GIS AND HYDROGEOLOGICAL MAPPING OF THE WALLOON REGION (BELGIUM)

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The Ministry of the Walloon Region, *Direction Générale des Ressources Naturelles et de l'Environnement (DGRNE)*, has initiated in 1999 the first Belgian hydrogeological mapping program. Four Walloon universities are involved : Faculty of Applied Sciences of Mons, Luxembourg University Foundation of Arlon, University of Liège and University of Namur. Twenty-height hydrogeological maps are already completed at a 1/25,000 scale but they are not yet officially published. Meanwhile, these documents are strongly required by environmental research and management actors. At the annual rate of three maps per team, the entire hydrogeological coverage of the Walloon region should be completed in 2010.

The hydrogeological maps development is essentially based on the collection and synthesis of existing data coming from as many as varied sources as water supply companies, Walloon Region administration, Belgian Geological Survey, environmental agencies, geological consultants, industries, public and private institutions, farmers,…(Figure 1). A significant field work is also carried out to check the exactitude of the collected data and to supplement them where they are missing (hydraulic heads,..).

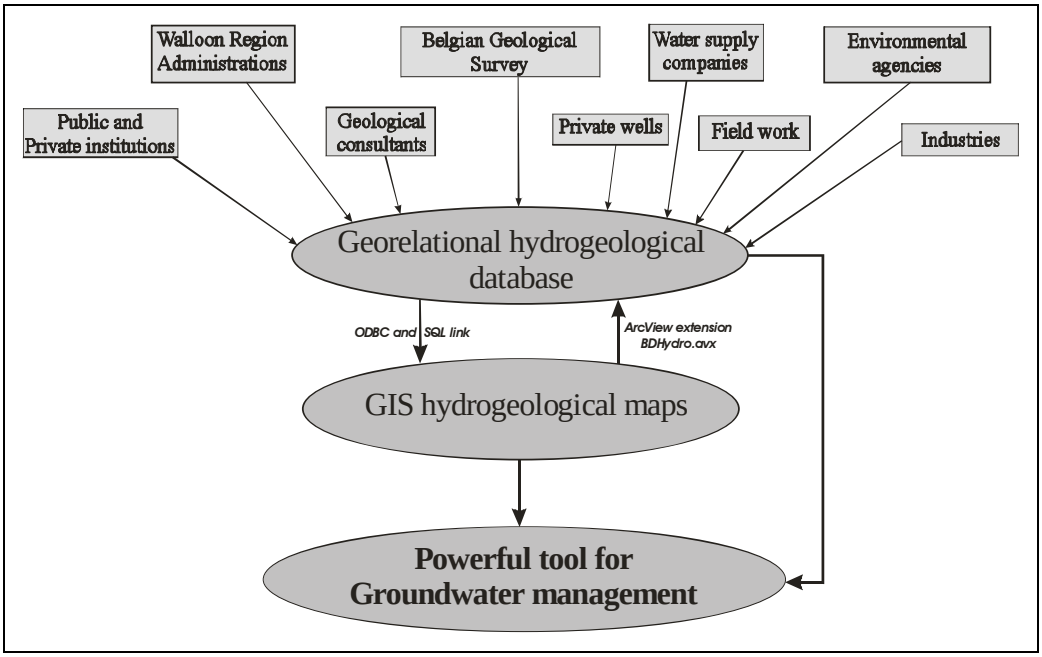

Figure 1. Simplified methodology for the elaboration of a hydrogeological map.

Coupling a Geographical Information System (GIS) with a hydrogeological database provides a powerful tool for groundwater management. Collected data are stored in an Access (Microsoft) georelational hydrogeological database [1] actively linked to the GIS ArcView (Environmental Systems Research Institute, ESRI) by an Open Database Connectivity (ODBC) connection coupled with the existing GIS Standard Query Language function (Figure 1). This connection allows an automatic update of the GIS project for punctual elements (wells, piezometers, springs, climatic stations, river-gauging stations,…) every time a new record is added to the database (with its geographic coordinates). Polylines (galleries, isopiestic lines,…) and polygons (protection zones, watersheds,…) are digitized in the GIS project and their attributes are actively related to the database by a unique number or by ID-codes. All elements are geographically referenced with Lambert coordinates (Belgium Lambert Conformal Conic Projection) and superimposed on georeferenced topographic maps. The database can be consulted starting from the map thanks to a developed ArcView extension called BDHydro (Figure 1). It opens a window by clicking on one of the element on the map and allows the user to display in the GIS project for example a hydraulic head evolution, a hydrochemical analysis table, the lithological log diagram of a well,…

Each hydrogeological map project is composed of a poster and an explanatory leaflet. The poster includes the following components (Figure 2) : (1) a main hydrogeological map (1/25,000) displaying several layers of information as topography, geology (with lithological formations grouped to form hydrogeological units depending on their hydrogeological characteristics), hydrographic network, localization of wells, springs, piezometers, galleries, drains, karstic phenomena, protection zones, arrows indicating the direction of underground flows, depth of the saturation level (isopiestic lines or punctual hydraulic heads),…, (2) geological and hydrogeological cross-sections displaying the geological structures and the saturation level depth, (3) a lithostratigraphic table showing the correspondences between geological formations and hydrogeological units described as aquifers (high hydraulic conductivity), aquitards (medium hydraulic conductivity) and aquicludes (low hydraulic conductivity) on a lithological basis and (4) thematic maps (1/50,000) showing more specific information as the confined or unconfined nature of the different hydrogeological units, localization of chemical analysis, pumping and tracing tests, well-logging, geophysical investigations, actual exploited volumes, thickness of the main aquifer,…

The explanatory leaflet is written for a non specialist public and allows a better understanding of the poster. It develops general considerations on regional geography, geology and hydrogeology. It also focuses on specicific hydrogeological aspects as local behaviour of the water table, karstic phenomena, hydrochemistry, hydraulic conductivity parameters, delimited protection zones in the area,…

Potential fields of application of such a document are as many as varied : qualitative as well as quantitative management of exploited groundwater in Wallonia, evaluation of the risks of pollution according to the direction of underground flow, intervention tool in case of contamination of the water table, establishment of new water catching points for water supply companies or industries, land-use policy,... This project represents an important step in the installation of effective and considered management and protection measures of groundwater resources of Wallonia.

References

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