ARL ACADEMY FOR TERRITORIAL DEVELOPMENT IN THE LEIBNIZ ASSOCIATION

Michael Bongartz

Groundwater

URN: 0156-55998107

This is a translation of the following entry:

Bongartz, Michael (2018): Grundwasser. In: ARL – Akademie für Raumforschung und Landesplanung (Hrsg.): Handwörterbuch der Stadt- und Raumentwicklung. Hannover, 875-882.

The original version can be accessed here:
urn:nbn:de:0156-5599810

Typesetting and layout: ProLinguo GmbH
Translation and proofreading: ProLinguo GmbH

Recommended citation:
Bongartz, Michael (2018): Groundwater.
https://nbn-resolving.org/urn:nbn:de:0156-55998107.

Leibniz Association

Michael Bongartz

Groundwater

Contents

In the future, ensuring the availability of groundwater in an adequate quality and quantity will become increasingly challenging. Protecting groundwater involves taking appropriate measures to ensure that aquifers are recharged and that groundwater pollution is prevented. This entry describes how spatial planning can ensure that groundwater is protected and that any adverse effects on it are minimised or prevented. It shows that spatial planners have suitable instruments at their disposal to perform this multidisciplinary task in a preventive manner.

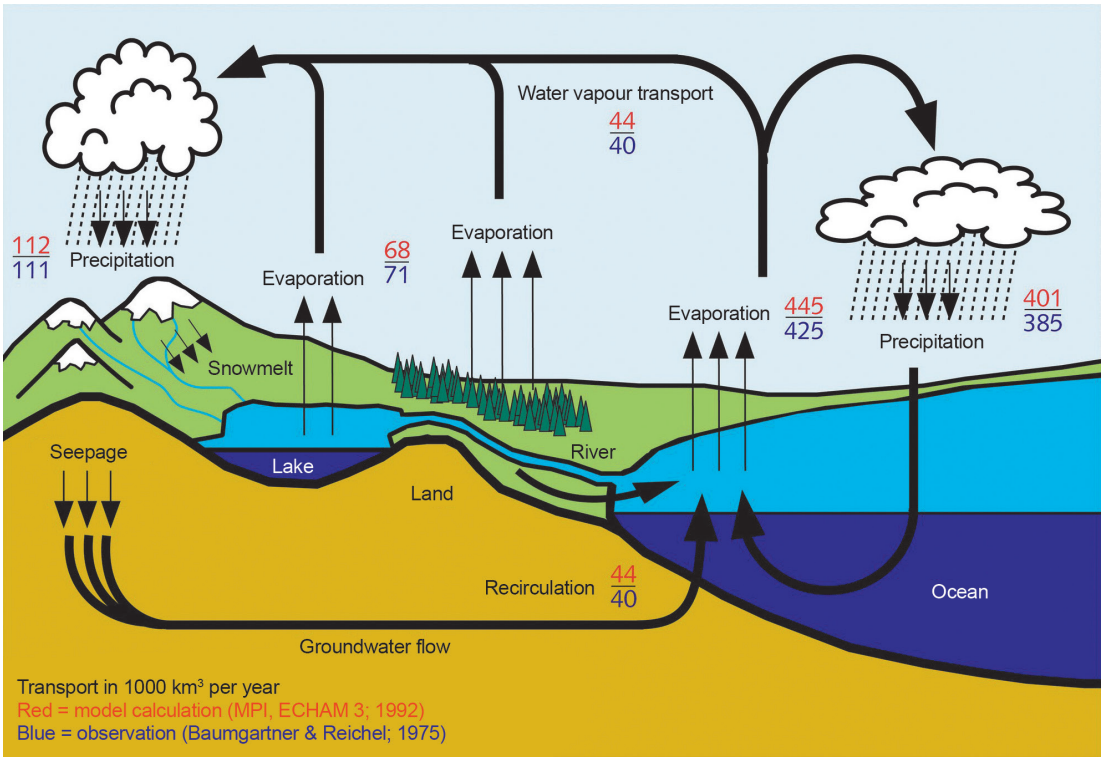
1 Groundwater

Of the world's water reserves, 98% is salt water in the oceans. Fresh water comprises approximately 0.7% and is mostly bound up in the polar icecaps. Lakes and rivers account for only 0.01%. At 0.06%, groundwater is the dominant resource for fresh water (Hölting 1992: 1).

2 The importance of groundwater

As a component of the water cycle, groundwater plays an important role in the balance of nature. A balanced water cycle is the foundation of a functioning ecosystem. Groundwater is a basic prerequisite for the existence of certain habitats, e.g. wet meadows or forests in floodplains, streams, or standing water. Such habitats are dependent on constant groundwater inflows and often on a consistent groundwater water table as well (cf. Fig. 1).

Figure 1: The water cycle



Source: SVGW (undated)

Groundwater is the most important source of drinking water. Underground water reserves are the source of up to 90% of the untreated water needed for the drinking water supply in the temperate climate zones of central and northern Europe. As sources of drinking water, reservoirs and lakes play a relatively minor or fulfil regionally limited supply functions. The supply of drinking water requires a sufficient volume of available water, which must be impeccable in terms of quality and safety. High quality standards apply for the groundwater to be used. European requirements for drinking water quality are set forth in Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption (Drinking Water Directive), and are implemented in Germany through the ordinance on drinking water and water for use in food processing facilities *(Trinkwasserverordnung, TrinkwV)*. Mineralized and/or heated groundwater is popular for its refreshment and health benefits or is used for medical and therapeutic purposes because of its naturally occurring active ingredients.

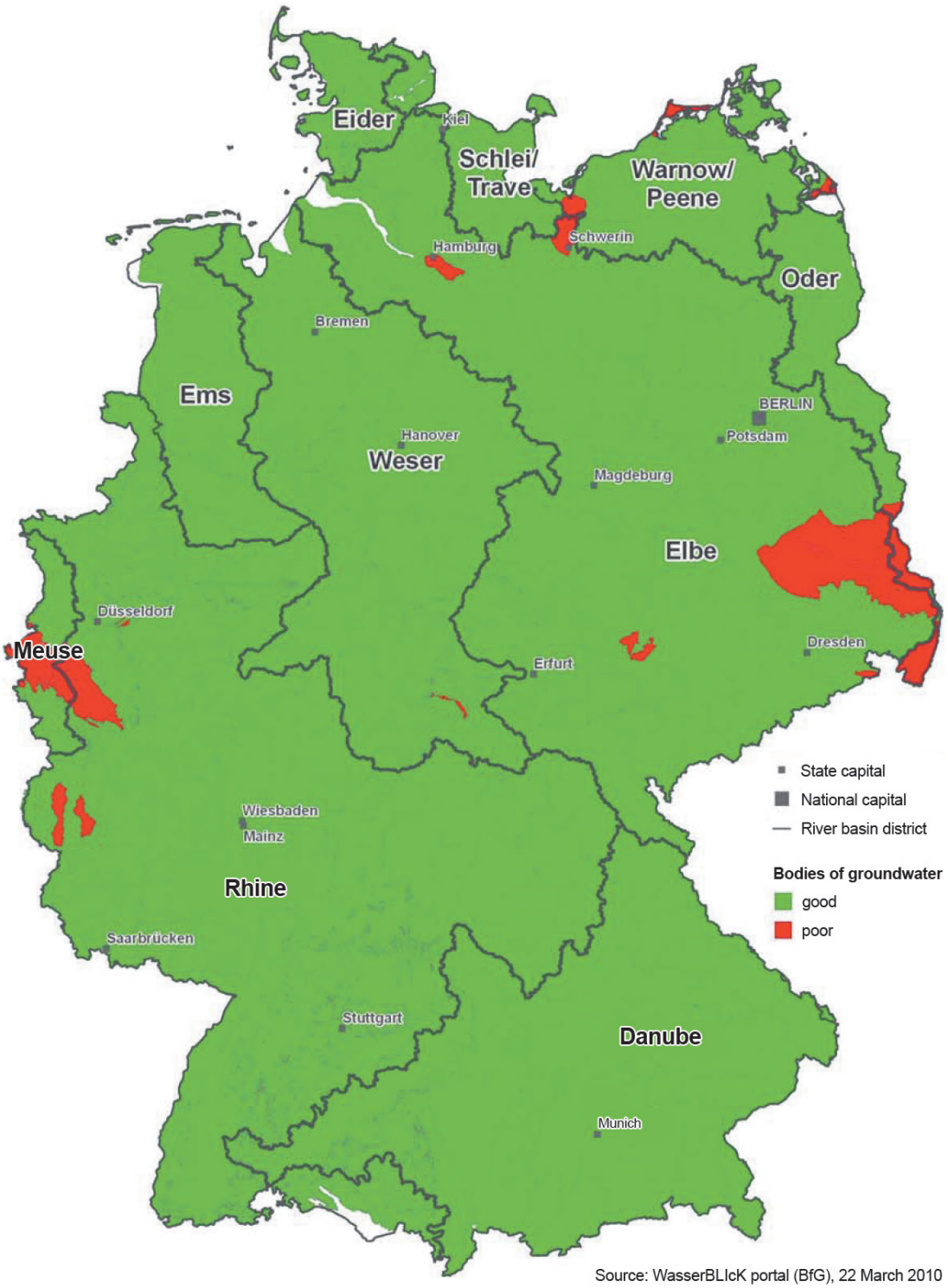
Commercial and industrial production processes often require large amounts of water as a cooling or cleaning agent, as a solvent, or for transport purposes (process water). Process water must be available in sufficient volumes and satisfy the relevant chemical, physical, and safety requirements. Satisfying these requirements calls for a sufficient volume of groundwater of an appropriate quality.

The naturally occurring heat in groundwater is also used for indoor heating. Energy is extracted from the groundwater with heat pumps and, after raised to a higher temperature level, used for heating purposes.

3 Protecting groundwater through spatial planning

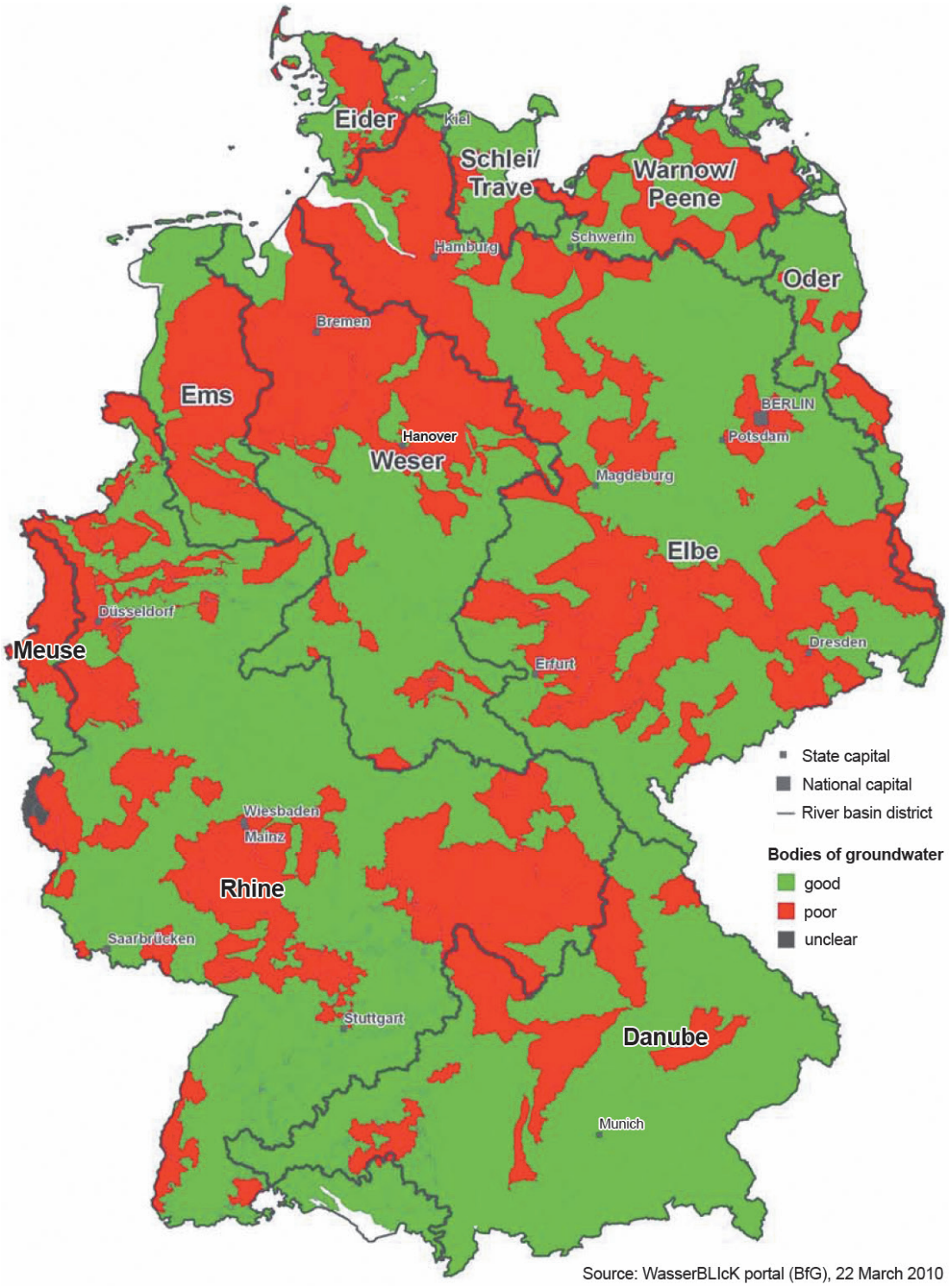
Preventive measures to protect the supply of groundwater involves ensuring that aquifers are recharged and groundwater pollution is prevented (cf. Fig. 3). The protection of open spaces as seepage areas for the formation of new groundwater also plays an important role in recharging aquifers (cf. Fig. 2). The quantitative status of a body of groundwater is good when its water table is not adversely affected by water abstraction. By precluding uses that have an adverse effect on underlying bodies of groundwater, spatial planning can play an important role in preventing groundwater pollution. Spatial planning thus establishes a planning framework for preventive groundwater protection, putting the latter in a direct spatial context.

Figure 2: Quantitative status of bodies of groundwater in Germany



Source: BfG 2010; BMU 2010: 33

Figure 3: Chemical status of bodies of groundwater in Germany



Source: BfG 2010; BMU 2010: 35

a) Protecting groundwater as a responsibility of spatial planning

The mission of spatial planning is to manage and moderate purposeful, long-term land development through cross-sectoral regulation and coordination of various space-related needs and interests while also preserving and protecting the natural living conditions. Spatial planning thus involves decisions about future settlement areas and about how to delimit and protect open spaces.

The Conference of Ministers for Spatial Planning specified spatial planning's contribution to the protection of groundwater as follows (MKRO 1985: 2):

- usable water resources (that are worthy of protection) are to be protected in consideration of other spatially-relevant demands, and the protection of such water resources is to be accorded particular importance when weighing competing spatial demands (▷ *Weighing of interests*);
- the groundwater recharge in resources protected by spatial planning may not be significantly limited by surface sealing in open spaces or by other activities with a negative impact on seepage;
- wetlands, natural flood zones, and important seepage areas are to be preserved;
- plans, activities, or impacts (pollution) that could have a negative impact on groundwater quality must be avoided;
- where a lower water table due to water extraction could result in damage to near-surface, groundwater-dependent nature reserves and valuable biotopes, especially careful consideration is to be given to the conflicting concerns of (▷ *Water management*) and (▷ *Nature protection*).

b) Groundwater protection in the Federal Spatial Planning Act

Section 1(2) of Germany's Federal Spatial Planning Act *(Raumordnungsgesetz, ROG)* declares sustainable spatial development to be a guiding principle of spatial planning. This principle was adopted in the Federal Spatial Planning Act after Agenda 21 of the 1992 Rio Conference called for efforts to counter further worsening of the human and environmental situation and to ensure the sustainable use of natural resources. This guiding principle thus implies that groundwater is also to be protected as a natural resource. Section 2 of the Federal Spatial Planning Act, which sets forth the principles of spatial planning, establishes that protecting groundwater resources is one of the tasks of spatial planning.

The Act provides for appropriate planning instruments to fulfil this mandate. To this end, when drawing up spatial development plans, territorial categories, priority areas, reserve areas, and areas suitable for development (▷ *Territorial categories*) (▷ *Priority area, reserve area and suitable area for development*) must be defined and their legal impact laid out. Groundwater protection can be enacted as a binding objective of spatial planning by establishing priority areas (section 8(7) no. 1 of the Federal Spatial Planning Act), or as principles of spatial planning and thus as directives for the weighing of interests by establishing reserve areas (section 8(7) no. 2 of the Federal Spatial Planning Act). Uses harmful to groundwater or projects affecting underlying bodies of groundwater can be ruled out by establishing priority areas that must be observed as binding for all spatially-relevant plans, activities, permits, planning approvals, and any other official decisions

about the permissibility of spatially-relevant activities. In the weighing of interests, those relating to groundwater protection have priority over all others. When reserve areas are established as part of the principles of spatial planning, groundwater protection concerns are given special weighting in the weighing of interests or in discretionary decision-making relating to permits, planning approvals, and any other official decisions about the permissibility of spatially-relevant activities and uses. However, in practice, other interests may be given priority over groundwater protection when planning decisions are made, relegating the interests of groundwater protection to a lower priority.

The boundaries of priority and reserve areas are based on the extent of the (spatially-relevant) bodies of groundwater requiring protection. Highly porous, fracture, or karstic rock formations depicted on hydrogeological maps represent a suitable basis for this. The extent of these potential aquifers and their horizontal structures can be used to draw conclusions about the delineation of bodies of groundwater. These conclusions can be calibrated with current measurements of groundwater levels, boreholes, or wells. Moreover, the thickness and filtering capacity of overlying layers are also considered as indicators of the aquifer recharge rate and the groundwater's sensitivity and productivity when the boundaries of priority or reserve areas are determined.

References

BfG – Bundesanstalt für Gewässerkunde (ed.) (2010): WasserBLIcK – Bund-Länder-Informations- und Kommunikationsplattform. http://www.wasserblick.net/servlet/is/1/WasserBLIcK-Crash-Kurs.pdf (22 March 2010).

BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (ed.) (2010): Die Wasserrahmenrichtlinie: Auf dem Weg zu guten Gewässern. Bonn.

Hölting, B. (1992): Hydrogeologie. Stuttgart.

MKRO – Conference of Ministers for Spatial Planning (ed.) (1985): Resolution 'Schutz und Sicherung des Wassers' by the Conference of Ministers for Spatial Planning, 21 March 1985. Bonn.

SVGW – Swiss Gas and Water Industry Association (ed.) (undated): Wasserkreislauf. https://lh3.googleusercontent.com/-6TD3rs36-vU/T0TGDDnHXMI/AAAAAAAALHQ/ym3zyqNEDwE/s2048-Ic42/wasserkreislauf.jpg (23 September 2015).

Additional literature

Adam, C.; Gläser, W.; Hölting, B. (2000): Hydrogeologisches Wörterbuch. Stuttgart.

DVWG – German Technical and Scientific Association for Gas and Water (ed.) (2006): Richtlinien für Trinkwasserschutzgebiete; Teil I: Schutzgebiete für Grundwasser. Bonn. = Technische Regel, Arbeitsblatt W 101.

Hoppe, W.; Jarass, H. D.; van Suntum, U. (eds.) (1998): Raumordnungsgebiete (Vorbehalts-, Vorrang- und Eignungsgebiete) nach dem neuen Raumordnungsgesetz: Colloquium of the Zentralinstitut für Raumplanung on 28 September 1998 in Münster. Münster. = Beiträge zur Raumplanung und zum Siedlungs- und Wohnungswesen 183.

Leser, H. (1997): Landschaftsökologie: Stuttgart.

Matthess, G.; Ubell, K. (1983): Lehrbuch der Hydrogeologie. Volume 1: Allgemeine Hydrogeologie, Grundwasserhaushalt. Berlin.

Scheffer, F.; Schachtschabel, P. (1998): Lehrbuch der Bodenkunde. Stuttgart.

Last update of the references: January 2017