## Discussion on the “Area Management” concept for GWML

So far the following concepts related to “management of an area” where identified:

 *(imported from http://external.opengis.org/twiki\_public/HydrologyDWG/Gwml2ConsolFeatureList)*

Management Areas:

* Protected Area
* Groundwater Management Zone
* Management Restriction Or Regulation Zone
* River Basin District
* Groundwater Basin

The group ‘Management Areas’ includes specific areas (surface, subsurface) which are under a type of regulation or restriction where usually state authority applies management based on legislation (not always). The delineation of these areas usually follows administrative boundaries thus do not strictly follow the natural phenomenon (e.g. Groundwater bodies). Very often there is a reporting on the “state” of the “management area” imposed by the different levels of state authorities thus the area could also be seen as a “reporting unit”.

Based on the analyses of the concept definitions (see in Annex 1) we see two possible modeling ways forward:

1. Defining a very generic concept/feature: ***“Area Management Unit”*** with the main property/attribute: ***“Type of area unit”*** that will be defined by a code list(s) of different types/categories for the “Area Management Unit”. Our so far identified concepts (e.g. protected areas, GW management Zones, River basin districts), but can be more are then defined as values of the “Type of Area unit” code list(s).

This option would follow the INSPIRE modeling approach (see below the screen shots of UML + the definitions for the main code lists used) which was applied due to the wide scope character of the INSPIRE “Area Management” data theme - not limited only to groundwater issues. (<http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_AM_v3.0rc3.pdf>)

***The option for GWML could be that the relevant code lists are populated only with groundwater management related activities***

1. Defining more **specific a**rea management units (protected zones, GW management zones, river bain etc..) as subtypes of the generic ***“Area Management Unit”.*** See the Section 2 where the example for WFD surface and groundwater bodies is demonstrated. Similarly we can add a sub type for e.g. protected zones..

**Option 1) Generic “Area Management Unit”** example from INSPIRE

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Figure : Overview of the Area Management Restriction and Regulation Zones application schema

The groundwater related area management information is derived/defined from following code lists: ZoneType, SpecialisedZoneTypes and EnvironmentDomain.

* zoneTypeCode {water body under the Water Framework Directive, river basin district},

Management units as defined in the WFD can be described using the generic ManagementRestrictionOrRegulationZone spatial object type with the value waterBodyForWFD as the zoneTypeCode.

* Specific types of water body could then be defined using the specialisedZoneTypeCode.specialisedZoneTypeCode{ any values, submitted by data provider}
* EnvironmentDomain{ natural resources, water}

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Figure : Overview of the code lists contained within the Area Management Restriction and Regulation Zones application schema

#### Code values for Area Management Restriction and Regulation Zones:

**EnvironmentalDomain:** Environmental domain, for which environmental objectives can be defined.

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| soil | The top layer of the land surface of the earth that is composed of disintegrated rock particles, humus, water and air. |
| noise | Sound which is unwanted, either because of its effects on humans, its effect on fatigue or malfunction of physical equipment, or its interference with the perception or detection of other sounds. |
| natural resources | A feature or component of the natural environment that is of value in serving human needs, e.g. soil, water, plant life, wildlife, etc. Some natural resources have an economic value (e.g. timber) while others have a non-economic value (e.g. scenic beauty). |
| climate and climate change | State of the climate and/or change in this state that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. |
| health protection | Measures or devices designed to reduce the risk of harm to human health posed by pollutants or other threatening conditions in the ecosystem. |
| air | A predominantly mechanical mixture of a variety of individual gases forming the earth's enveloping atmosphere. |
| water | Common liquid (H2O) which forms rain, rivers, the sea, etc., and which makes up a large part of the bodies of organisms. |
| waste | Material, often unusable, left over from any manufacturing, industrial, agricultural or other human process; material damaged or altered during a manufacturing process and subsequently left useless. |
| nature and biodiversity | Active management of the earth's natural resources and environment to ensure their quality is maintained and that they are wisely used. |
| sustainable development | Development that provides economic, social and environmental benefits in the long term having regard to the needs of living and future generations. |
| land use | The term land use deals with the spatial aspects of all human activities on the land and with the way in which the land surface is adapted, or could be adapted, to serve human needs. |

**ZoneTypeCode:** High-level classification defining the type of Management, Restriction or Regulation Zone.

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| air quality management zone | Part of the territory of a Member State, as delimited by that Member State for the purposes of air quality assessment and management. |
| noise restriction zone | An area delimited by a competent authority to manage and mitigate noise pollution. This includes agglomerations and quiet areas (in agglomerations and open country) as defined in the Directive 2002/49/EC of the European Parliament and of the Council. |
| animal health restriction zone | Restriction zones established for the control and eradication of notifiable animal diseases. |
| prospecting and mining permit area | The area on which the prospection or extraction of any mineral has been authorised and for which that right or permit is granted. |
| regulated fairway at Sea or large inland water | Regulated navigation areas port-to-port established to organise traffic, prevent accident and pollution and to support management and planning. |
| restricted zones around contaminated sites | Zones established to protect human, plant and animal health and control movement and development within a contaminated site. |
| area for disposal of waste | Area affected by disposal of waste as defined in Article 3(19) of Directive 2008/98/EC[1]. |
| coastal zone management area | Area in which integrated coastal zone management takes place. |
| drinking water protection area | Area in which waste water leakage, use of fertilizer or pesticides, or establishment of waste disposal sites are prohibited. |
| nitrate vulnerable zone | Areas of land which drain into polluted or threatened waters and which contribute to nitrate pollution. |
| marine region | Marine regions and their subregions are sea regions designated under international, Union, national or sub-national legislation for the purpose of assessment, management and regulation. |
| river basin district | Area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, identified under Article 3(1) of Directive 2000/60/EC[2] as the main unit for management of river basins. |
| bathing waters | Coastal waters or inland waters (rivers, lakes) explicitly authorised, or not prohibited for recreational bathing by large numbers of people. |
| flood unit of management | Area of land and sea, identified under Directive 2007/60/EC of the European Parliament and Council[3] as the main unit for management when an alternative to the River Basin Districts or Sub-Districts are chosen. |
| water body under the Water Framework Directive (2000/60/EC) | The “water body” is a coherent sub-unit in the river basin (district) to which the environmental objectives of the Directive 2000/60/EC must apply. The identification of water bodies is based on geographical and hydrological determinants. This includes surface (river, lake, transitional and coastal) and ground water bodies. |
| sensitive area | Water bodies identified as sensitive areas, as defined in Annex II to Directive 91/271/EEC[4]. |
| designated waters | Marine, coastal or surface waters designated by Member States as needing protection or improvement in order to support fish life. |
| plant health protection zone | Protection zone within which protective measures are established against the introduction of organisms harmful to plants or plant products and against their spread. |
| forest management area | Area designated for the sustainable management of forest resources and functions. |

**Option 2) specification – subtyping of the generic “Area Management Unit”** example from INSPIRE



Figure : UML class diagram: Relationships between the Water Framework Directive application schema and the spatial data themes Hydrography and Geology

In both cases information about legal or other relevant documentation of the area management unit is provided via two generic classes: LegislationCitation and a DocumentCitation (***see in the option1 UML diagram)***. For GWML we can also follow this modeling approach which is again very flexible.

#### Conlusion

In case of taking option 1) we do not need all identified concepts (e.g.: Protected Area, Groundwater Management Zone, Groundwater Basin). Instead only one generic class with a “Type of Area unit” code list(s) can be used. In case of taking option 2) we can define 3 different subtypes of generic area management unit (Protected Area, groundwater management zone and river basin districts (?). Area – is/ could be covered by the INSPIRE application schema ‘ProtectedSide’ (generic concept). In this case we see the Groundwater basin concept as not necessary, because it is not defined by the administrative or political boundaries.

***Annex 1) Definitions and discussions from our GWML TWIKI***

***Protected Area***

**Protected sites**

An area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives. (Protected sites – INSPIRE)

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| COMMENT: in this place I see two different concepts:Area of Groundwater Protection – the first definition.Protected Site – the second definition (it can be planar, linear or point), for example: national parks, nature or heritage reserves, wetland protection etc. [JM] |
| COMMENT: In INSPIRE Protected Site refers to any protected site – not just those to do with water resources. It also requires there be protecting legislation (which I would think is required in any definition or there isn’t any protection?). [JL] |
| COMMENT[ID]: I think this is special to INSPIRE and not subject of a generally applicable GWML |
| The surface and subsurface area surrounding a water well or wellfield through which contaminants are reasonably likely to move toward and reach such water well or well field. <http://www.wrds.uwyo.edu/wrds/deq/whp/whpgloss.html> |

***Groundwater Management Zone***

No input from INSPIRE or Use case 2

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| COMMENT: I propose to remove "(catchment)". GMZ (or GMA - Groundwater Management Area) is the most often administrative unit. There is a huge difference between GMZ, surface catchment and groundwater catchment. [JM] |
| COMMENT[ID]: HY\_Features defines catchment as the basic unit of study or reporting. in case of hydrologic determination, a catchment is considered a basin wherein all waters are channeled to a common (topological) outfall. in this sense the "groundwater management zone" maybe understood as a catchment, or a basin when it concides with the hydrologic determined unit. |
| Distinct area, defined by either political, natural or other reasons, for which water budget is calculated and policies are in place. {input source other} |

***Management Restriction Or Regulation Zone***

Area managed, restricted or regulated in accordance with a legal requirement related to an environmental policy or a policy or activity that may have an impact on the environment at any level of administration (international, European, national, regional and local).

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| No other comments… |

***River Basin District***

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.

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| COMMENT: Concept from European Water Framework Directive. I think it is very difficult find its application in other domains. [JM] |
| COMMENT: In INSPIRE "River Basin District" is a concept derived from the Water Framework Directive and is defined as "Area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, identified under Article 3(1) as the main unit for management of river basins" – so very much a regulatory definition. [JL] |
| COMMENT[ID]: see "groundwater management zone". furthermore (in basin hierarchy) any catchment/basin may be part of a containing unit (in HY\_Features). |
| COMMENT: What means "flow underground of inland water"? Is it applicable for karstik systems only? Are karstic systems in scope of GW2IE?? [JM] |
| COMMENT[ID]: an administrative (INSPIRE) unit such as "River Basin District" has nothing to do with the property of water to flow in whatever connecting system, no matter on or below the land surface. - |
| COMMENT[ID]: does GWML refers to subterreanean waters and water bodies? |

***Groundwater Basin***

No input from INSPIRE or Use case 2

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| **COMMENT [ID]**: area is a 2D representation of a unit. groundwaterbasin is an abstract unit of study or reporting multiple represented in the real world, e.g. an area, groundwater divide, aquifer system, ... |
| The underground area (?, see comment above, ID) from which groundwater drains. The basins could be separated by geologic or hydrologic boundaries (<http://www.groundwater.org/gi/gwglossary.html#G>) |
| A groundwater basin (usually a [sedi mentary basin](http://www.ga.gov.au/groundwater/groundwater-in-australia/sedimentary-basins.html)) that covers a large area (?, see commetn above, ID) and delineates a natural hydrogeological province. It may contain several hydrogeologic units, aquifers, confining beds and groundwater systems (based on <http://www.ga.gov.au/groundwater/groundwater-in-australia.html> and <http://vro.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/water-vics-gwater-basins> ) |
| Groundwater resources of the region are subdivided into groundwater basins on the basis of: (1) a natural boundary that does not change with time, such as one determined by structural features, intervening layers, or aquifer extent; (2) a boundary that may change with time, such as an underground watershed or groundwater divide which may change in response to pumpage or recharge; or (3) a boundary designated solely for administrative or operative reasons. (<http://exact-me.org/overview/p11.htm>) [BB] |
| Physiographic unit containing one large or several connected or interrelated aquifers, whose waters are flowing to a common outlet, and which is delimited by a groundwater divide. IGH0552 |