Mandatory if the data set does not assure centreline topology (connectivity of centrelines) for the network.

8.1.1 Coordinate Reference System

Metadata element name	Coordinate Reference System – Horizontal Component
Definition	Description of the coordinate reference system used in the dataset.
ISO 19115 number and name	13. referenceSystemInfo
ISO/TS 19139 path	referenceSystemInfo
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1
Data type(and ISO 19115 no.)	189. MD_CRS
Domain	Either the referenceSystemIdentifier (RS_Identifier) or the projection (RS_Identifier), ellipsoid (RS_Identifier) and datum (RS_Identifier) properties shall be provided.
Implementing instructions	–
Example	referenceSystemIdentifier: code: ETRS_89 codeSpace: INSPIRE RS registry
Example XML encoding	–
Comments	–

8.1.2 Temporal Reference System

Metadata element name	Temporal Reference System
Definition	Description of the temporal reference systems used in the dataset.
ISO 19115 number and name	13. referenceSystemInfo
ISO/TS 19139 path	referenceSystemInfo
INSPIRE obligation / condition	Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	186. MD_ReferenceSystem
Domain	No specific type is defined in ISO 19115 for temporal reference systems. Thus, the generic MD_ReferenceSystem element and its reference SystemIdentifier (RS_Identifier) property shall be provided..
Implementing instructions	–
Example	referenceSystemIdentifier: code: GregorianCalendar codeSpace: INSPIRE RS registry
Example XML encoding	–
Comments	–

8.1.3 Encoding

Metadata element name	Encoding
Definition	Description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel
ISO 19115 number and name	271. distributionFormat
ISO/TS 19139 path	distributionInfo/MD_Distribution/distributionFormat
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1
Data type (and ISO 19115 no.)	284. MD_Format

Domain	See B.2.10.4. The following property values shall be used for default and alternative encodings specified in section 9.2: <u>Default Encoding</u> <ul style="list-style-type: none"> – name: Hydrography GML application schema – version: version 3.0; GML, version 3.2.1 – specification: D2.8.I.8 Data Specification on Hydrography – Guidelines
Implementing instructions	–
Example	name: Hydrography GML application schema version: version 3.0, GML, version 3.2.1 specification: D2.8.I.8 Data Specification on Hydrography – Guidelines
Example XML encoding	–
Comments	–

8.1.4 Character Encoding

Metadata element name	Metadata dataset character set
Definition	Full name of the character coding standard used for the dataset.
ISO 19115 number and name	4. characterSet
ISO/TS 19139 path	IdentificationInfo/*/characterSet
INSPIRE obligation / condition	Mandatory, if a non-XML-based encoding is used that does not support UTF-8
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	40. MD_CharacterSetCode
Domain	Codelist (See B.5.10 of ISO 19115)
Implementing instructions	
Example	
Example XML encoding	
Comments	

8.1.5 Data Quality – Logical Consistency – Topological Consistency

Metadata element name	Data Quality – Logical Consistency – Topological Consistency
Definition	Correctness of the explicitly encoded topological characteristics of the dataset as described by the scope (*). Note *: 138. DQ_Scope
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	115. DQ_TopologicalConsistency
Domain	Lines 100-107 from ISO 19115
Implementing instructions	This metadata should be filled, at least, with these elements: <ul style="list-style-type: none"> - 135. valueUnit: Class UnitOfMeasure (ISO/TS 19103) - 137. value: Class Record (ISO/TS 19103)
Example	-
Example XML encoding	-

Comments	See clause 7.2.3 in Chapter 7 related to missing connections due to undershoots and overshoots for detailed information. This metadata element is mandatory if connectivity is not assured for network centrelines in the dataset. In this case the <i>Connectivity tolerance</i> parameter – as described in 7.2.3 – must be provided in order to ensure automatic and unambiguous creation of centreline topology in post-process.
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8.2 Optional metadata elements

Recommendation 15 The metadata describing a spatial data set or a spatial data set series related to the theme *Hydrography* should comprise the theme-specific metadata elements specified in Table 14.

Table 14 – Optional theme-specific metadata for the theme *Hydrography*

List all metadata elements here that have a multiplicity of 0..1 or 0..*.

INSPIRE Data Specification <i>Hydrography</i> Section	Metadata element	Multiplicity
8.2.1	Maintenance Information	0..1
8.2.2	Data Quality – Completeness – Commission	0..*
8.2.3	Data Quality – Completeness – Omission	0..*
8.2.4	Data Quality – Logical consistency – Conceptual consistency	0..*
8.2.5	Data Quality – Logical consistency – Domain consistency	0..*
8.2.6	Data Quality – Logical consistency – Topological Consistency	0..*
8.2.7	Data Quality – Positional accuracy – Absolute or external accuracy	0..*
8.2.8	Data Quality – Thematic accuracy – Non-quantitative attribute correctness	0..*
8.2.9	Data Quality – Thematic accuracy – Quantitative attribute correctness	0..*
8.2.10	Identification – Extent	0..*
8.2.11	Distribution – Digital Transfer Options	0..1

8.2.1 Maintenance Information

Metadata element name	Maintenance information
Definition	information about the scope and frequency of updating
ISO 19115 number and name	30. resourceMaintenance
ISO/TS 19139 path	identificationInfo/MD_Identification/resourceMaintenance
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..1
Data type(and ISO 19115 no.)	142. MD_MaintenanceInformation

Domain	<p>This is a complex type (lines 143-148 from ISO 19115). At least the following elements should be used (the multiplicity according to ISO 19115 is shown in parentheses):</p> <ul style="list-style-type: none"> – maintenanceAndUpdateFrequency [1]: frequency with which changes and additions are made to the resource after the initial resource is completed / domain value: MD_MaintenanceFrequencyCode – updateScope [0..*]: scope of data to which maintenance is applied / domain value: MD_ScopeCode – maintenanceNote [0..*]: information regarding specific requirements for maintaining the resource / domain value: free text
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	–

8.2.2 Data Quality – Completeness – Commission

Metadata element name	Data Quality – Completeness – Commission
Definition	DQ Completeness: presence and absence of features, their attributes and their relationships; Commission: excess data present in the dataset, as described by the scope
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	109. DQ_CompletenessCommission
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.1.1 in Chapter 7 for detailed information.

8.2.3 Data Quality – Completeness – Omission

Metadata element name	Data Quality – Completeness – Omission
Definition	data absent from the dataset, as described by the scope
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	110. DQ_CompletenessOmission
Domain	Lines 100-107 from ISO 19115
Implementing instructions	This quality measure should answer the consumer question: How many real world items/instances does the content provider expect and how many of them are encoded at a given scope: spatial object type, dataset or dataset series.
Example	The following statement should e.g. be expressed here correspondingly: 10 River basins in the real world, 9 of them encoded in the dataset
Example XML encoding	–
Comments	See clause 7.1.2 in Chapter 7 for detailed information.

Recommendation 16 For evaluation purpose the Data quality measure and Metadata element *Rate of missing items* (Completeness Omission – see 7.1.2) should be included for all spatial object types apart from the following list of types: HydroPointOfInterest and ManMadeObjects.

8.2.4 Data Quality – Logical consistency – Conceptual consistency

Metadata element name	Data Quality – Logical consistency – Conceptual consistency
Definition	Adherence to rules of the conceptual schema
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	112. DQ_ConceptualConsistency
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.2.1 in Chapter 7 for detailed information.

8.2.5 Data Quality – Logical consistency – Domain consistency

Metadata element name	Data Quality – Logical consistency – Domain consistency
Definition	Adherence of values to the value domain
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	113. DQ_DomainConsistency
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.2.2 in Chapter 7 for detailed information.

8.2.6 Data Quality – Logical Consistency – Topological Consistency

Metadata element name	Data Quality – Logical Consistency – Topological Consistency
Definition	correctness of the explicitly encoded topological characteristics of the dataset as described by the scope
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	115. DQ_TopologicalConsistency
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.2.3 in Chapter 7 for detailed information.

8.2.7 Data Quality – Positional Accuracy – Absolute or external accuracy

Metadata element name	Data Quality - Positional accuracy - Absolute or external accuracy
Definition	closeness of reported coordinate values to values accepted as or being true
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	117. DQ_AbsoluteExternalPositionalAccuracy
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.3.1 in Chapter 7 for detailed information.

8.2.8 Data Quality – Thematic Accuracy – Non-quantitative attribute accuracy

Metadata element name	Data Quality - Thematic accuracy - non-quantitative accuracy
Definition	Accuracy of non-quantitative attributes
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	126. DQ_NonQuantitativeAccuracy
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.4.1 in Chapter 7 for detailed information.

8.2.9 Data Quality – Thematic Accuracy – Quantitative attribute accuracy

Metadata element name	Data Quality - Thematic accuracy - Quantitative accuracy
Definition	Accuracy of quantitative attributes
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	127. DQ_QuantitativeAttributeAccuracy
Domain	Lines 100-107 from ISO 19115
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	See clause 7.4.2 in Chapter 7 for detailed information.

8.2.10 Identification – Extent

Metadata element name	Extent
Definition	Extent information including the bounding box, bounding polygon, vertical, and temporal extent of the dataset

ISO 19115 number and name	45. extent
ISO/TS 19139 path	identificationInfo/MD_DataIdentification/extent
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	334. EX_Extent
Domain	This is a complex type (lines 335-338 from ISO 19115). In addition to the Geographic bounding box the following element should be used to provide a common "name" for the extent (the multiplicity according to ISO 19115 is shown in parentheses): - description [0..1]: spatial and temporal extent for the referring object/ domain value: free text
Implementing instructions	Use e.g. WISE River basin districts (RBDs) Use the terms provided here: < http://dataservice.eea.europa.eu/dataservice/metadetails.asp?id=1041 > Last visited: 2009-07-21
Example	Use e.g. NAME_ENGL and EUCD_RBD values like description: "East Estonia, A6018" or description: "Rhine, A5001"
Example XML encoding	–
Comments	In future the use of a common register (gazetteer) of e.g. river names is expected to be useful

8.2.11 Distribution information – Digital Transfer options

Metadata element name	Digital Transfer options
Definition	Provides information about technical means and media by which a resource is obtained from the distributor
ISO 19115 number and name	273. transferOptions
ISO/TS 19139 path	distributionInfo/MD_Distribution/transferOptions
INSPIRE obligation / condition	Optional
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	274. MD_DigitalTransferOptions
Domain	This is a complex type (lines 275-278 from ISO 19115). At least the following element should be used (the multiplicity according to ISO 19115 is shown in parentheses): - transferSize [0..1]: estimated size of a unit in the specified transfer format, expressed in megabytes. The transfer size is > 0.0/ domain value: Real
Implementing instructions	–
Example	–
Example XML encoding	–
Comments	–

8.3 Guidelines on using metadata elements defined in Regulation 1205/2008/EC

8.3.1 Conformity

The *Conformity* metadata element defined in Regulation 1205/2008/EC allows to report the conformance with the Implementing Rule for interoperability of spatial data sets and services or another specification. The degree of conformity of the dataset can be *Conformant* (if the dataset is

INSPIRE	Reference: INSPIRE_DataSpecification_HY_v3.0.1.pdf		
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fully conformant with the cited specification), *Not Conformant* (if the dataset does not conform to the cited specification) or *Not evaluated* (if the conformance has not been evaluated).

Recommendation 17 In order to report conceptual consistency with this INSPIRE data specification, the *Conformity* metadata element should be used. The value of Conformant should be used for the Degree element only if the dataset passes all the requirements described in the abstract test suite presented in Annex A. The Specification element should be given as follows:

- title: "INSPIRE Data Specification on *Hydrography* – Guidelines"
- date:
 - dateType: publication
 - date: 2010-04-26

8.3.2 Lineage

Following the ISO 19113 Quality principles, if a data provider has a procedure for quality validation of their spatial data sets then the data quality elements listed in the Chapter 8 should be used. If not, the *Lineage* metadata element (defined in Regulation 1205/2008/EC) should be used to describe the overall quality of a spatial data set.

According to Regulation 1205/2008/EC, lineage "is a statement on process history and/or overall quality of the spatial data set. Where appropriate it may include a statement whether the data set has been validated or quality assured, whether it is the official version (if multiple versions exist), and whether it has legal validity. The value domain of this metadata element is free text".

Recommendation 18 Apart from describing the process history, if feasible within a free text, the overall quality of the dataset (series) should be included in the *Lineage* metadata element. This statement should contain any quality information required for interoperability and/or valuable for use and evaluation of the data set (series).

8.3.3 Temporal reference

According to Regulation 1205/2008/EC, at least one of the following temporal reference metadata elements shall be provided: temporal extent, date of publication, date of last revision, date of creation.

Recommendation 19 If feasible, the date of the last revision of a spatial data set should be reported using the *Date of last revision* metadata element.

8.3.4 Topic category

The topic categories defined in Part D 2 of the INSPIRE Implementing Rules for metadata are derived directly from the topic categories defined in B.5.27 of ISO 19115. Regulation 1205/2008/EC defines the INSPIRE data themes to which each topic category is applicable, i.e., Hydrography (I.8) is the INSPIRE theme for which the **Inland waters** topic category is applicable.

Requirement 24 When publishing metadata for any dataset conforming to this specification; it shall have the topic category 'Inland Waters' for the corresponding metadata element.

For an examples of this metadata element customized to hydrography topic, see Annex C.1.

8.3.5 Keyword

Regulation 1205/2008/EC requires that, for spatial data sets or spatial data set series, “at least one keyword shall be provided from the General Environmental Multi-lingual Thesaurus (GEMET) describing the relevant spatial data theme as defined in Annex I, II or III to Directive 2007/2/EC”.

Recommendation 20 Keywords should be taken from the GEMET – General Multilingual Environmental Thesaurus where possible.

For an examples of this metadata element customized to hydrography topic, see Annex C.2.

9 Delivery

9.1 *Delivery medium*

Requirement 25 Data conformant to this INSPIRE data specification shall be made available through an INSPIRE network service.

Requirement 26 All information that is required by a calling application to be able to retrieve the data through the used network service shall be made available in accordance with the requirements defined in the Implementing Rules on Network Services.

EXAMPLE 1 Through the Get Spatial Objects function, a download service can either download a pre-defined data set or pre-defined part of a data set (non-direct access download service), or give direct access to the spatial objects contained in the data set, and download selections of spatial objects based upon a query (direct access download service). To execute such a request, some of the following information might be required:

- the list of spatial object types and/or predefined data sets that are offered by the download service (to be provided through the Get Download Service Metadata operation),
- and the query capabilities section advertising the types of predicates that may be used to form a query expression (to be provided through the Get Download Service Metadata operation, where applicable),
- a description of spatial object types offered by a download service instance (to be provided through the Describe Spatial Object Types operation).

EXAMPLE 2 Through the Transform function, a transformation service carries out data content transformations from native data forms to the INSPIRE-compliant form and vice versa. If this operation is directly called by an application to transform source data (e.g. obtained through a download service) that is not yet conformant with this data specification, the following parameters are required:

Input data (mandatory). The data set to be transformed.

- Source model (mandatory, if cannot be determined from the input data). The model in which the input data is provided.
- Target model (mandatory). The model in which the results are expected.
- Model mapping (mandatory, unless a default exists). Detailed description of how the transformation is to be carried out.

9.2 *Encodings*

9.2.1 Encoding for application schema ‘Hydro – base’

Requirement 27 Data conformant to the application schema 'Hydro – base' shall be encoded using the encoding specified in section 9.2.1.1.

9.2.1.1 Default Encoding: GML Application Schema

Format name: 'Hydro – base' GML Application Schema
Version of the format: 3.0, GML, version 3.2.1
Reference to the specification of the format: ISO 19136:2007
Character set: UTF-8

The GML Application Schema is distributed in a zip-file separately from the data specification document.

9.2.2 Encoding for application schema 'Hydro – Physical Waters'

Requirement 28 Data conformant to the application schema 'Hydro – Physical Waters' shall be encoded using the encoding specified in section 9.2.2.1.

9.2.2.1 Default Encoding: GML Application Schema

Format name: 'Hydro – Physical Waters' GML Application Schema
Version of the format: 3.0, GML, version 3.2.1
Reference to the specification of the format: ISO 19136:2007
Character set: UTF-8

The GML Application Schema is distributed in a zip-file separately from the data specification document.

9.2.3 Encoding for application schema 'Hydro – Network'

Requirement 29 Data conformant to the application schema 'Hydro – Network' shall be encoded using the encoding specified in section 9.2.3.1.

9.2.3.1 Default Encoding: GML Application Schema

Format name: 'Hydro – Network' GML Application Schema
Version of the format: 3.0, GML, version 3.2.1
Reference to the specification of the format: ISO 19136:2007
Character set: UTF-8

The GML Application Schema is distributed in a zip-file separately from the data specification document.

9.2.4 Encoding for application schema 'Hydro – Reporting'

Requirement 30 Data conformant to the application schema 'Hydro – Reporting' shall be encoded using the encoding specified in section 9.2.4.1.

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 86

9.2.4.1 Default Encoding: GML Application Schema

Format name: 'Hydro – Reporting' GML Application Schema

Version of the format: 3.0, GML, version 3.2.1

Reference to the specification of the format: ISO 19136:2007

Character set: UTF-8

The GML Application Schema is distributed in a zip-file separately from the data specification document.

10 Data Capture

Requirement 31 All hydrographic data which are under the INSPIRE scope shall be published

Objects are considered as under the INSPIRE scope if:

1. They are part of, or form the basis thereof, government water-related reporting obligations such as the Water Framework Directive (2000/60/EC) or they are needed to form a complete, clean hydrographic network (see recommendation 19)
2. They are used for mapping purposes in the context of (1)
3. They are needed for a correct topographic understanding of the relation to (1) and its surroundings.
4. They are available as vector data.

Recommendation 21 The selection rules for INSPIRE hydrographic objects should be decided by each Member State, based on the guidelines given in this document and then documented as metadata, under lineage element.

10.1 Data capture for Physical Waters

10.1.1 Inundated land

Excluded from inundated land are irrigated lands as these are not a normal part of the hydrological network. Included are areas that under normal circumstances do not form part of the network but will form part of it under extreme hydrological conditions. Examples of inundated land can be so-called 'green rivers' and areas lying below parts of an embankment that have been lowered with the specific purpose of flooding during high water situations. Lands bordering a watercourse that always overflow at high water (water level not reached for < 95% of the time) are considered part of the shore.



Figure 21 - watercourse, shore and inundated land; in the right situation the overflowed bank is not considered inundated land.

10.1.2 Objects potentially falling into different categories

In some situations objects could be classified into different spatial object groups in the Hydrography model. For example, small weirs and sluices can behave (and look) in a similar way; e.g. if the waterlevel rises a sluice will start to act like a weir with water flowing over its gates. The classification of an object shall be done based on the normal function. i.e. a weir is different in construction than a sluice and should be classified based upon its normal operation.



Figure 22 - Small weir (left) and sluice (right)

Requirement 32 The classification of an object shall be done based on the normal function.

10.1.3 Delineation known

10.1.3.1 Watercourse

A watercourse can have a geometry that is not very well defined; this signifies a watercourse that cannot always be found where it is displayed on the map because it only holds water during a certain time of the year. When the flow increases to a certain level, the water finds a natural outlet through a not specifically-defined riverbed segment. In some situations a river may branch into various smaller branches that later reconnect but are not shown on the map. In these case the watercourse is said to have a not well defined geometry since it cannot be found on exactly the location shown on the map.



Figure 23 - The watercourse vanishes meaning it is impossible to position it. (Arrow indicates water flow direction)

10.1.3.2 Shore

The DelineationKnown attribute can be used in one of the following cases:

- Fluctuated, changeable shoreline. Shoreline that is changed due to currents and winds e.g. sandbars.
- Indistinct shoreline, which is difficult to determine. E.g. Indistinct transition towards marshes.; Areas with reeds.

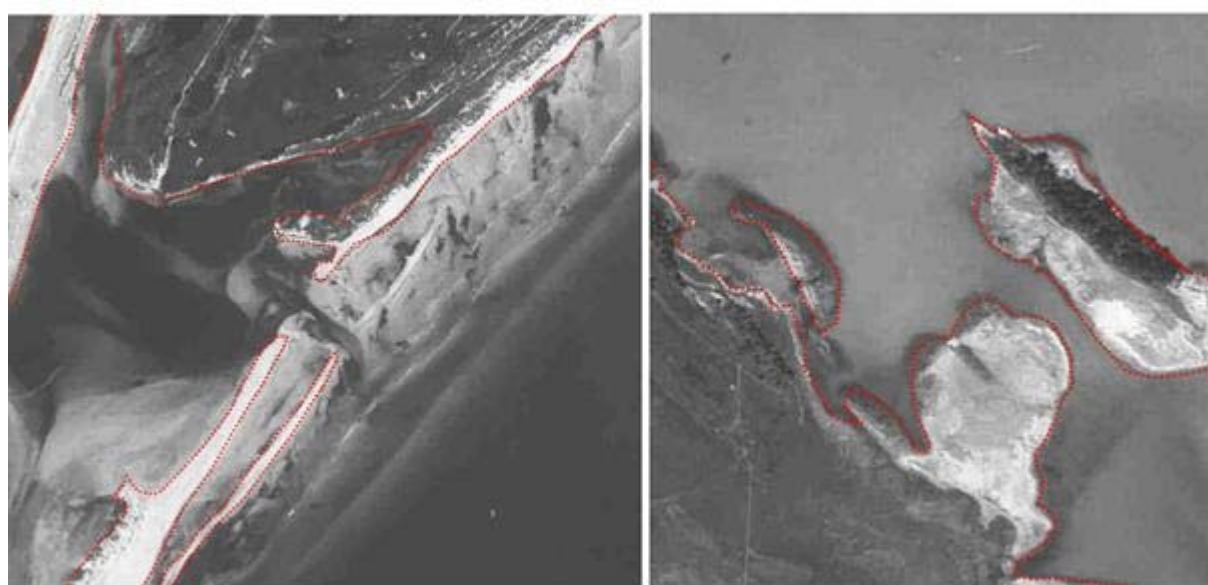


Figure 24 - examples of the use of DelineationKnown on Shore (dashed line is 'False'; continuous line is 'True'. Situation with sandbars left; indistinct shoreline right.

10.1.3.3 Changes in geometry over time

This is not the same case as that mentioned above; in this case the geometry is known but it is also known to change over time. If the change over time is relevant than the lifecycle attributes can be used to end a certain 'version' of the object with an endtime and start a new version at the same start time. This would allow the modelling / exchange of changes of the same geometry over time (temporal changes).

Requirement 33 The attribute delineationKnown shall not be used to indicate a change of geometry over time where this change of geometry is known.

Recommendation 22 Changes in geometry over time should be exchanged using the various geometries over time of the spatial object using the same unique identifier with the correct version information.

10.1.4 Alternative representations

Where network centreline, reporting units and physical waters objects coexist it is important that users holding information in one of these forms can share information with another. It is important therefore that these alternative representations are well synchronised and follow the requirement in 10.2. Cross referencing using the unique identification on the Hydro base objects will support easy and unambiguous data exchange and support synchronised maintenance – whichever organisation is responsible for the alternative forms.

Recommendation 23 Alternative representations should be cross referenced using unique identification to support data sharing and synchronised maintenance.

10.1.5 Width range

Watercourses are commonly described and classified by their width. However, it is difficult to indicate an actual width over a certain length of a watercourse. Therefore, the width is given as a range value, indicating a lower and upper bound of width.

Requirement 34 The Width range shall be populated as such to allow a consistent classification of watercourses according to their width throughout one data set.

Recommendation 24 In case the actual width is known, the following lower and upper bound of width are recommended to apply:

- 1 to 5m
- 5 to 20m
- 20 to 50m
- 50 to 125m.

Recommendation 25 If the lower bound of width of a watercourse is unknown the value should be 1m.

Recommendation 26 If the upper bound of width of a watercourse is unknown the value should be set to the width criterion between linear and areal representation of the watercourses in the data set. Otherwise, it should be set to unknown.

10.2 Data capture for Network

The topics in this paragraph highlight specific cases that require specific attention in collecting and assembling data and information that constitutes the components of the network model. In order to

create a usable network model (e.g. for discharge modelling; flood heights etc) there are requirements imposed on the network (see also chapter 7: Data quality).

Requirement 35 Only a network model that adheres both to the recommendations described in section 7 (Data quality) of this document and to the recommendations described in this section will be fully useful for modelling studies.

10.2.1 Generalization and the network

Recommendation 27 Where possible the geometry used in the network model or for reporting should be derived from the physical waters geometry.

In certain situations, it may not be necessary to have links (centerlines) available for every single watercourse in the model even though all the watercourses may be shown on the map. The follow examples serve as indication when and how to generalize:

- a watercourse that branches into several different branches that later rejoin. This branching can be represented by a single (fictitious) link with the correct amount of flow for the entire system of branches.
- a watercourse with a number of harbours / docks lying on it where no additional inflow / outflow is generated. In this situation, a single link represent the entire system.
- The network is a 'topologic' network with nodes representing real-world phenomena and the links connecting the nodes represented as straight lines.
- Links representing abstractions / discharges or water transfer (e.g. pumping station) in the network. These are represented with a length of 'zero'.



If a link is generalized then this will be indicated with the attribute 'fictitious' set to 'True'.

10.2.2 Centrelines

The primary way to represent a network geometry is using a centreline (i.e. a line that approximates the centre of the real world object). It would be prohibitively expensive and impracticable to faithfully record the true centreline since this would result in an irregular line and far too many data points. Therefore a pragmatic approach is often taken which results in a much smoother line requiring the minimum number of data points to represent the object.

However problems can arise when too few points are used and the line will no longer be smooth or useful in most applications. Equally the centreline may often be combined with the topographic (area) objects e.g. watercourse. It is therefore important that the centreline falls within the physical boundary of the object it represents with the exceptions of the cases described in 10.2.1

Requirement 36 The centrelines of watercourse objects shall fall within the extent of the physical real world object that they represent if the Watercourse Link is indicated as not being 'fictitious' (as illustrated in **Figure 25**).

	<p>Not acceptable; link is 'fictitious'</p> <p>The centreline falls outside the real world object</p>
	<p>Acceptable</p> <p>The centreline falls inside the real world object</p>


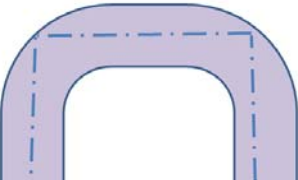
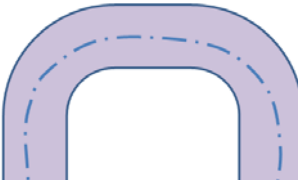
	<p>Not acceptable; link is 'fictitious'</p> <p>The centreline falls outside the real world object</p>
	<p>Not acceptable; link is 'fictitious'</p> <p>The centreline falls inside the real world object but does not follow the shape faithfully.</p>
	<p>Acceptable</p> <p>The centreline falls inside the real world object and while it does not follow the exact centreline it is acceptable</p>

Figure 25 – Acceptable and non acceptable forms of centreline representation that are not 'fictitious'

10.2.3 Area shaped features and the network

In order to create a closed network it is necessary to include standing waters; glacier/snowfields as well as wetlands into the model. Since these are surface-based features (area shaped) it is necessary to add a link (or multiple links) to these. The following situations can occur:

- An area with a single inlet or a single outlet (but not both). This can be represented as a single node on the network.
- The area lies in a single watercourse. In this case the area is represented by a (fictitious) link with a single node at the inlet and a single node at the outlet of the area.

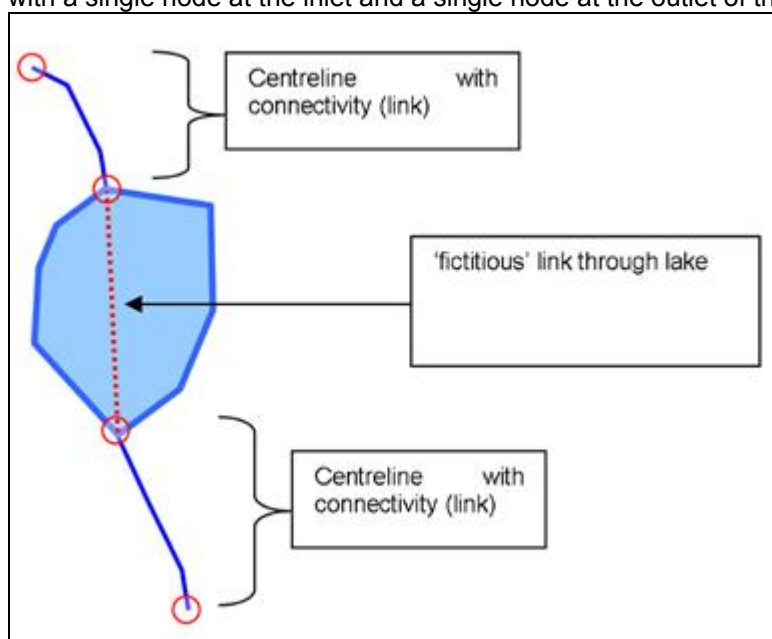


Figure 26 - Link through a lake with one inlet and one outlet

- Multiple watercourses end / start at the area. In this case one or more nodes are used to represent the area feature. Each link is then connected to a node within the area.

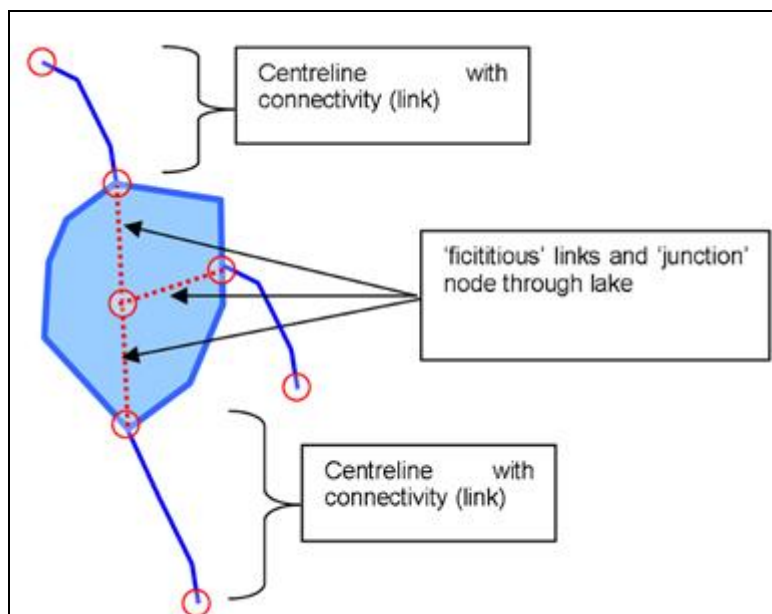


Figure 27 - Links through a lake with multiple inlets / outlets

10.2.4 Connecting watercourses

Links can only join at nodes (see section 7). Where a watercourse flows into another watercourse and one or both are represented as an area shape on the map there are two options for connecting both watercourses:

1. The link of the watercourse is extended at the edge in such a way that it is connected on the link of the other watercourse.
2. An additional node is inserted on the edge of the watercourse from where a small, fictitious, link connects it to the link of the other watercourse.

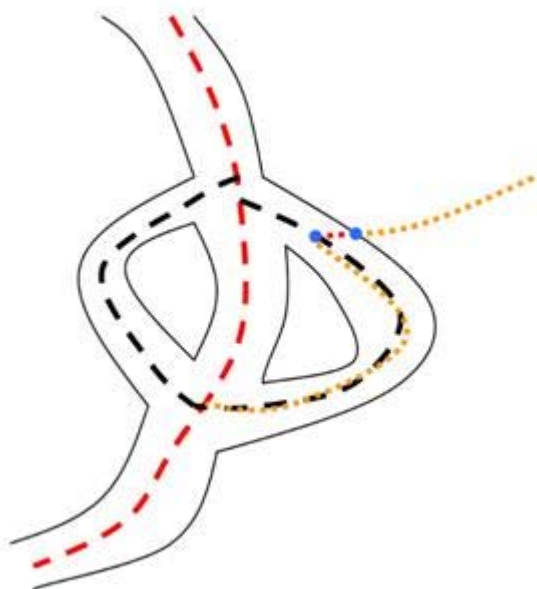


Figure 28 - Insertion of an additional node and small link where two watercourses meet.

Recommendation 28 It is recommended to use method 2 for this type of connection

10.2.5 Closed network – topology recommendations

In order to create a closed network, the following recommendations should be observed:

- The network must be digitised in the direction of flow (upstream to downstream) with the following exceptions:
 - When flow is not determinable from the source
 - When flow is variable in direction
- Sections where flow is not as digitised should be attributed as such.
- Start node is either the most upstream point (Source), or the point at which two rivers meet.
- End Point is either the most downstream point (Outlet) if the feature has not changed, or the point at which two rivers meet

Recommendation 29 Digitization of the network should adhere to the rules set out in this paragraph

10.2.6 Ensuring Network Connectivity

This data specification does not incorporate a topological model for the reasons given in Chapters 4 and 5.1.1.1. Since a users system will build the topology for an application it is essential that the data is captured in such a way that this topology build can be undertaken automatically, repeatedly and faultlessly each time.

Therefore the data has to be supplied to the user with topology “implicit” in the structure (i.e. it must be “clean”). This implicit topology is based on coincidence which does not have to be absolute but relies on a connectivity tolerance. This connectivity tolerance will be supplied as metadata with the hydrographic network data. (see Section 8.1.5)

When automatically constructing topological relationships:

- All points, nodes, vertices and link ends that are located at a distance of less than the connectivity tolerance of each other are considered to coincide,
- All points, nodes, vertices and link ends that are located at a distance of more than the connectivity tolerance of each other are considered not to coincide.

To ensure automatic and unambiguous creation of centreline topology:

- All link ends and the optional node that take part in a connection have to be positioned at a distance of less than the connectivity tolerance from each other,
- A distance that is greater than the connectivity tolerance shall always separate link ends and nodes that are not connected.

This will ensure the correct connectivity between links and the nodes in the system. Supporting quality criteria will be found in Section 7.

Requirement 37 Wherever a connection exists in a hydrographic network, all connected link ends and the optional node that take part in this connection have to be positioned at a distance of less than the connectivity tolerance from each other.

Requirement 38 Link ends and nodes that are not connected shall always be separated by a distance that is greater than the connectivity tolerance.

Requirement 39 In data sets where both network links and nodes are present, the relative position of nodes and link ends in relation to the specified connectivity tolerance shall correspond to the associations that exist between them in the data set.

	Acceptable
	The perfect case where the node and all link ends share the same coordinates.

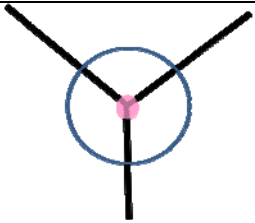
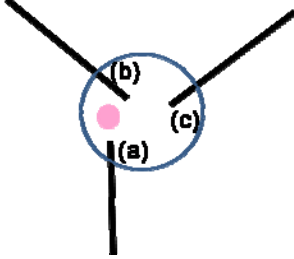
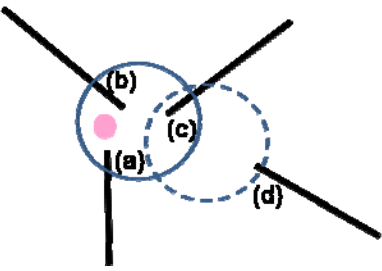
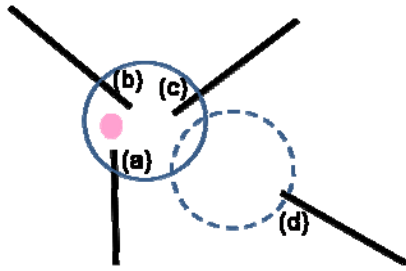
	
	<p>Acceptable</p> <p>The three link ends (a, b and c) and the node are all within a distance of less than the connectivity tolerance (indicated by the blue circle). All of these elements will be assumed connected during an automatic topology build.</p>
	<p>Not acceptable</p> <p>The three link ends (a, b and c) and the node are all within a distance of less than the connectivity tolerance.</p> <p>Link end (d) lies within a distance of less than the connectivity tolerance from link end (c), but at a distance greater than the tolerance from link ends (a) and (b) and the network node.</p> <p>The connectivity is ambiguous and the topology building would fail.</p>
	<p>Acceptable (but possible error)</p> <p>The three link ends (a, b and c) and the node are all within a distance of less than the connectivity tolerance and will be assumed connected during an automatic topology build.</p> <p>Link end (d) is at a distance greater than the tolerance from all three link ends and the node. It will be considered not connected (dangle).</p> <p>Note: while this is an acceptable situation for automatic topology build, it can constitute an error in the data: if, in reality, (d) is connected to (a), (b) and (c) it should be moved to within the tolerance distance from all three link ends and the node.</p>

Figure 29 – Acceptable and unacceptable positioning of link ends and nodes.

10.2.7 Cross border issues

Wherever a watercourse crosses a border, the dataset holders must agree upon a common node so that the network connects across the border. Border nodes are identified by the HydroNodeCategory type 'boundary' and should have the same unique identification attribution in the datasets that connect.

Whenever the watercourse forms the border, it must be included by both member states with the same unique identification attribution in order to ensure integrity of the model.

10.2.8 Linear Referencing

Recommendation 30 The use of linear referencing is recommended.

Linear referencing as defined in the draft ISO 19148 will be adopted and aligned with the GNM (and hence this data specification) with after it reaches DIS status, The adoption in the *Hydrographic* data specification is limited to a simple model at this stage and not mandatory.

In general it is expected that linear referencing will be used to model the relationships of objects that are associated with a network, but where the position of those associated objects is not known (or required) to a very high level of absolute accuracy ~ better than 1-3m at local level (e.g. changes in discharge, hydraulic resistance).

The position of centrelines and nodes in a network in many cases will vary from the “true position” (since the centreline is rarely that and the node is not a tangible physical feature or location (see 10.1 above)).

Where absolute accuracy is required such objects should be reused, and referenced, if they already exist as related objects.

10.2.9 Abstraction / discharge from the network

Water that is inserted or extracted from the network, or that moves from one (sub) network needs to be modelled in a specific way. In case of the following situations, the following model is recommended.

Recommendation 31 Abstractions / discharges and water that is moved between (sub) networks should be modelled conform the capture rules in this paragraph

Type of regulation	Node category	Link to node		Link from node	
		fictitious	length	fictitious	length
Abstraction from the network (water disappears from the network)	Regulation	-	-	Y	0
Discharge into the network (water is inserted into the network)	Regulation	Y	0	-	-
Transfer of water between (sub)networks at a single location	Regulation	Y	0	Y	0
Transfer of water between (sub)networks using a pipe	Regulation	N	Actual length	N	Actual length

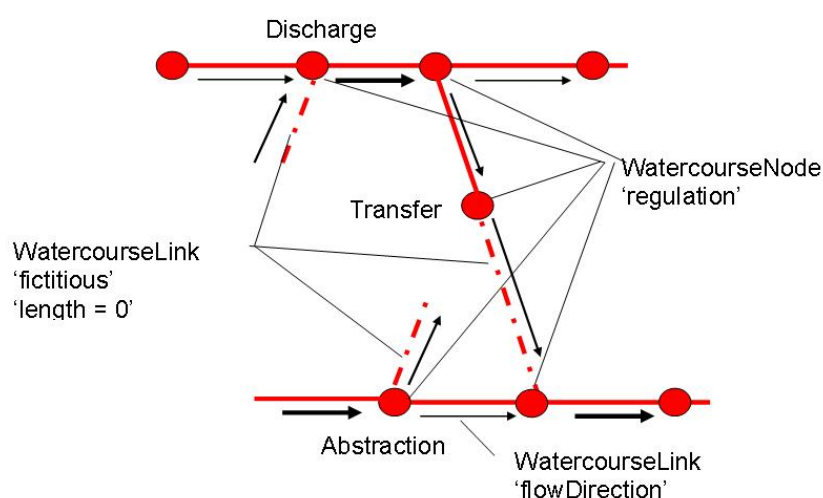


Figure 30 – Modelling of abstraction, discharge and water transfer.

11 Portrayal

This clause defines the rules for layers and styles to be used for portrayal of the spatial object types defined for this theme.

In section 11.1, the *types* of layers are defined that are to be used for the portrayal of the spatial object types defined in this specification. A view service may offer several layers of the same type, one for each dataset that it offers on a specific topic.

Section 11.2 specifies the default styles to be used for each of these layer types, while section 11.3 specifies other well-defined styles.

The XML fragments in these sections use the following namespace prefixes:

- sld="http://www.opengis.net/sld" (WMS/SLD 1.1)
- se="http://www.opengis.net/se" (SE 1.1)
- ogc="http://www.opengis.net/ogc" (FE 1.1)

In section 11.5 there is included a colour chart and the symbols used in sections 11.2 and 11.3.

11.1 Layer Types

Requirement 40 If an INSPIRE view services supports the portrayal of data related to the theme *Hydrography*, it shall provide layers of the types specified in this section.

Table 15: Layer types for the spatial data theme *Hydrography*

Layer Name	Layer Title	Spatial object type(s)	Keywords
HY.PhysicalWaters.Waterbodies	Waterbody	Watercourse, StandingWater	Watercourse, River, Stream, Lake, Reservoir
HY.PhysicalWaters.LandWaterBoundary	Land water boundary	LandWaterBoundary	Coastline, Shoreline
HY.PhysicalWaters.Catchments	Catchment	DrainageBasin, RiverBasin	Basin, Catchment area, Drainage basin
HY.Network	Hydrographic network	HydroNode, WatercourseLink	Hydrographic network,
HY.PhysicalWaters.HydroPointOfInterest	Hydro Point of Interest	Rapids, Falls	Rapids, Falls, Cascade
HY.PhysicalWaters.ManMadeObject	Man-made Object	Crossing, DamOrWeir, Sluice, Lock, Ford, ShorelineConstruction	Bridge, Aqueduct, Dam, Weir, Lock, Ford, Dick
HY.AquiferNode	Spring or Seep, Vanishing Point	SpringOrSeep, VanishingPoint	
HY.HydroObject	Shore, Wetland, Glacier, Snowfield	Shore, Wetland, GlacierSnowfield	
HY.Reporting.WFDRiver	WFD-River	WFDRiver	
HY.Reporting.WFDLake	WFD-Lake	WFDLake	
HY.Reporting.WFDTransitionalWater	WFD-Transitional water	WFDTransitionalWater	
HY.Reporting.WFDCoastalWater	WFD-Coastal water	WFDCoastalWater	

stalWater			
HY.OceanRegion	Ocean Region	OceanRegion	

11.2 Default Styles

Requirement 41 If an INSPIRE view network service supports the portrayal of spatial data sets corresponding to the spatial data theme *Hydrography*, it shall support the default styles specified in the tables in this section.

If no user-defined style is specified in a portrayal request for a specific layer to an INSPIRE view service, the default style specified in this section for that layer shall be used.

Table 16: Default styles for the spatial data theme *Hydrography*

Layer Name	HY.PhysicalWaters.Waterbodies
Style Name	HY.PhysicalWaters.Waterbodies.Default
Style Title	Water bodies default style
Style Description	Physical waters as watercourses or standing water can be portrayed with different geometries depending on its dimensions and the level of detail or resolution. Lineal watercourses are depicted by solid blue (#33CCFF) lines with stroke width of 1 pixel and the superficial ones are depicted by filled blue light polygons (#CCFFFF) without border. Punctual standing waters are depicted by dark blue (#0066FF) circles with size of 6 pixel and the superficial ones are depicted by filled blue light polygons (#CCFFFF) without border.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.PhysicalWaters.Waterbodies</se:Name> <sld:UserStyle> <se:Name>HY.PhysicalWaters.Waterbodies.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Water bodies default style</se:Title> <se:Abstract>Physical waters as watercourses or standing water can be portrayed with different geometries depending on its dimensions and the level of detail or resolution. Lineal watercourses are depicted by solid blue (#33CCFF) lines with stroke width of 1 pixel and the superficial ones are depicted by filled blue light polygons (#CCFFFF) without border. Punctual standing waters are depicted by dark blue (#0066FF) circles with size of 6 pixel and the superficial ones are depicted by filled blue light polygons (#CCFFFF) without border.</se:Abstract> </se:Description> <se:FeatureTypeName>PhysicalWaters.Watercourse</se:FeatureTypeName> <se:Rule> <ogc:Filter> <!--Delineation is known--> <se:PropertyIsEqualTo> <ogc:PropertyName>delineationKnown</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:Filter> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>

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	<pre> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:FeatureTypeName>PhysicalWaters.StandingWater</se:FeatureTypeName> <se:Rule> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:Mark> <se:WellKnownName>circle</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#0066FF</se:SvgParameter> </se:Fill> </se:Mark> <se:Size> <se:SvgParameter name="size">6</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.PhysicalWaters.LandWaterBoundary
Style Name	HY.PhysicalWaters.LandWaterBoundary.Default
Style Title	Land water boundary default style
Style Description	The contact line between a land mass and a water body is portrayed by a solid blue (#33CCFF) line with stroke width of 1 pixel.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.PhysicalWaters.Waterbodies</se:Name> <sld:UserStyle> <se:Name> HY.PhysicalWaters.LandWaterBoundary.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Land water boundary default style</se:Title> <se:Abstract>The contact line between a land mass and a water body is portrayed by a solid blue (#33CCFF) line with stroke width of 1 pixel.</se:Abstract> </se:Description> <se:FeatureTypeName>PhysicalWaters.LandWaterBoundary</se:FeatureTypeName> > <se:Rule> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum &	No scale limits

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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maximum scales	
Layer Name	HY.PhysicalWaters.Catchments
Style Name	HY.PhysicalWaters.Catchments.Default
Style Title	Drainage Basin default style
Style Description	Drainage basins are portrayed by no filled polygons with a solid blue (#0066FF) border with stroke width of 4 pixel the RiverBasin features and with stroke width of 2 pixel the DrainageBasin ones.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.PhysicalWaters.Catchments</se:Name> <sld:UserStyle> <se:Name>HY.PhysicalWaters.Catchments.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Catchments default style</se:Title> <se:Abstract>Drainage Basin areas are portrayed by no filled polygons with a solid blue (#0066FF) border with stroke width of 4 pixel the RiverBasin features and with stroke width of 2 pixel the DrainageBasin ones.</se:Abstract> </se:Description> <se:FeatureTypeName>PhysicalWaters.DrainageBasin</se:FeatureTypeName> <se:Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#0066FF</se:SvgParameter> <se:SvgParameter name="stroke-width">2</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:FeatureTypeName>PhysicalWaters.RiverBasin</se:FeatureTypeName> <se:Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#0066FF</se:SvgParameter> <se:SvgParameter name="stroke-width">4</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.Network
Style Name	HY.Network.Default
Style Title	Hydrographic network default style
Style Description	Hydrographic network is rendered by solid blue (#33CCFF) lines with stroke width of 1 pixel and 3 pixel size filled circles with black (#000000) border.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.Network</se:Name> <sld:UserStyle> <se:Name>HY.Network.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Hydrographic network default style</se:Title> <se:Abstract>Hydrographic network is rendered by solid blue (#33CCFF) lines with stroke width of 1 pixel and 3 pixel size filled circles with black (#000000) border.</se:Abstract> </se:Description> <se:FeatureTypeName>Network.WatercourseLink</se:FeatureTypeName> <se:Rule> <se:LineSymbolizer> <se:Geometry> </pre>

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	<pre> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> </se:Rule> <se:FeatureTypeName>Network.HydroNode</se:FeatureTypeName> <se:Rule> <ogc:Filter> <ogc:Or> <ogc:PropertyIsEqualTo> <ogc:PropertyName>hydroNodeCategory</ogc:PropertyName> <ogc:Literal>outlet</ogc:Literal> </ogc:PropertyIsEqualTo> <ogc:PropertyIsEqualTo> <ogc:PropertyName>hydroNodeCategory</ogc:PropertyName> <ogc:Literal>junction</ogc:Literal> </ogc:PropertyIsEqualTo> <ogc:PropertyIsEqualTo> <ogc:PropertyName>hydroNodeCategory</ogc:PropertyName> <ogc:Literal>source</ogc:Literal> </ogc:PropertyIsEqualTo> </ogc:Or> </ogc:Filter> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:Mark> <se:WellKnownName>circle</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#000000</se:SvgParameter> </se:Stroke> </se:Mark> <se:Size> <se:SvgParameter name="size">3</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> <ogc:Filter> <ogc:Or> <ogc:PropertyIsEqualTo> <ogc:PropertyName>hydroNodeCategory</ogc:PropertyName> <ogc:Literal>flowConstriction</ogc:Literal> </ogc:PropertyIsEqualTo> <ogc:PropertyIsEqualTo> <ogc:PropertyName>hydroNodeCategory</ogc:PropertyName> <ogc:Literal>regulation</ogc:Literal> </ogc:PropertyIsEqualTo> </ogc:Or> </ogc:Filter> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:Mark> <se:WellKnownName>circle</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#000000</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#000000</se:SvgParameter> </se:Stroke> </se:Mark> <se:Size> <se:SvgParameter name="size">3</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> <ogc:Filter> <ogc:PropertyIsEqualTo> <ogc:PropertyName>hydroNodeCategory</ogc:PropertyName> </ogc:PropertyIsEqualTo> </ogc:Filter> </pre>
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	<pre> <ogc:Literal>boundary</ogc:Literal> </ogc:PropertyIsEqualTo> </ogc:Filter> </se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:Mark> <se:WellKnownName>circle</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#FF0000</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#000000</se:SvgParameter> </se:Stroke> </se:Mark> <se:Size> <se:SvgParameter name="size">3</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.PhysicalWaters.HydroPointOfInterest
Style Name	HY.PhysicalWaters.HydroPointOfInterest.Default
Style Title	Hydrographic points of interest default style
Style Description	Fluvial points as rapids or falls are depicted with symbols; if the geometry is a curve they are depicted in aligned blue (#0066FF) marks (stars for Falls and crosses for Rapids); if the geometry is a surface it will be an area with blue (#0066FF) marks (stars for Falls and crosses for Rapids).
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.HydroPointOfInterest</se:Name> <sld:UserStyle> <se:Name>HY.PhysicalWaters.HydroPointOfInterest.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Hydrographic points of interest default style</se:Title> <se:Abstract>Fluvial points as rapids or falls are depicted with symbols; if the geometry is a curve they are depicted in aligned blue (#0066FF) marks (stars for Falls and crosses for Rapids); if the geometry is a surface it will be an area with blue (#0066FF) marks (stars for Falls and crosses for Rapids).</se:Abstract> </se:Description> <se:FeatureTypeName>Rapids</se:FeatureTypeName> <se:Rule> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../rapids.png"/> <Format>image/png</Format> </se:ExternalGraphic> <se:Size> <se:SvgParameter name="size">10.0</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> </pre>

	<pre> <se:Stroke> <se:GraphicStroke> <se:Graphic> <se:Mark> <se:WellKnownName>cross</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#0066FF</se:SvgParameter> </se:Fill> </se:Mark> </se:Graphic> </se:GraphicStroke> </se:Stroke> </se:LineSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:Mark> <se:WellKnownName>cross</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#0066FF</se:SvgParameter> </se:Fill> </se:Mark> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:FeatureTypeName>Falls</se:FeatureTypeName> <se:Rule> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../falls.png"/> <Format>image/png</Format> </se:ExternalGraphic> </se:Graphic> </se:PointSymbolizer> </se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:GraphicStroke> <se:Graphic> <se:Mark> <se:WellKnownName>star</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#0066FF</se:SvgParameter> </se:Fill> </se:Mark> </se:Graphic> </se:GraphicStroke> </se:Stroke> </se:LineSymbolizer> <se:PolygonSymbolizer> </pre>
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	<pre> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:Mark> <se:WellKnownName>star</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#0066FF</se:SvgParameter> </se:Fill> </se:Mark> </se:Graphic> <se:Size> <se:SvgParameter name="size">5.0</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.PhysicalWaters.ManMadeObject
Style Name	HY.PhysicalWaters.ManMadeObject.Default
Style Title	Man-made objects default style
Style Description	There are only depicted the fully functional objects. Punctual objects are depicted with symbols; if the geometry is a curve they are depicted in solid or dashed lines with different stroke width and different colours depending on the feature type; if the geometry is a surface it will be a filled polygon of solid colour, depending on the feature type.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.ManMadeObject</se:Name> <sld:UserStyle> <se:Name> HY.PhysicalWaters.ManMadeObject.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title> Man-made objects default style</se:Title> <se:Abstract> There are only depicted the fully functional objects. Punctual objects are depicted with symbols; if the geometry is a curve they are depicted in solid or dashed lines with different stroke width and different colours depending on the feature type; if the geometry is a surface it will be a filled polygon of solid colour adding or not some marks, depending on the feature type.</se:Abstract> </se:Description> <se:FeatureTypeName>Crossing</se:FeatureTypeName> <se:Rule> <ogc:Filter> <!--FULLY FUNCTIONAL Bridge--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>condition</ogc:PropertyName> <ogc:Literal>functional</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>type</ogc:PropertyName> <ogc:Literal>bridge</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" </pre>

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```

xlink:href="http://.../bridge.png"/>
  <Format>image/png</Format>
</ExternalGraphic>
<se:Size>
  <se:SvgParameter name="size">10.0</se:SvgParameter>
</se:Size>
</se:Graphic>
</se:PointSymbolizer>
<se:LineSymbolizer>
  <se:Geometry>
    <ogc:PropertyName>geometry</ogc:PropertyName>
  </se:Geometry>
  <se:Stroke>
    <se:SvgParameter name="stroke">#999999</se:SvgParameter>
    <se:SvgParameter name="stroke-width">2</se:SvgParameter>
  </se:Stroke>
</se:LineSymbolizer>
<se:PolygonSymbolizer>
  <se:Geometry>
    <ogc:PropertyName>geometry</ogc:PropertyName>
  </se:Geometry>
  <se:Fill>
    <se:SvgParameter name="fill">#CCCCCC</se:SvgParameter>
  </se:Fill>
  <se:Stroke>
    <se:SvgParameter name="stroke">#999999</se:SvgParameter>
    <se:SvgParameter name="stroke-width">2</se:SvgParameter>
  </se:Stroke>
</se:PolygonSymbolizer>
</se:Rule>
<se:FeatureTypeName>DamOrWeir</se:FeatureTypeName>
<se:Rule>
  <ogc:Filter>
    <!--FULLY FUNCTIONAL-->
    <se:PropertyIsEqualTo>
      <ogc:PropertyName>condition</ogc:PropertyName>
      <ogc:Literal>functional</ogc:Literal>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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```

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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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Minimum & maximum scales	No scale limits

Requirement 42 It is necessary to decide which *LandWaterBoundary.waterLevelValue* should be depicted by default

Recommendation 32 The recommended water level is HW level in tidal areas or MSL / Local datum in areas without significant tide in agreement with the IHO specifications.

Recommendation 33 It is recommended that toponyms are added according to the portrayal rules of geographical names.

Table 17: Default styles for the spatial data theme Geology

Default Style	
Layer Name	HY. AquiferNode
Style Name	HY. AquiferNode.Default
Style Title	Hydrography default style
Style Description	Points of contact between surface waters and ground water bodies as springs or seeps and vanishing points or sinkholes are rendered by symbols.
Symbology	<pre> <sld:NamedLayer> <se:Name>GE.HydroObject</se:Name> <sld:UserStyle> <se:Name> GE.HydroObject.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Hydrography default style</se:Title> <se:Abstract> Points of contact between surface waters and ground water bodies as springs or seeps and vanishing points or sinkholes are rendered by symbols.</se:Abstract> </se:Description> <se:FeatureTypeName>SpringOrSeep</se:FeatureTypeName> <se:Rule> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../spring.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10.0</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> </se:Rule> <se:FeatureTypeName>VanishingPoint</se:FeatureTypeName> <se:Rule> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:Mark> <se:WellKnownName>triangle</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#FFFFFF</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33FFFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:Mark> </se:Graphic> </se:PointSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>

	<pre> <se:SvgParameter name="opacity">0.5</se:SvgParameter> </se:Opacity> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits

Table 18: Default styles for the spatial data theme Land cover

Default Style	
Layer Name	HY.HydroObject
Style Name	HY.HydroObject.Default
Style Title	Hydrographic land cover default style
Style Description	Shore areas are portrayed as pale yellow (#FFFFCC) surfaces; wetlands are depicted with blue-green (#00CCCC) surfaces and glaciers and snowfields are rendered filled white (#FFFFFF) polygons with a solid blue (#3333CC) border with stroke width of 1 pixel.
Symbology	<pre> <sld:NamedLayer> <se:Name>LC.HydroObject</se:Name> <sld:UserStyle> <se:Name>LC.HydroObject.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Hydrographic land cover default style</se:Title> <se:Abstract>Shore areas are portrayed as pale yellow (#FFFFCC) surfaces; wetlands are depicted with blue-green (#00CCCC) surfaces and glaciers and snowfields are rendered filled white (#FFFFFF) polygons with a solid blue (#3333CC) border with stroke width of 1 pixel.</se:Abstract> </se:Description> <se:FeatureTypeName>Shore</se:FeatureTypeName> <se:Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#FFFFCC</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:FeatureTypeName>Wetland</se:FeatureTypeName> <se:Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#00CCCC</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:FeatureTypeName>GlacierSnowfield</se:FeatureTypeName> <se:Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="Fill">#FFFFFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>

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Minimum & maximum scales	No scale limits

Table 19: Default styles for the spatial data theme Sea regions

Default Style	
Layer Name	HY.OceanRegion
Style Name	HY.OceanRegion.Default
Style Title	Hydrographic sea regions default style
Style Description	Sea waters are portrayed by light blue (#CCFFFF) polygons without border.
Symbology	<pre> <sld:NamedLayer> <se:Name>SR.HydroObject</se:Name> <sld:UserStyle> <se:Name>SR.HydroObject.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Hydrographic sea regions default style</se:Title> <se:Abstract>Sea waters are portrayed by light blue (#CCFFFF) polygons without border.</se:Abstract> </se:Description> <se:FeatureTypeName>OceanRegion</se:FeatureTypeName> <se:Rule> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits

Table 20: Default styles for the spatial data theme Area management/restriction/regulation zones and reporting units

Default Style	
Layer Name	HY.Reporting.WFDRiver
Style Name	HY.Reporting.WFDRiver.Default
Style Title	WFD River default style
Style Description	For reporting purposes WFDRiver are portrayed by a solid line with stroke width of 2 pixels if they are classified as main and of 3 pixels if they are large. The colour of the line is magenta (#CC0099) if they are artificial, orange (#FF9900) if they are considered heavily modified; otherwise is blue (#33CCFF).
Symbology	<pre> <sld:NamedLayer> <se:Name>AM.WaterFrameworkDirective.WFDRiver</se:Name> <sld:UserStyle> <se:Name>I AM.WaterFrameworkDirective.WFDRiver.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> </pre>

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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	<pre> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>WFD River default style</se:Title> <se:Abstract>For reporting purposes WFDRiver are portrayed by a solid line with stroke width of 2 pixels if they are classified as main and of 3 pixels if they are large. The colour of the line is magenta (#CC0099) if they are artificial, orange (#FF9900) if they are considered heavily modified; otherwise is blue (#33CCFF).</se:Abstract> </se:Description> <se:FeatureTypeName>WaterFrameworkDirective.WFDRiver</se:FeatureTypeName > <se:Rule> <ogc:Filter> <!--LARGE and ARTIFICIAL rivers--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#CC0099</se:SvgParameter> <se:SvgParameter name="stroke-width">3</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--LARGE and HEAVILYMODIFIED rivers--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#FF9900</se:SvgParameter> <se:SvgParameter name="stroke-width">3</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--LARGE and not artificial neither heavilyModified rivers--> <ogc:and> <se:PropertyIsEqualTo> </pre>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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```


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--	--

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Minimum & maximum scales	No scale limits
Layer Name	HY.Reporting.WFDLake
Style Name	AM.WaterFrameworkDirective.WFDLake.Default
Style Title	WFD Lake default style
Style Description	For reporting purposes WFDLake are portrayed by a solid blue (#CCFFFF) polygon with blue (#33CCFF) border of 1 pixels width if they are classified as main and of 2 pixels if they are large, otherwise without border. Instances classified as artificial are filled with magenta (#CC0099) horizontal lines with stroke width of 2 pixels; if they are not artificial but heavilyModified will be filled with orange (#FF9900) vertical lines with stroke width of 2 pixels.

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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Symbology	<pre> <sld:NamedLayer> <se:Name>Am.WaterFrameworkDirective.WFDLake</se:Name> <sld:UserStyle> <se:Name>AM.WaterFrameworkDirective.WFDLake.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>WFD Lake default style</se:Title> <se:Abstract>For reporting purposes WFDLake are portrayed by a solid blue (#CCFFFF) polygon with blue (#33CCFF) border of 1 pixel width if they are classified as main and of 2 pixels if they are large, otherwise without border. Instances classified as artificial are filled with magenta (#CC0099) horizontal lines with stroke width of 2 pixels; if they are not artificial but heavilyModified will be filled with orange (#FF9900) vertical lines with stroke width of 2 pixels.</se:Abstract> </se:Description> <se:FeatureTypeName>WaterFrameworkDirective.WFDLake</se:FeatureTypeName> <se:Rule> <ogc:Filter> <!--LARGE and ARTIFICIAL lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../artificial1.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">2</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--LARGE and HEAVILYMODIFIED lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> </se:Rule> </pre>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 115

	<pre> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../ heavilyModified1.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">2</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--LARGE and not artificial neither heavilyModified lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">2</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--MAIN and ARTIFICIAL lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> </pre>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 116

	<pre> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../artificial1.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--MAIN and HEAVILYMODIFIED rivers--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../ heavilyModified1.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> </pre>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 117

	<pre> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--MAIN and not artificial neither heavilyModified lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Not large and not main ARTIFICIAL lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../artificial1.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> </pre>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 118

	<pre> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Not large and not main HEAVILYMODIFIED lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>false </ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../ heavilyModified1.png" /> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Not large and not main not artificial neither heavilyModified lakes--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>large</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>main</ogc:PropertyName> <ogc:Literal>false </ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> </se:Stroke> </pre>
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INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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	<pre> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.Reporting.WFDTransitionalWater
Style Name	HY.Reporting.WFDTransitionalWater.Default
Style Title	WFD Transitional water default style
Style Description	For reporting purposes WFDTransitionalWater are portrayed by a solid gray-blue (#9999CC) polygon without border. Instances classified as artificial are filled with magenta (#CC0099) horizontal lines with stroke width of 2 pixels; if they are not artificial but heavilyModified will be filled with orange (#FF9900) vertical lines with stroke width of 2 pixels.
Symbology	<pre> <sld:NamedLayer> <se:Name>Am.WaterFrameworkDirective.WFDTransitionalWater</se:Name> <sld:UserStyle> <se:Name> AM.WaterFrameworkDirective.WFDTransitionalWater.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>WFD Transitional water default style</se:Title> <se:Abstract>For reporting purposes WFDTransitionalWater are portrayed by a solid gray-blue (#9999CC) polygon without border. Instances classified as artificial are filled with magenta (#CC0099) horizontal lines with stroke width of 2 pixels; if they are not artificial but heavilyModified will be filled with orange (#FF9900) vertical lines with stroke width of 2 pixels.</se:Abstract> </se:Description> <se:FeatureTypeName>WaterFrameworkDirective.WFDTransitionalWater</se:Fea tureTypeName> <se:Rule> <ogc:Filter> <!--ARTIFICIAL transitional water--> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../artificial2.png"/> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--HEAVILYMODIFIED transitional water--> <ogc:and> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> </pre>

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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	<pre> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../ heavilyModified2.png" /> <Format>image/png</Format> </ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Not artificial neither heavilyModified transitional water--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#9999CC</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.Reporting.WFDCoastalWater
Style Name	HY.Reporting.WFDCoastalWater.Default
Style Title	WFD Coastal water default style
Style Description	For reporting purposes WFDCoastalWater are portrayed by a solid blue (#33CCFF) polygon without border. Instances classified as artificial are filled with magenta (#CC0099) horizontal lines with stroke width of 2 pixels; if they are not artificial but heavilyModified will be filled with orange (#FF9900) vertical lines with stroke width of 2 pixels.
Symbology	<pre> <sld:NamedLayer> <se:Name>Am.WaterFrameworkDirective.WFDCoastalWater</se:Name> <sld:UserStyle> <se:Name> AM.WaterFrameworkDirective.WFDCoastalWater.Default</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>WFD Coastal water default style</se:Title> </pre>

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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	<pre> <se:Abstract>For reporting purposes WFDcoastalWater are portrayed by a solid blue (#33CCFF) polygon without border. Instances classified as artificial are filled with magenta (#CC0099) horizontal lines with stroke width of 2 pixels; if they are not artificial but heavilyModified will be filled with orange (#FF9900) vertical lines with stroke width of 2 pixels.</se:Abstract> </se:Description> <se:FeatureTypeName>WaterFrameworkDirective.WFDcoastalWater</se:FeatureT ypeName> <se:Rule> <ogc:Filter> <!--ARTIFICIAL coastal water--> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../artificial3.png"/> <Format>image/png</Format> </se:ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--HEAVILYMODIFIED coastal water--> <ogc:and> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:GraphicFill> <se:Graphic> <se:ExternalGraphic> <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink" xlink:type="simple" xlink:href="http://.../ heavilyModified3.png"/> <Format>image/png</Format> </se:ExternalGraphic> <se:Size> <se:SvgParameter name="size">10</se:SvgParameter> </se:Size> </se:Graphic> </se:GraphicFill> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Not artificial neither heavilyModified coastal water--> </pre>
--	---

	<pre> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>artificial</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>heavilyModified</ogc:PropertyName> <ogc:Literal>>false</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#33CCFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits

11.3 Other Well-defined Styles

Requirement 43 If an INSPIRE view service supports the portrayal of spatial data sets corresponding to the spatial data themes *Hydrography*, apart from the default styles specified in Section 11.2, it shall also support the well-defined styles specified in this section.

Table 21: Other well-defined styles for the spatial data theme *Hydrography*

Well-defined Style	
Layer Name	HY.PhysicalWaters.Waterbodies
Style Name	HY.PhysicalWaters.Waterbodies.Persistence
Style Title	Water bodies persistence style
Style Description	Physical waters as watercourses or standing water are depicted taking into account their water persistence. Perennial water bodies are depicted using the INSPIRE default style and non-perennial are depicted with dashed lines or dashed border areas.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.PhysicalWaters.Waterbodies</se:Name> <sld:UserStyle> <se:Name>HY.PhysicalWaters.Waterbodies.Persistence</se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Water bodies persistence style</se:Title> <se:Abstract>Physical waters as watercourses or standing water are depicted taking into account their water persistence. Perennial water bodies are depicted using the INSPIRE default style and non-perennial are depicted with dashed lines or dashed border areas.</se:Abstract> </se:Description> <se:FeatureTypeName>PhysicalWaters.Watercourse</se:FeatureTypeName> <se:Rule> <ogc:Filter> <!--Delineation is known and PERENNIAL--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>delineationKnown</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> </pre>

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	<pre> <se:PropertyIsEqualTo> <ogc:PropertyName>persistence</ogc:PropertyName> <ogc:Literal>perennial</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Delineation is known and INTERMITTENT--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>delineationKnown</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>persistence</ogc:PropertyName> <ogc:Literal>intermittent</ogc:Literal> </se:PropertyIsEqualTo> </ogc:and> </ogc:Filter> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> <se:SvgParameter name="stroke-dasharray">10 5 10 5</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> <se:SvgParameter name="stroke-dasharray">10 5 10 5</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--Delineation is know, and DRY or EPHEMERAL--> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>delineationKnown</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <ogc:or> <se:PropertyIsEqualTo> <ogc:PropertyName>persistence</ogc:PropertyName> <ogc:Literal>ephemeral</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>persistence</ogc:PropertyName> </pre>
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      </se:PropertyIsEqualTo>
    </ogc:or>
  </ogc:and>
</ogc:Filter>
<se:LineSymbolizer>
  <se:Geometry>
    <ogc:PropertyName>geometry</ogc:PropertyName>
  </se:Geometry>
  <se:Stroke>
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    <se:SvgParameter name="stroke-width">1</se:SvgParameter>
  </se:Stroke>
  <se:SvgParameter name="stroke-dasharray">5 5 5
5</se:SvgParameter>
</se:LineSymbolizer>
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  </se:Geometry>
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    <se:SvgParameter name="stroke-dasharray">5 5 5
5</se:SvgParameter>
  </se:Stroke>
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</se:Rule>
<se:FeatureTypeName>PhysicalWaters.StandingWater</se:FeatureTypeName>
<se:Rule>
  <ogc:Filter>
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      <ogc:Literal>perennial</ogc:Literal>
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  </ogc:Filter>
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</se:Rule>
<se:Rule>
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  </ogc:and>
</ogc:Filter>
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```

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
TWG-HY	INSPIRE Data Specification on <i>Hydrography</i>	2010-04-26	Page 125

	<pre> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> <se:SvgParameter name="stroke-dasharray">10 5 10 5</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!-- DRY or EPHEMERAL, only polygons --> <ogc:or> <se:PropertyIsEqualTo> <ogc:PropertyName>persistence</ogc:PropertyName> <ogc:Literal>ephemeral</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>persistence</ogc:PropertyName> <ogc:Literal>dry</ogc:Literal> </se:PropertyIsEqualTo> </ogc:or> </ogc:Filter> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> <se:SvgParameter name="stroke-dasharray">5 5 5 5</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.PhysicalWaters.Waterbodies
Style Name	HY.PhysicalWaters.Waterbodies.Man.Made
Style Title	Water bodies man-made style
Style Description	Physical waters as watercourses or standing water are depicted taking into account if they are natural or man-made. Natural water bodies are depicted using the INSPIRE default style and man-made are depicted if they are curves with dark blue (#0066FF) colour; if they are surfaces or points are depicted with black (#000000) borders.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.PhysicalWaters.Waterbodies</se:Name> <sld:UserStyle> <se:Name>HY.PhysicalWaters.Waterbodies.Man.Made </se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Water bodies man-made style</se:Title> <se:Abstract>Physical waters as watercourses or standing water are depicted taking into account if they are natural or man-made. Natural water bodies are depicted using the INSPIRE default style and man-made are depicted if they are curves with dark blue colours; if they are surfaces or points are depicted with black (#000000) borders.</se:Abstract> </se:Description> <se:FeatureTypeName>PhysicalWaters.Watercourse</se:FeatureTypeName> <se:Rule> <ogc:Filter> <!-- Delineation is known, NATURAL --> <ogc:and> <se:PropertyIsEqualTo> <ogc:PropertyName>delineationKnown</ogc:PropertyName> <ogc:Literal>true</ogc:Literal> </se:PropertyIsEqualTo> <se:PropertyIsEqualTo> <ogc:PropertyName>origin</ogc:PropertyName> <ogc:Literal>natural</ogc:Literal> </pre>

INSPIRE	Reference: INSPIRE DataSpecification_HY_v3.0.1.pdf		
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```

        </se:PropertyIsEqualTo>
      </ogc:and>
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  </se:Stroke>
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  <se:Geometry>
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  </se:Fill>
</se:PolygonSymbolizer>
</se:Rule>
<se:Rule>
  <ogc:Filter>
    <!--Delineation is known, MANMADE -->
    <ogc:and>
      <se:PropertyIsEqualTo>
        <ogc:PropertyName>delineationKnown</ogc:PropertyName>
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      </se:PropertyIsEqualTo>
      <se:PropertyIsEqualTo>
        <ogc:PropertyName>origin</ogc:PropertyName>
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<se:FeatureTypeName>PhysicalWaters.StandingWater</se:FeatureTypeName>
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      <ogc:PropertyName>origin</ogc:PropertyName>
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        <se:Fill>
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  </se:PointSymbolizer>

```

INSPIRE	Reference: INSPIRE DataSpecification HY v3.0.1.pdf		
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	<pre> </se:Graphic> </se:PointSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> </se:PolygonSymbolizer> </se:Rule> <se:Rule> <ogc:Filter> <!--MAN-MADE--> <se:PropertyIsEqualTo> <ogc:PropertyName>origin</ogc:PropertyName> <ogc:Literal>manMade</ogc:Literal> </se:PropertyIsEqualTo> </ogc:Filter> <se:PointSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Graphic> <se:Mark> <se:WellKnownName>circle</se:WellKnownName> <se:Fill> <se:SvgParameter name="fill">#0066FF</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#0000</se:SvgParameter> </se:Stroke> </se:Mark> <se:Size> <se:SvgParameter name="size">6</se:SvgParameter> </se:Size> </se:Graphic> </se:PointSymbolizer> <se:PolygonSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Fill> <se:SvgParameter name="fill">#CCFFFF</se:SvgParameter> </se:Fill> <se:Stroke> <se:SvgParameter name="stroke">#0000</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:PolygonSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	No scale limits
Layer Name	HY.PhysicalWaters.LandWaterBoundary
Style Name	HY.PhysicalWaters.LandWaterBoundary
Style Title	Land water boundary well defined style
Style Description	The contact line between a land mass and a water body is portrayed by a solid blue (#33CCFF) if its origin is natural if not will be a solid black (#000000) line with stroke width of 1 pixel.
Symbology	<pre> <sld:NamedLayer> <se:Name>HY.PhysicalWaters.Waterbodies</se:Name> <sld:UserStyle> <se:Name>HY.PhysicalWaters.LandWaterBoundary </se:Name> <sld:IsDefault>1</sld:IsDefault> <se:FeatureTypeStyle version="1.1.0"> <se:Description> <se:Title>Land water boundary well defined style</se:Title> <se:Abstract>The contact line between a land mass and a water body is portrayed by a solid blue (#33CCFF) if its origin is natural if not will be a </pre>

	<pre> solid black (#000000) line with stroke width of 1 pixel.</se:Abstract> </se:Description> <se:FeatureTypeName>PhysicalWaters.LandWaterBoundary</se:FeatureTypeName> > <se:Rule> <ogc:Filter> <se:PropertyIsEqualTo> <ogc:PropertyName>origin</ogc:PropertyName> <ogc:Literal>natural</ogc:Literal> </se:PropertyIsEqualTo> </ogc:Filter> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#33CCFF</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> </se:Rule> <se:Rule> <se:ElseFilter/> <se:LineSymbolizer> <se:Geometry> <ogc:PropertyName>geometry</ogc:PropertyName> </se:Geometry> <se:Stroke> <se:SvgParameter name="stroke">#000000</se:SvgParameter> <se:SvgParameter name="stroke-width">1</se:SvgParameter> </se:Stroke> </se:LineSymbolizer> </se:Rule> </se:FeatureTypeStyle> </sld:UserStyle> </sld:NamedLayer> </pre>
Minimum & maximum scales	> 1:500.000



11.4 Layers organization

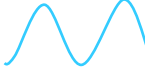






















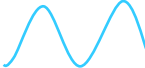



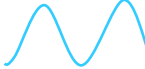
No specific layer organization is used by the theme *Hydrography*.
























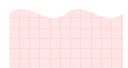










11.5 Symbology

Colours and symbols are base on existing maps, but as the data set visualization will be through network services; consequently, portrayal rules use safe hexadecimal colour codes, non-dithering colours. Nevertheless the data appearance depends on the calibration device (screen, printer or plot) and the user perception of colours.

Table 22: Legend

Feature Type	Style	Symbology
Watercourse	Default	 

Feature Type	Style	Symbology
	Persistence	<i>Perennial</i>  
		<i>Intermittent</i>  
		<i>Dry / Ephemeral</i>  
	Man-made	<i>Natural</i>  
		<i>Man-made</i>  
Standing Waters	Default	 
	Persistence	<i>Perennial</i>  
		<i>Intermittent</i>  
		<i>Dry / Ephemeral</i>  
	Man-made	<i>Natural</i>  
		<i>Man-Made</i>  
Land Water Boundary	Default	
	Man-made	<i>Natural</i> 
		<i>Man-Made</i> 
Drainage Basin	Default	
River Basin	Default	
Watercourse Link	Default	

Feature Type	Style	Symbology
HydroNode	Default	<i>Outlet / Junction / source</i>  <i>FlowConstriction / Regulation</i>  <i>Boundary</i> 
Rapids	Default	  
Falls	Default	  
Crossing	Default	<i>Bridge</i>   
DamOrWeir	Default	  
Lock	Default	  
ShoreLineConstruction	Default	  
Ford	Default	  
SpringOrSeep	Default	
VanishingPoint	Default	
Shore	Default	
Wetland	Default	
GlacierSnowfield	Default	
OceanRegion	Default	
WFDRiver	Default	<i>LARGE Artificial</i>  <i>HeavilyModified</i>   



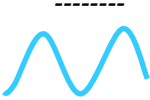
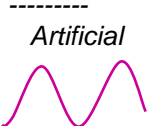

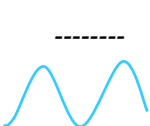





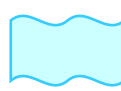












Feature Type	Style	Symbology		
		MAIN <i>Artificial</i> 	<i>HeavilyModified</i> 	
				
WFDLake	Default	LARGE <i>Artificial</i> 	<i>HeavilyModified</i> 	
		MAIN <i>Artificial</i> 	<i>HeavilyModified</i> 	
				
WFDTransition alWaters	Default			
WFDCoastalW aters	Default			

Table 23: Colour chart

Colour Hexadecimal code

	#CCFFFF
	#33CCFF
	#0066FF
	#33FFFF
	#3333CC
	#00CCCC
	#FFFFCC
	#FFFFFF

Colour Hexadecimal code

	#000000
	#666666
	#999999
	#CCCCCC
	#FFCCCC
	#CC0099
	#FF9900

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- [DS-D2.6] INSPIRE DS-D2.6, Methodology for the development of data specifications, v3.0, http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf
- [DS-D2.7] INSPIRE DS-D2.7, Guidelines for the encoding of spatial data, v3.0, http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.7_v3.0.pdf
- [DS-D2.8.I.3] INSPIRE DS-D2.8.I.3, INSPIRE Data Specifications on Geographical Names – Guidelines, v3.0
- [ISO 19101] EN ISO 19101:2005 Geographic information – Reference model (ISO 19101:2002)
- [ISO 19103] ISO/TS 19103:2005, Geographic information – Conceptual schema language
- [ISO 19107] EN ISO 19107:2005, Geographic information – Spatial schema (ISO 19107:2003)
- [ISO 19108] EN ISO 19108:2005 Geographic information - Temporal schema (ISO 19108:2002)
- [ISO 19111] EN ISO 19111:2007 Geographic information - Spatial referencing by coordinates (ISO 19111:2007)
- [ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)
- [ISO 19118] EN ISO 19118:2006, Geographic information – Encoding (ISO 19118:2005)
- [ISO 19135] EN ISO 19135:2007 Geographic information – Procedures for item registration (ISO 19135:2005)
- [ISO 19139] ISO/TS 19139:2007, Geographic information – Metadata – XML schema implementation
- [OGC 06-103r3] Implementation Specification for Geographic Information - Simple feature access – Part 1: Common Architecture v1.2.0

Reference material used in the creation of this specification

ATKIS, DLM Feature catalogue

CCM, River and Catchment database

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CNIG, Evaluation des produits publics d'information géographique en regard des critères définissant un référentiel

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ESRI, ArcHydro

ESRI, ArcMarine

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Eurogeographics, EuroRegionalMap Specification and Data Catalogue

Eurogeographics, Eurospec draft feature catalogue hydrography

Eurogeographics, GiMoDig Global Schema specification

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IGN, BD Carto, Uni, Topo, Carthage

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Nato, Additional Military Layers

Ordnance Survey, OS MasterMap Topography Layer - user guide and technical specification

Ravi; NCGI, NEN3610 - Basic scheme for geo-information

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SeaZone Solutions Ltd, Seazone Hydrospatial

Sitad SP, Progetto evoluzione del SIRI Glossario

Stanli, SS 63 70 08 Geographic information - Surface water systems - Conceptual model and Application schema

US Naval Oceanographic Office (USNOO), Generic Sensor Format library

USGS, NHD; National Map Fact Sheet - Hydrography

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Annex A (normative)

Abstract Test Suite

Any dataset conforming to this INSPIRE data specification shall meet all requirements specified in this document.

NOTE A common abstract test suite including detailed instructions on how to test each requirement will be added at a later stage.

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Annex B (informative) Background and use

B.1 Introduction

During the development of this data specification, the members of the Thematic Working Group (TWG) involved have had many discussions that have led to the current data specification. The previous chapters do clearly indicate how the data has to be structured but do not give this additional background information. This chapter attempts to give additional information on specific subjects encountered during the creation of this data specification that may be useful when creating a data set that is compliant with this specification.

B.2 Use cases

During the development of this data specification, the TWG has gone through a number of steps. During these steps the user requirements as well as existing reference, documentation was analyzed. Another important step was the development of use cases. This data specification is a direct result of these use cases and some knowledge of the use cases may lead to a better understanding of modelling decisions taken during the development of the data specification.

The TWG developed three major use cases for hydrographic data; these are:

- Mapping
- Reporting
- Modelling & spatial analyses

These use cases are generic and require more information than just the hydrographic information. The following paragraphs give a short overview of the data requirements and background that the TWG has considered when developing the data specification. It gives more insight into the distribution of attributes in the current data specification.

For all use cases TWG Hydrography found that similar backgrounds were needed; many of them coming from EU directives / legislation. Amongst these are:

- 2000/60/EC (Water Framework Directive)
- Flood risk management COM(2004)472 final
- Directive 2006/7 (Bathing waters)
- Directive 92/43/EEC (Habitats)
- Directive 79/409/EEC (Birds)
- Directive 91/676/EEC (Nitrate)
- Directive 96/61/EC concerning integrated pollution prevention and control
- WISE GIS Guidance
- Eurostat GISCO

B.2.1 Use case: Mapping of physical objects

The representation of all main hydrographic elements, both natural and artificial, is needed to provide a map background for orientation and to understand place relationship. One of the main purposes of maps is to inform the public (understandable form, effective communication). An example is the overlaying of flood risk information on a background map as displayed in the following Use Case diagram.

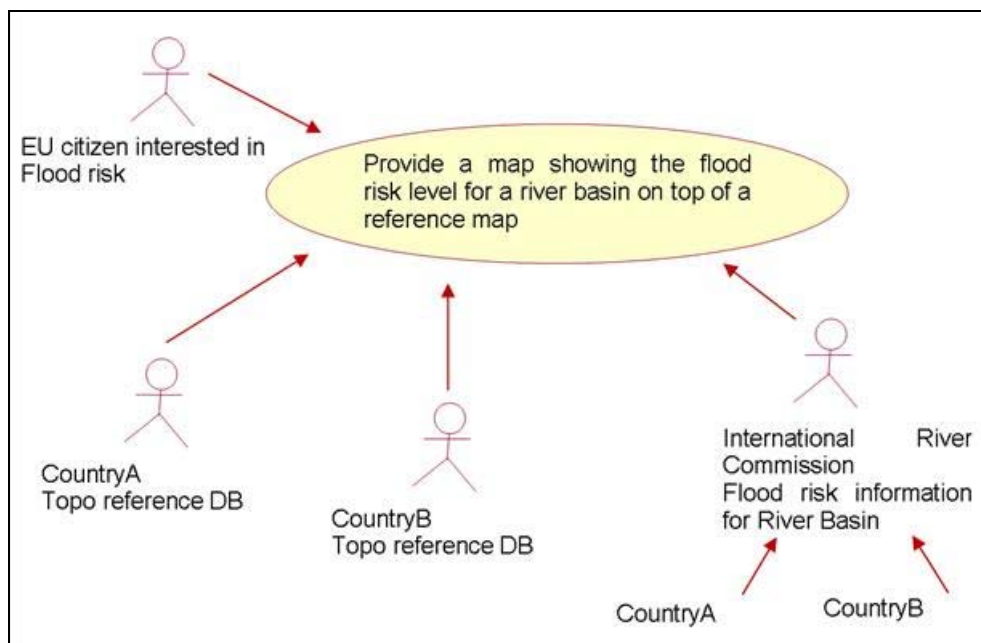


Figure 1 – Use case mapping.

Data requirements	<ul style="list-style-type: none"> • Main hydrographic elements, both natural and artificial; Facilities and constructions; • Other topographic reference data, like transportation network and settlements • Name and position of the hydrographic element that enable users to plot and symbolize features • Identification of river basin, the hydrographic element belongs to
Dimension	European, cross-border and national
Cross-thematic	to provide background information together with themes Administrative Units, Transport Networks, Geographical Names and Protected Sites.

B.2.2 Use case: Reporting

It is neither intended nor a goal of the INSPIRE directive to take over and organize the reporting duties of Member States on EU directives. INSPIRE intends to build an infrastructure that helps to organize and implement reporting structures for decentralized European data structures. Reports are however always given in relation to existing geographical structures; even though the reporting units themselves may differ from these due to specific legislation.

Data requirements	<p>Depend on the specific directive / reporting requirement. Examples of identified data requirements:</p> <p>2000/60/EC (Water Framework Directive)</p> <ul style="list-style-type: none"> - main rivers (names) - river basin districts - competent authority (name & address) - surface water bodies (name, ID, category, artificial / heavily modified, status) - ground water bodies (ID, status) - water abstraction points - ecoregions - protected areas - monitoring networks <p>COM/2004/474 – final (Flood risk Management):</p> <ul style="list-style-type: none"> - flood risk zones - river basin
Dimension	European, cross-border (and national)

Cross-thematic	Create a framework to report information from other Annex Themes (risk zones, environmental monitoring etc.)
----------------	--

B.2.3 Use case: Spatial Analyses & Modelling

To enable GIS-based analysis and modelling for the following applications (list is exemplary):

- a) Hydrology, water supply / drought
- b) Morphology
- c) Flood control / risk assessment
- d) Environmental Impact Analysis
- e) Spatial planning

Data requirements	<ul style="list-style-type: none"> Connectivity between other applications / themes Closed and complete river network (from spring to mouth; without any gaps for lakes, transitional waters and e.g. glaciers) Water flow direction. Information about the direction of waterflow, when combined with other data, enables users to model the transport of materials in hydrographic networks, such as contaminants. Stream addresses. Linear reference information helps to link observed phenomena samples to hydrographic features. Certain attributes that can vary depending on the modelling
Dimension	Cross-border and national, hydrological units
Cross-thematic	Input information from <ul style="list-style-type: none"> other INSPIRE themes user specific data

The following diagram shows the interaction between the modelling process for flood risk management and the subsequent reporting. There is also an interaction with the mapping process as described before.

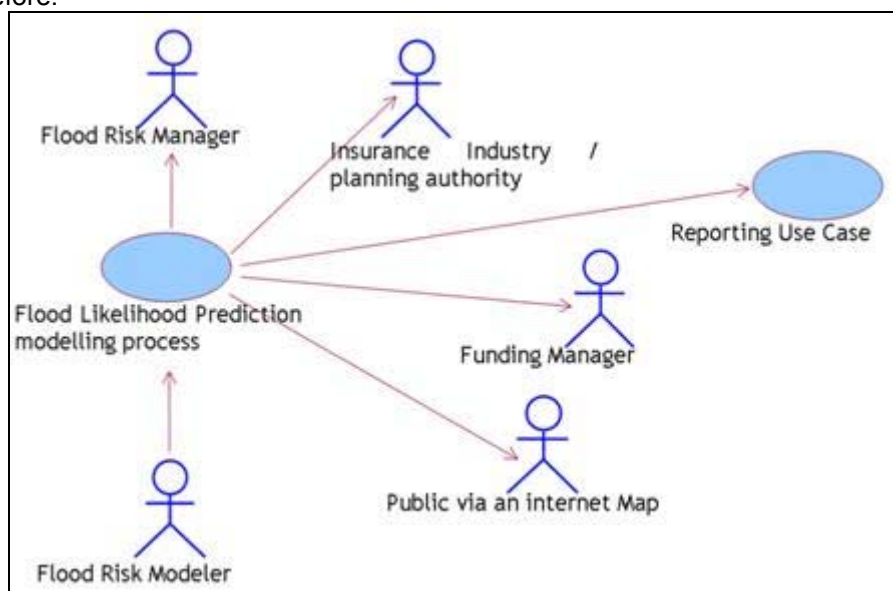


Figure 2 – Use case reporting.

B.3 Data model background

This chapter describes specific issues and the way they have been addressed during the modelling phase by the Thematic Working Group. The issues described here are mainly for informative purposes; the exact way of modelling etc can be found in the normative chapters.

B.3.1 Physical waters / related objects

B.3.1.1 Selection of features

Before starting to model the physical waters and related objects, several maps at different scales and from different countries have been reviewed to get an idea what kind of hydrographic elements are represented. Note: Quite often map legends do not include all features present on the map. Map features, like sea, river and lake are not explained in the map legends as they seem to be "commonly known features".

Another input into the selection of features was a brainstorm held with the members of the TWG that led to a selection of features that have (potential) importance in the water network.

B.3.1.2 Level of detail

One of the major problems to be dealt with when portraying information from different sources is resolution, which means the model should be useful at a certain level of detail. Similarly; depending on the level of detail of a certain source dataset it may or may not include a specific feature or will display the geometry differently (e.g. a small lake may be represented as a point on a small scale or as a surface at a large scale).

Reference material provided to the TWG has information at several resolutions, from 1:1000 till 1:1,000,000 scale. However, it is not possible to take into account such a wide range of scales as multiple-representation and generalization are research fields. Instead the TWG has chosen to document the level of detail / scale rather than prescribe a scale. This attribute is only available for those objects that can have multiple representation (e.g. can have different geometries). For all other objects, the generic metadata element can be used to describe the scale / resolution level of the dataset as a whole.

B.3.1.3 Physical waters

B.3.1.3.1 Watercourse / standing water / sea

The physical surface waters can be classified in different ways; e.g. according to:

- Feature type (e.g. river, canal, ditch)
- Tidal regime
- Salinity
- Artificial / natural
- Streaming / non streaming
- Geometric shape (linear / surface)
- Navigability
- ...

A first approach of the TWG was to create a classification of different feature types. In practice this proved difficult since what in one Member State is classified as canal can well be a ditch in others. As a result it was decided to use a two-fold approach. The first is to classify the water type according to a few specific parameters:

- Geometry type: Linear (Watercourse) and Surface (Standing Water).
- Origin: Natural or man-made.
- Persistence: e.g. tidal, seasonal, dry etc

Using this approach (together with the tidal type attribute for a watercourse) it is felt by TWG Hydrography that all watercourses can be classified for mapping purposes. The second part of the approach is to allow for a localized water type. The localized type represents the type given by the member state / data supplier to that type of water and is exchanged in the original language or

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alternatively in an exact translation into English. The TWG uses this approach to ensure similar mapping of the same feature across borders while still allowing local differences needed for local water management to be usable.

In this sense a lake would be identified by the localtype “lake” and would be of the subtype StandingWater with the attributes Origin: natural and the appropriate persistence. A reservoir would be coded similarly but with origin: man-made. A similar approach can be followed for watercourses, resulting in e.g.:

natural: river, stream, brook, creek
artificial: canal, ditch, moat, flume

The seas are not modelled using the approach above; the main reason for this is that the sea (OceanRegion) belongs in Annex III and as such is only a placeholder for the hydrography model. The more generic name of OceanRegion was chosen to include all the other surface waters other than groundwater; watercourses / standing waters; wetlands and glaciers / snowfields. Transitional waters are identified as watercourses with a specific persistence and tidal regime. The point where a transitional water becomes an OceanRegion is usually not clearly defined, but overlap between these should be avoided (i.e. the OceanRegion begins where the watercourse ends).

There are no rules in this specification on how a watercourse should be broken into smaller pieces. This will of course vary with data suppliers but will also depend on the relation with the network and reporting units. It is possible to build a reporting unit e.g. from sections of watercourse and / or standing water, through a common identification in the base HydroObject. A number of these sections would then form e.g. a WFDRiver or WFDLake. In a similar manner the watercourse geometry can be reused for the watercourselinks in the network part of the model. Such geometry re-use must be implemented by the data provider, it is not explicitly modelled.

B.3.1.3.2 LandWaterBoundary, Shore and Embankment

TWG Hydrography identified early in the modelling process that there are two different types of line identified where land goes into sea. The first is the natural boundary; the other is a socio-political boundary. Where adjoining the sea the boundary is usually called coastline; when adjoining an inland water it is called the shoreline.

Hydrography is only involved with the natural coastline / riverbank whereas administrative units is concerned with the socio-political boundary. As both are referred to as coastline but have different definitions and geographic locations; TWG Hydrography decided to use the more generic term LandWaterBoundary for this feature.

The model makes it possible to indicate whether the LandWaterBoundary was captured relative to a specific waterlevel. This is not so much for identification as it is for cross border matching of these boundaries. Especially where the beach is relatively flat the geographic distance between the two lines can be very large (hundreds of meters) and in these circumstances such a high water boundary should not be joined to a low water boundary.

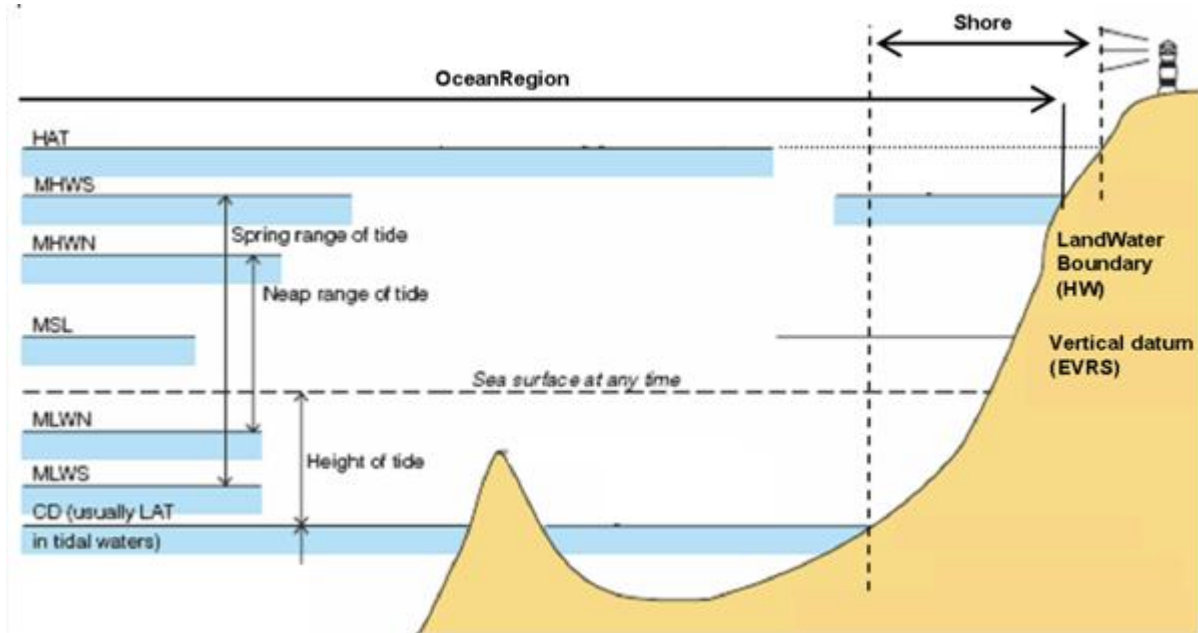


Figure 3 – Shore, LandWaterBoundary and levels in a tidal situation (adapted from IHO H20)

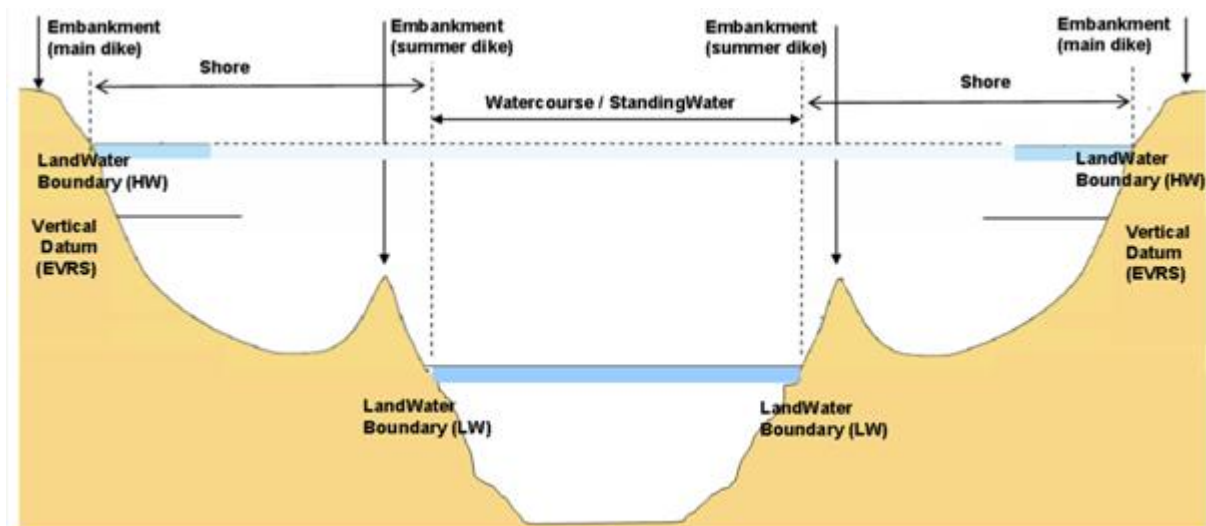


Figure 4 – Shore, LandWaterBoundary and embankment in an inland situation

Sandbanks are not part of the shore; the shore is considered a continuous surface between the high water line and low water line and not interrupted by water areas. Areas such as the Waddensea to the North of the Netherlands, Germany and Denmark can be considered to be part of the foreshore but also of OceanRegion since it is normally covered with water.

If an adequate elevation / depth model of an area exists as well as a model of the various tidal levels for that area, then it is also possible to generate the shore automatically from this information. This option was not chosen since that information is not always available and will change on a frequent basis.

B.3.1.3.3 Harbours / Islands

The Hydrography model does not contain a feature class for harbours or islands. This was discussed within the TWG but it was decided that both were not essential to the use cases identified. From a hydrographic point of view an island is hole in a physical water (StandingWater) potentially surrounded by a LandWaterBoundary and a shore.

Similarly a harbour is physical water with a specific function in terms of e.g. navigation or industry but not from a hydrographic point of view. Harbours are included in their navigation function in the Transport Network theme.

From the above it cannot be concluded that harbours and islands are not part of INSPIRE or even of the Hydrography theme; the conclusion is that they require a specific type of modelling in the light of the hydrographic network and potentially a different type of modelling for other purposes.

B.3.1.3.4 Wetland / Glacier / Snowfield / Inundated land

These features are included in the model to create a complete hydrographic network even though they could also be considered as part of the Annex II/III themes concerned with land cover and natural risk zones. As such no distinction is made between various types of wetlands / glaciers / snowfield as they are only included because water potentially flows into such an area on one side and flows out of it on the other side.

For the same reason saltpans were identified as a important for mapping but not for the hydrographic network and as such do not form part of the theme Hydrography.

Inundated land is different from a wetland; where a wetland is normally 'wet', inundated land is only wet for certain periods of time.

B.3.1.3.5 Polders

Polders and other low-lying areas within dikes or subunits of polders are also considered catchments in this data specification. There is however one major difference between 'regular' catchments and polders; i.e. the polder is a type of catchment where the water cannot flow out of it by gravity but needs to be pumped whilst other catchments can be determined based on elevation differences and have a single flow direction within the catchment.

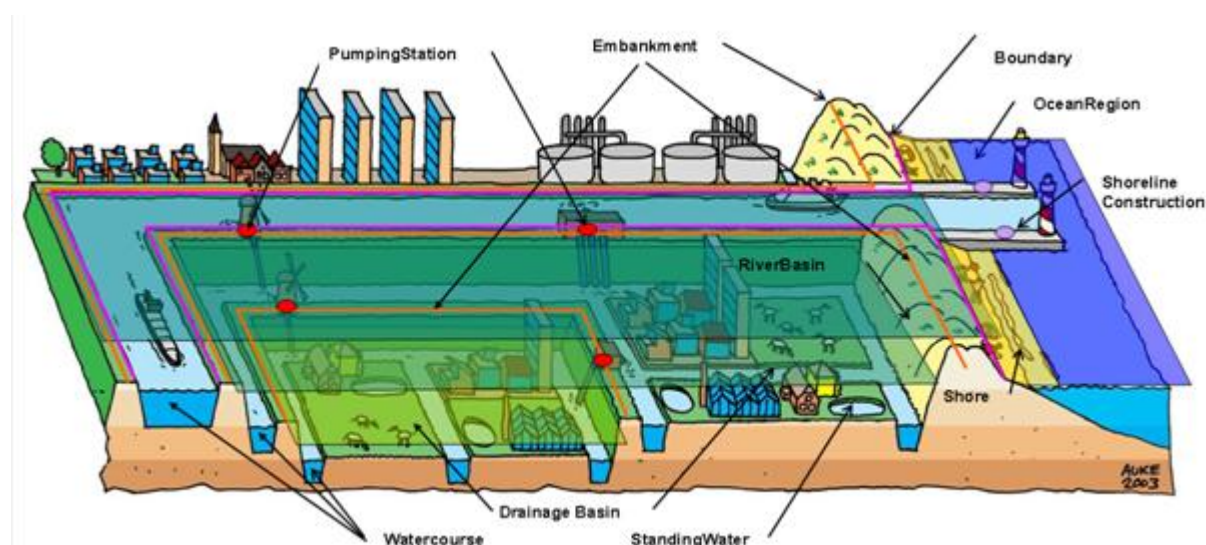


Figure 5 –Modelling of a polder and associated physical waters / related objects

It was decided not to model 'inflow' points into polders because this inflow would be artificial (opening of sluice gates etc). The outflow point of a polder is / are one or more pumping stations.

B.3.1.3.6 River Basin versus River Basin District and Subunits

In this data specification the terms drainage basins and catchment or catchment area are used as synonyms. The drainage basin and river basin in this data specification pertain to the physical catchment area and not to the RiverBasinDistrict or SubUnit as defined in the Water Framework Directive. These last two are administrative units that have no direct relation to the physical catchment and basin; this is therefore not modelled by Annex I theme but is deemed to be part of Annex III theme management and reporting units. This decision is a result from the inclusion of non-basin land that is

assigned to a basin boundary as well as the extension of the RBD boundary to include groundwater bodies and coastal water bodies.

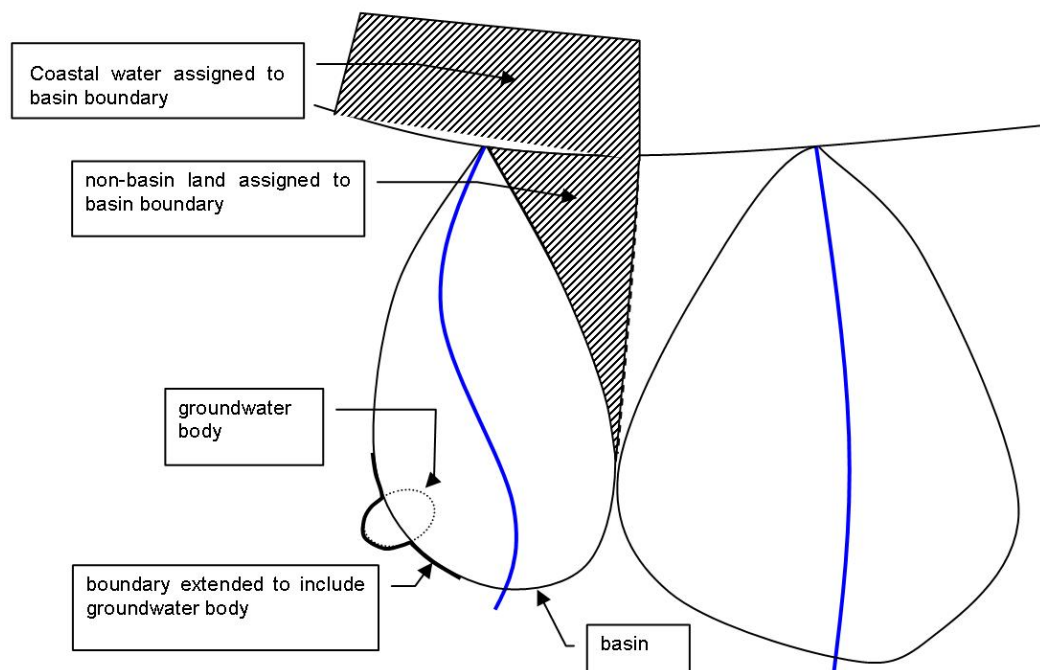


Figure 6 – River basin district boundary versus catchment / basin

The resulting difference between the river basin and the river basin district (RBD) makes the RBD more a reporting unit than a physical feature which should be handled by the appropriate Annex III theme or other EU project (e.g. WISE / SEIS).

B.3.1.3.7 Hierarchy of basins

In discussions within the TWG no clear hierarchy in catchments / sub catchments etc could be made since this will vary with application. The current modelling reflects this and allows the building of larger drainage basins from smaller drainage basins (aggregation).

One special type of drainage basin was identified however; the river basin, which always has an outflow point in sea whilst drainage basin may outflow into e.g. a larger river, lake or other drainage basin.

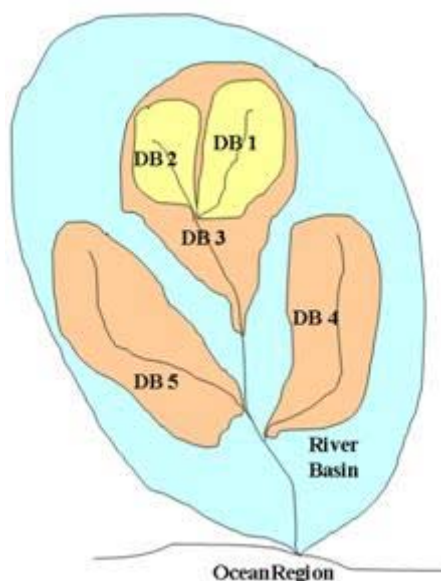


Figure 7 – example of drainage basin vs. river basin

The example above shows how the situation looks in reality. The river basin is the top of the hierarchy and can be split into a number of (sub) drainage basins (CM3, 4 and 5). Drainage basin 3 in turn can be split into even smaller drainage basins (CM 1 and 2) and so on.

B.3.1.3.8 Ordering of streams and basins: Horton-Strahler, Pfaffstetter, etc.

There are various ways of putting a stream order on a physical water and / or basin. Some text on various methods is given here, see hydrology literature for more extensive backgrounds.

Horton-Strahler

"In mathematics, the Strahler number or Horton–Strahler number of a mathematical tree is a numerical measure of its branching complexity. These numbers were first developed in hydrology by Robert E. Horton (1945) and Arthur Newell Strahler (1952, 1957); in this application, they are referred to as the Strahler stream order and are used to define stream size based on a hierarchy of tributaries.

In the application of the Strahler stream order to hydrology, each segment of a stream or river within a river network is treated as a node in a tree, with the next segment downstream as its parent. When two first-order streams come together, they form a second-order stream. When two second-order streams come together, they form a third-order stream. Streams of lower order joining a higher order stream do not change the order of the higher stream. Thus, if a first-order stream joins a second-order stream, it remains a second-order stream. It is not until a second-order stream combines with another second-order stream that it becomes a third-order stream. As with mathematical trees, a segment with index i must be fed by at least $2i - 1$ different tributaries of index 1.

To qualify as a stream a hydrological feature must be either recurring or perennial. Recurring streams have water in the channel for at least part of the year. The index of a stream or river may range from 1 (a stream with no tributaries) to 12 (the most powerful, river, the Amazon, at its mouth). The Ohio River is of order eight and the Mississippi River is of order 10. 80% of the streams and rivers on the planet are first or second order." [Extracted from Wikipedia].

Pfaffstetter code

"The Pfaffstetter approach is recommended for providing a structured hydrological code segment, identifying river basins and river sub basins. The Pfaffstetter system follows a systematic approach as it is derived from topological relationships of the underlying drainage system. The numbering schema is self-replicating from the largest to the smallest drainage system. With Pfaffstetter codes it is possible to identify all nested sub-basins within the larger basin and the "parent" basin from a sub-basin. All upstream sub-basins or river segments as well as all downstream segments are identifiable at each location of the river network

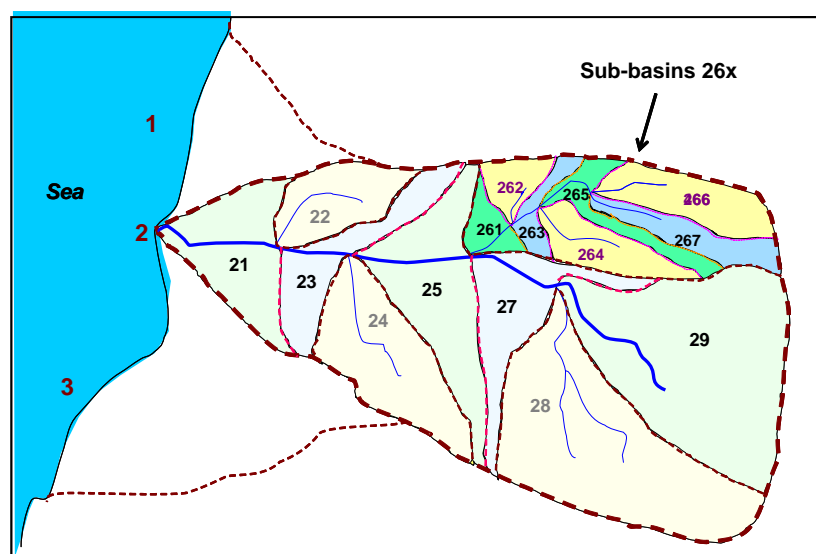


Figure 8 – The Pfafstetter principle of coding drainage-basins and interbasins, illustrated for a hypothetical river basin with code 2. Code 2 indicates the north-eastern primary catchment system within a sea region.

After the recognition of the longest flow path in a given river basin, the four most important tributaries (and drainage-basins) are identified according to their drainage area size. They receive numbers 2, 4, 6, and 8 in upstream order. Interbasins receive odd numbers from 1 to 9, also in upstream order. Drainage-basins and interbasins are then further subdivided according to the same principle. It is important to remind that there is a one to one relationship between a river segment and its catchment. This approach requires the existence of a consistent dataset of catchment areas at European level.

Lakes should be included in the Pfafstetter coding system. If they are connected to the river network, they should receive the Pfafstetter code of the river segment to which they drain (the outlet). If they are not connected to the river network, they should receive the code of the lowest level river (drainage-) basin or interbasin in which they are located. In case that more than one isolated lake is located within one drainage- or interbasin, lakes should be distinguished by a specific identifier.

For the implementation of a Pfafstetter system, the river network must be fully connected also within the lakes (fictitious links).” [Adapted from WISE GIS Guidance]

B.3.1.4 Related Objects

TWG Hydrography has identified a number of objects that are important in either visualization on the map or that have an impact on the flow of water through the hydrographic network.

B.3.1.4.1 Hydrographic points of interest

Special features in this group are the Spring/Seep and the Sinkhole/Vanishing point that identify both the start and the end of the hydrographic network. Quite often the starting point of a watercourse cannot be easily identified; in this case a feature spring/seep is inserted into the network to act as starting point; even when the exact location of the source cannot be identified.

The vanishing point / sinkhole are used to identify the point where a watercourse ends / disappears; for example at the end of a river. It marks the endpoint of the network and as such the vanishing point can be lying in a sea area (end of e.g. a river). Another use of sinkhole / vanishing points is when a watercourse goes underground; the point where it disappears is then identified as the sinkhole / vanishing point whilst the point where it reappears is identified as a spring / seep.

B.3.1.4.2 Man-made objects

This category holds all the objects that are not falling into the category of hydrographic points of interest. These objects have a specific function in relation to the hydrographic network or are important to map. They also serve a function in the network where they define a critical change in the network

that needs to be taken into account. Man-made objects are geographically located in or along the network and have an impact on that network.

In general, man-made objects can have the following type of functions:

- Retain the water (objects parallel to the watercourse such as embankments).
- Regulate the quantity of water (dam / weir; pumping station; hydro power plant)
- Alter the course of the water (lock ; sluice)
- Allow watercourses to cross each other or another object (crossing)

B.3.1.4.3 Crossing

Currently, for mapping purposes the level of the watercourse will define whether it is on ground level or above ground level and allows; together with the man-made object crossing (type: Aqueduct) the correct drawing. In the network, with the grade-separated watercourse crossing there is the option to exactly define how watercourses cross each other at certain points.



Figure 9 – Aquaduct with two watercourses crossing each other (source: www.leestrainer.nl) and aquaduct crossing a road (water still on ground level)

B.3.1.4.4 Network relation

The related objects describe the feature itself but are not directly used to describe the effect these features have on the network model (and therefore e.g. the actual flow). The fact that the features form a constriction in the network is defined through the fact that the related objects can be put into the network with a specific function (hydroNodeCategory) thus defining the actual effect upon the network.

B.3.2 Network model

B.3.2.1 Network model types

A quite extensive discussion has been held on the type of network model needed; with the following options available:

- 1 Schematic or simple network: this provides connectivity (links) but holds no geometry. The nodes are at geographic locations. The links in this type of network are 'fictitious'
- 2 Centreline geometry representation of the network (sometimes referred to as a geometric network). Except for connecting links through e.g. StandingWaters, all the links are 'real – not fictitious'.
- 3 Detailed representation – polygons of wetted area of river. This specific situation is handled by the physical waters application scheme (no connectivity is used)

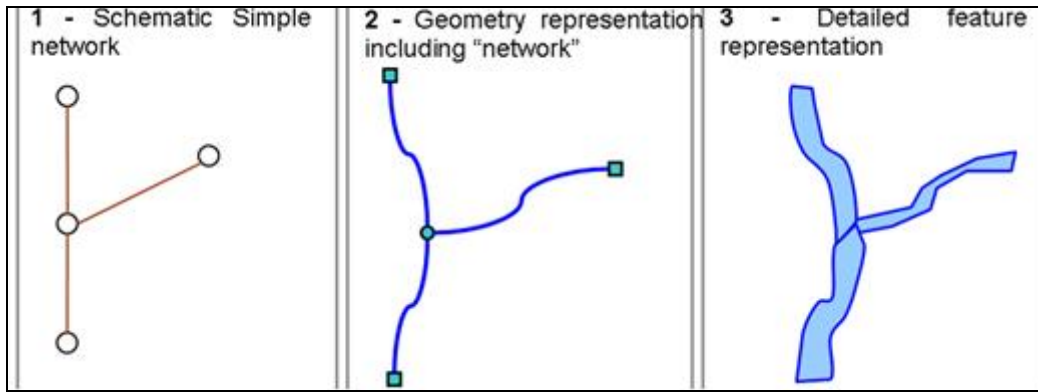


Figure 10 – Network terminology

The current model reflects the second option; the geometric network where the centreline is an "alternative representation" of the watercourse and so it is a spatial object in itself. The various centrelines are connected by 'nodes' that signify a special point. In the case of the hydrographic network the nodes do not only connect the various centrelines but can also represent 'constrictions' in the network such as hydrographic points of interest or man-made objects (see B.3).

The relation between the centrelines, nodes and detailed representations in the model is as follows:

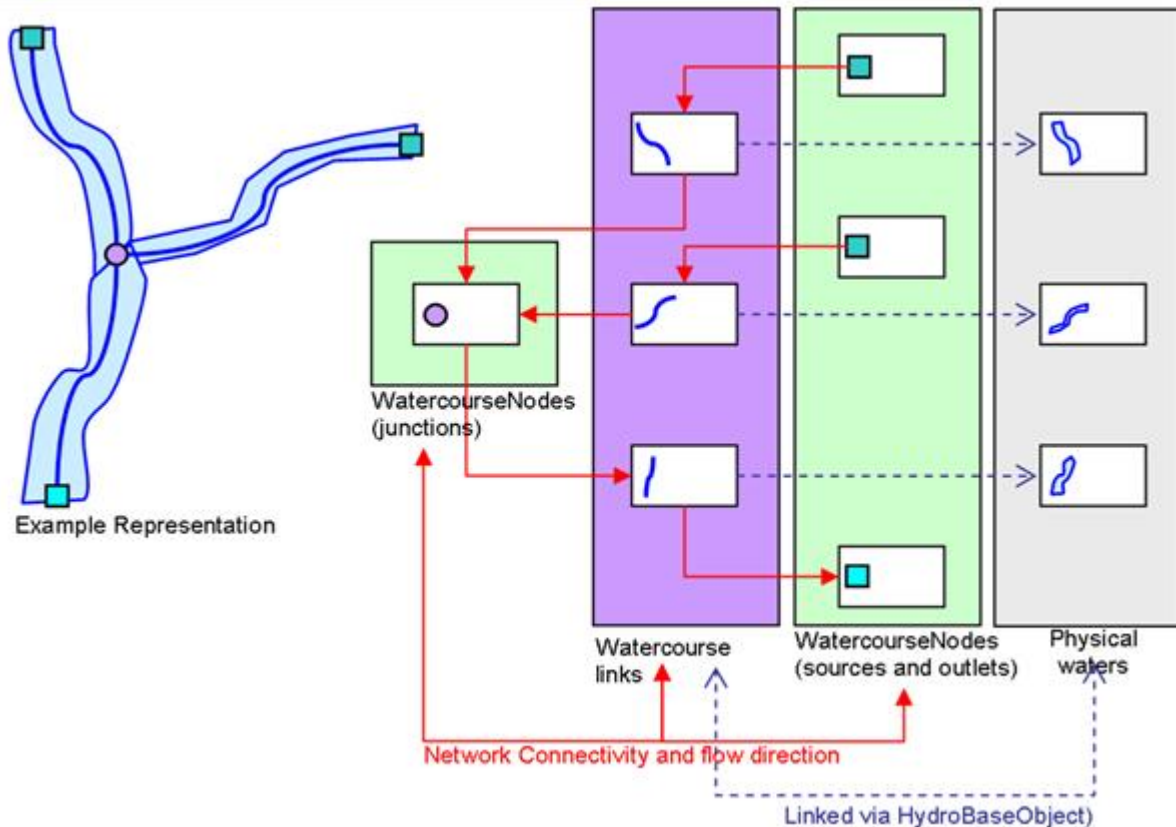


Figure 11 – relation between representation, physical waters / related objects

B.3.2.2 Specific network elements

B.3.2.2.1 WatercourseLinkSequence

There is no possibility to build an entire watercourse from sections using the watercourse class in the physical waters. This can however be done using the WatercourseLinkSequence in the Network part of the model. Of course if sections belong to the same watercourse they should have the same GeographicName indicating them as part of a larger watercourse / surfacewater.

In a similar manner if two watercourses are exchanged that have first a confluence and then a bifurcation, then the central section should only be exchanged once since it is the same physical watercourse. In the network model the central section would be represented by a single watercourseLink. However, that single link could be part of two WatercourseLinkSequences.

B.3.2.2.2 Polder

There is no 'inflow' points into polders in a network model because this inflow would be artificial (opening of sluice gates etc). The outflow point of a polder is a fictitious WatercourseLink connected to a WatercourseNodes with the hydroCategoryType "pump".

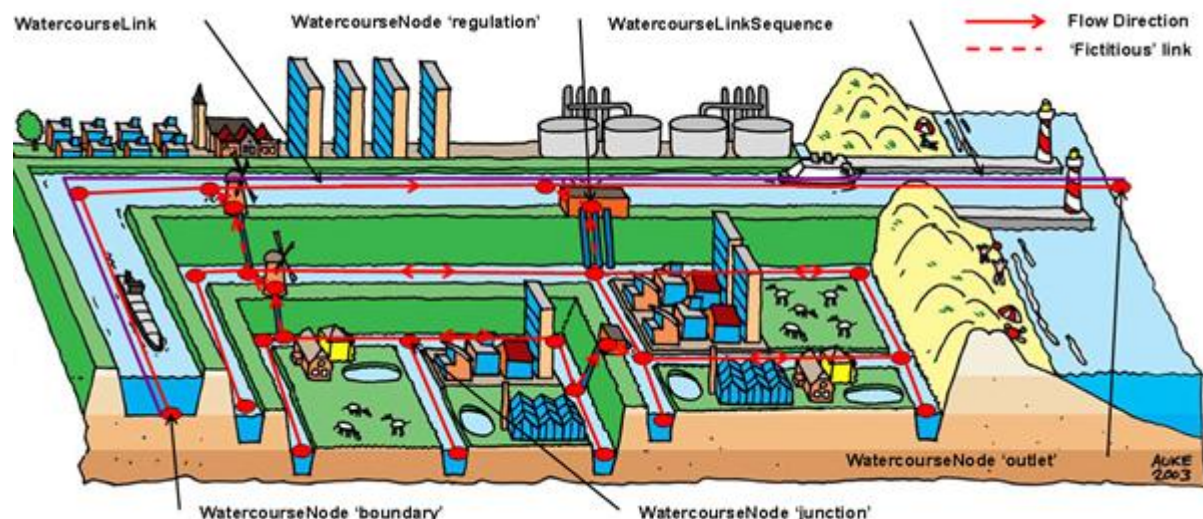


Figure 12 – Network elements in a polder situation

B.3.2.3 Network attributes and types

B.3.2.3.1 Attributes

There are not many attributes on the network features. The reason for this is that attributes are considered to be very application specific, i.e. depending on what is going to be modelled, different attributes will be needed. Therefore, the WatercourseNode has no additional attributes. WatercourseLink has only two attributes; flowDirection and length. Two other attributes are inherited from Network::Link; centerlineGeometry and fictitious. Fictitious should be used to create e.g. lines through a standing water in order to complete the network.

B.3.2.3.2 HydroNodeCategory

Nodes in a network can have different purposes; this is described using the hydroNodeCategory attribute. The table below describes the purpose of the different node categories and to which HydroNodeCategoryType the feature types of HydroPointOfInterest and ManMadeObjects should be mapped into the network.

Purpose or Feature type	HydroNodeCategoryType
SpringOrSeep (Start node)	Source
VanishingPoint (End node)	Outlet
FluvialPoint (Rapids, Falls)	FlowConstriction
Division of watercourse	Junction
Merging of many watercourses into one	Junction
Change of attribute values on a watercourse	n.a.; linear referencing
Embankment, ShorelineConstruction, Ford	FlowConstriction
Lock, Sluice, DamOrWeir	FlowRegulation
PumpingStation, HydroPowerPlant	FlowRegulation
Crossing	n.a.; grade separated crossing
Wetland, InundatedLand, GlacierSnowfield	FlowConstriction
Watercourse crosses a border	Boundary

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B.3.2.4 Data quality elements

In order to build a topologically-sound and closed hydrological network (that can be used for e.g. modelling and network analyses), certain topological consistency rules need to be followed. The Data quality section of this data specification includes eight data quality measures that, if followed, will ensure that the network is topologically-sound and closed.

B.4 Reporting

B.4.1.1 Waterbodies

One of the discussions held in TWG Hydrography pertained to the way of modelling / classifying waterbodies. The starting point for this has been the Water Framework Directive itself, but some modelling options remained open. The TWG has opted for a classification based upon the physical water types (river, lake, transitional, coastal, groundwater) where each type - except groundwater - has two attributes, heavily modified and artificial. Some other models combine the two attributes into a single one; TWG Hydrography decided against this to follow the WFD as closely as possible. A restriction has been placed on the two attributes stating that a waterbody cannot be natural as well as heavily modified.

B.4.1.2 Main rivers / lakes

For reporting under WISE a separation has been made between large and main rivers and lakes. This separation is reflected in the model with the main and large attributes. For canals no such separation is currently available; as such the attributes do not have to be filled when the waterbody is artificial.

B.4.1.3 Waterbody versus physical waters / surfacewater

Where the WFD is concerned, the waterbody is directly related to a physical body of water. The term 'waterbody' was for some member states introduced by the WFD. From a data perspective different approaches have been used to build/create WFD waterbodies by member states. One key element in most approaches is that although waterbodies will follow the geometry of the surface waters; they can begin / end at different locations. The nodes of WFD waterbodies can differ from the nodes of the physical watercourse segments. Another potential issue is that a number of watercourses form a single waterbody for the WFD. The following figure illustrates the relation of physical waters and WFD waterbodies.

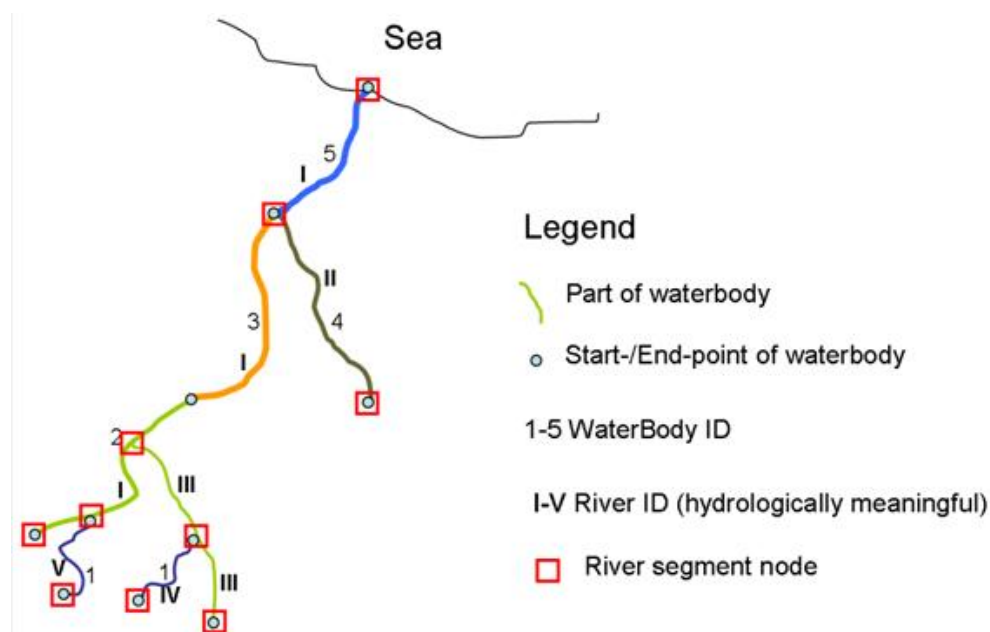


Figure 13 - The relation of physical waters (here: rivers) and WFD River waterbodies

In some member states the solution has been to keep on using the original geometries and use a relational database approach to create the waterbody geometry from these; this is supported in this data specification by referencing the geometry of the watercourse / standing water in the waterbody in the encoding (i.e. the GML 'by-reference' pattern). The other solution is that the waterbody has its own

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geometry which is then managed independently from the geometries of the waters that the waterbody is derived from. This is supported in the specification by giving the waterbody its own geometry. Another option could be the use of linear referencing. TWG Hydrography has identified that this can be a good solution but that this method is, as far as reference material shows, not a common approach in member states. Furthermore the current state of standardisation within e.g. ISO on linear referencing is not sufficiently mature to be considered as a viable solution. When, in the future, user requirements change, this needs to be reconsidered.

B.4.1.4 Extension of INSPIRE reporting units

This data specification only specifies the geometry of the waterbody in addition to some generic attributes. As such it is the framework for reporting. The actual value (e.g. the WFD status or potential of the waterbody) that needs to be reported on is not included in this specification. It is envisioned by the TWG that whenever there is the need for a digital reporting obligation within the EU or member state, that the organization requesting this information will start with this specification as a base model and extend it in such a way that the information to be reported on is included. This can potentially lead to a number of reporting formats that all reference the same definition of waterbody and can as such be related to each other even though reported on independently.

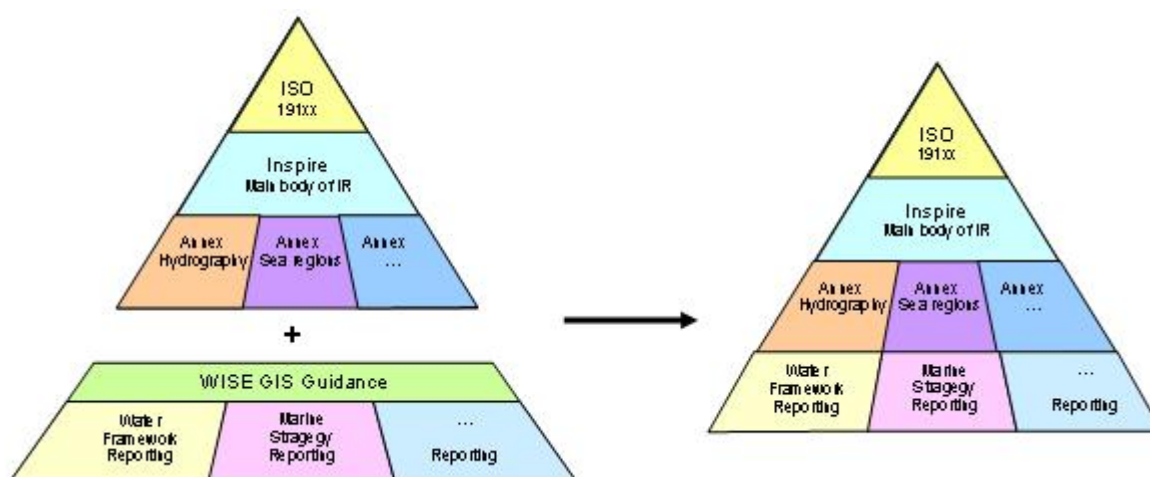


Figure 14 – Combining the current WISE Specification with the INSPIRE IR and data specification

The example below shows how e.g. WFD status or potential can be linked (in UML modelling) to the existing model.

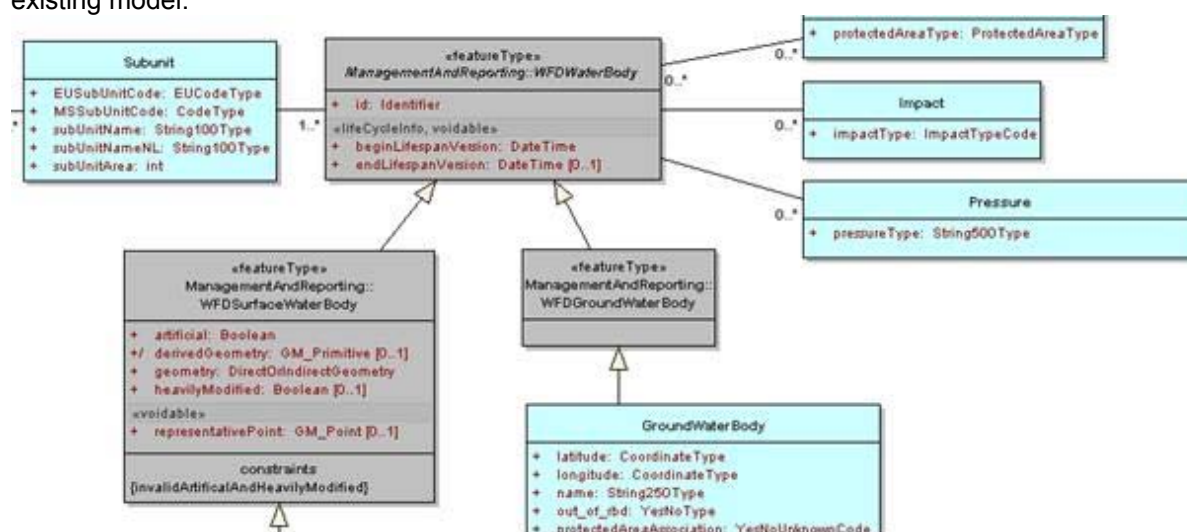


Figure 15 – Detail from the draft WISE UML / INSPIRE integrated model showing a.o. Impact and pressures related to the INSPIRE WFDWaterbody

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B.4.2 Placeholders

Since all INSPIRE themes are interconnected, themes will have overlap with other themes. There are two cases of types being specified that thematically belong to an Annex II or III theme:

- a) Types with a "preliminary specification" (including a proper definition and attributes). These types are essential components of Annex I themes, but thematically belong to an Annex II or III theme (example: Habitat).

These shall not receive a stereotype.

In the UML model they shall be included in a package for the Annex II/III theme, where they thematically belong. They shall be included in the Annex I data specification for the theme that does the preliminary specification (in a section for the Annex II/III package). This section of the Application Schema can be generated by JRC.

In the IR, the types shall be included in the section of the Annex I theme that does the preliminary specification.

- b) Types that serve as a "reminder" for the groups doing the Annex II or III specifications to include some such type (along the lines of the definition given in the Annex I spec), to which there is a (loose) relationship from an Annex I type.

These shall receive the stereotype <<placeholder>>.

They shall have proper definition in order to give the Annex II/III group a good idea of the intention that the Annex I TWG had for that type.

In the UML model and the data specification they shall be included in the package/application schema of the Annex I theme that creates the placeholder type (in a section dedicated to placeholders).

In the IR, these types (and attributes or association roles pointing to them) shall not be included.

For the *Hydrography* the following placeholders were identified. Furthermore a number of feature types were identified that thematically belong to *Hydrography* but that could be of use (as a 'category A' placeholder from Hydrography for themes in Annex II / III).

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FeatureType	HY	Placeholder 'A'	Placeholder 'B'	RelatedThemes not A/B	Remarks
Basin	X			Elevation Energy Resources	
CatchmentArea	X			Elevation Energy Resources	
GlacierSnowfield			LandCover		Combined featurtype that may be split by <i>Land Cover</i> theme into two separate classes
InundatedLand		NaturalRiskZones			From the <i>Hydrography</i> point of view fully specified but may require additional attributes
LandWaterBoundary	X			Elevation	
Shore	X			Sea Regions	
StandingWater	X			Land Cover Land Use Elevation Environmental Monitoring Energy Resources	
Watercourse	X			Land Cover Land Use Elevation Environmental Monitoring	
SurfaceWater	X			Land Cover Land Use Elevation Environmental Monitoring	
OceanRegion		SeaRegions		Oceanographic Geographical Ftrs LandCover	From the <i>Hydrography</i> point of view fully specified but may require additional attributes
Wetland		LandCover			From the <i>Hydrography</i> point of view fully specified but may require additional attributes
Falls	X				
FluvialPoint	X				
HydroPointOfInterest	X				
Rapids	X				
SpringOrSeep			Geology		Defines the boundary between the two

INSPIRE	Reference: INSPIRE DataSpecification_HY_v3.0.1.pdf		
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FeatureType	HY	Placeholder 'A'	Placeholder 'B'	RelatedThemes not A/B	Remarks
VanishingPoint			Geology		themes and has therefore relations with both. If included further attributes / changes to definition are expected. Can be pushed back to <i>Hydrography</i> by <i>Geology</i> .
Crossing	X				
DamOrWeir	X			Energy Resources Natural Risk Zones	
Embankment		NaturalRiskZones		Elevation	Whether this is part of this theme is uncertain, but if included further attributes are expected. Kept as placeholder to prevent inclusion in the IR when changes may still occur. Can be pushed back to <i>Hydrography</i> by <i>Natural Risk Zones</i> .
Ford	X				
Lock	X			Natural Risk Zones	
ManMadeObject	X				
Pipe		Utility and Governmental Services			Definition in <i>Hydrography</i> is wider than needed but includes all use cases described for the theme <i>Utility and Governmental Services</i> ; further attributes are expected to be added.
PumpingStation		Utility and Governmental Services		Buildings	Whether this is part of this theme is uncertain, but if included further attributes are expected. Kept as placeholder to prevent inclusion in the IR when changes may still occur. Can be pushed back to <i>Hydrography</i> by <i>Utility and Governmental Services</i> .
ShorelineConstruction	X				
HydroPowerPlant		EnergyResources		Buildings Utility and Governmental Services	Whether this is part of this theme is uncertain, but if included further attributes are expected. Kept as placeholder to prevent inclusion in the IR when changes may still occur. Can be pushed back to <i>Hydrography</i> by <i>Energy Resources</i> .
Sluice	X			Natural Risk Zones	
WFDGroundWaterBody		AreaMgmt / ReportingUnits		Geology	Whether this is part of this theme is uncertain, but if included further attributes

INSPIRE	Reference: INSPIRE DataSpecification_HY_v3.0.1.pdf		
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FeatureType	HY	Placeholder 'A'	Placeholder 'B'	RelatedThemes not A/B	Remarks
WFDCoastalWater		AreaMgmt / ReportingUnits		Environmental Monitoring	are expected. Kept as placeholder to prevent inclusion in the IR when changes may still occur. Can be pushed to <i>Area Management and Reporting Units</i> from <i>Geology</i> if required. Part of <i>Area Management and Reporting Units</i> but deemed to be important for <i>Hydrography</i> considering the linkage with Physical Waters that <i>Hydrography</i> decided to model these. No changes or additional attribution expected.
WFDLake		AreaMgmt / ReportingUnits		Environmental Monitoring	
WFDRiver		AreaMgmt / ReportingUnits		Environmental Monitoring	
WFDRiverOrLake		AreaMgmt / ReportingUnits		Environmental Monitoring	
WFDSurfaceWaterBody		AreaMgmt / ReportingUnits		Environmental Monitoring	
WFDTransitionalWater		AreaMgmt / ReportingUnits		Environmental Monitoring	
WFDWaterbody		AreaMgmt / ReportingUnits		Environmental Monitoring	
WatercourseNode	X			Utility and Governmental Services	
WatercourseLink	X			Utility and Governmental Services	
Watercourse SeparatedCrossing	X			Utility and Governmental Services	
Watercourse LinkSequence	X			Utility and Governmental Services	

Annex C (informative)

Examples of metadata elements specified in INSPIRE Metadata Regulation

The following are examples of the INSPIRE Implementing Rule on Metadata customized to hydrography topic. This annex describes how to fill the mandatory metadata elements from the Implementing Rule when publishing the metadata for datasets conforming to this data specification.

C.1 Topic category

ISO 19115	Number	41
	Name	topicCategory
	Definition	Main theme(s) of the dataset
	XPath	identificationInfo[1]/*topicCategory
	Data type	MD_TopicCategory
	Domain	Enumeration (See B.5.27 of ISO 19115)
	Example	Inland waters
Implementing instructions		The topic categories defined in B.2 of the INSPIRE Implementing rules for metadata are derived directly from the topic categories defined in B.5.27 of ISO 19115. INSPIRE Implementing rules for metadata define the INSPIRE data themes to which each topic category is applicable, i.e., Hydrography (I.8) is the INSPIRE theme for which the Inland waters topic category is applicable. The value of the ISO 19115/ISO 19119 metadata element is the value appearing in the “name” column of the table in B.5.27 of ISO 19115.

C.2 Keyword

An INSPIRE Keyword is defined by:

- a keyword value (see C.2.1);
- and an optional originating controlled vocabulary (see C.2.2).

There may be multiple keywords for a single resource, but the multiplicity of the keyword value and of the originating controlled vocabulary is expressed relative to a single keyword.

The INSPIRE Implementing rules for metadata mandate the presence of at least one keyword:

- for spatial dataset or spatial dataset series, it shall describe the relevant INSPIRE spatial data theme (as defined in Annex I, II and III of the Directive) originating from the general environmental multilingual thesaurus (GEMET) (<http://www.eionet.europa.eu/gemet>);
- for spatial data services, it shall at least define the category or subcategory of the service using its language neutral name as defined in B.4 of the Metadata Implementing Rules.

C.2.1 Keyword value

ISO 19115	Number	53
	Name	keyword
	Definition	Commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject.
	XPath	identificationInfo[1]/*/descriptiveKeywords/*/keyword
	Data type	CharacterString
	Domain	Free text
	Example	hydrography, flood, freshwater, inland water
Implementing instructions		Each instance of ISO 19115 keyword may originate from a controlled vocabulary described through the thesaurusName property of the instance of descriptiveKeywords to which the keyword pertains.

C.2.2 Originating controlled vocabulary

ISO 19115	Number	55
	Name	ThesaurusName
	Definition	Name of the formally registered thesaurus or a similar authoritative source of keywords.
	XPath	identificationInfo[1]/*/descriptiveKeywords/*/thesaurusName
	Data type	CI_Citation
	Domain	The following properties are expected: <ul style="list-style-type: none"> • title of type CharacterString (Free text) • reference date defined as: <ul style="list-style-type: none"> ○ a date type : creation, revision or publication ○ an effective date
	Example	<ul style="list-style-type: none"> • title: "GEMET Thesaurus version 1.0" • date: <ul style="list-style-type: none"> ○ dateType: publication ○ date: 2009-06-30
Implementing instructions		In order to be consistent with ISO 19115, all the keyword values originating from a single version of a single controlled vocabulary shall be grouped in a single instance of the ISO 19115 descriptiveKeywords property.