

Flooding of the residual lakes in the Rhenish lignite area by use of the river Rhine

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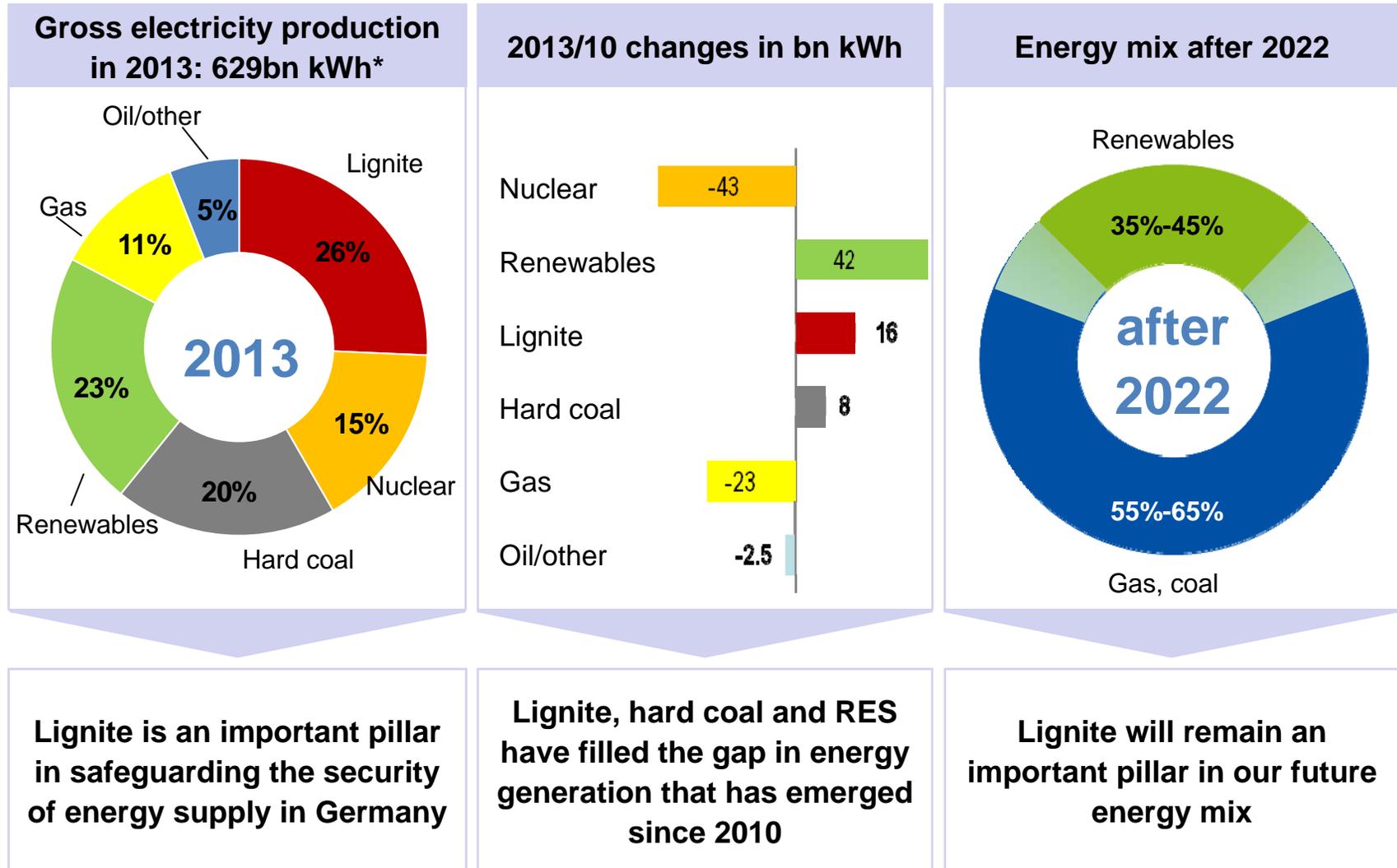


CHR – 1st spring seminar

Socio-economic influences on the discharge of the river Rhine

Bregenz, Austria, 26-27 March 2014

Importance of lignite for energy policy



*AG Energiebilanzen, 12/12/2013



The Rhenish lignite mining area

Garzweiler opencast mine

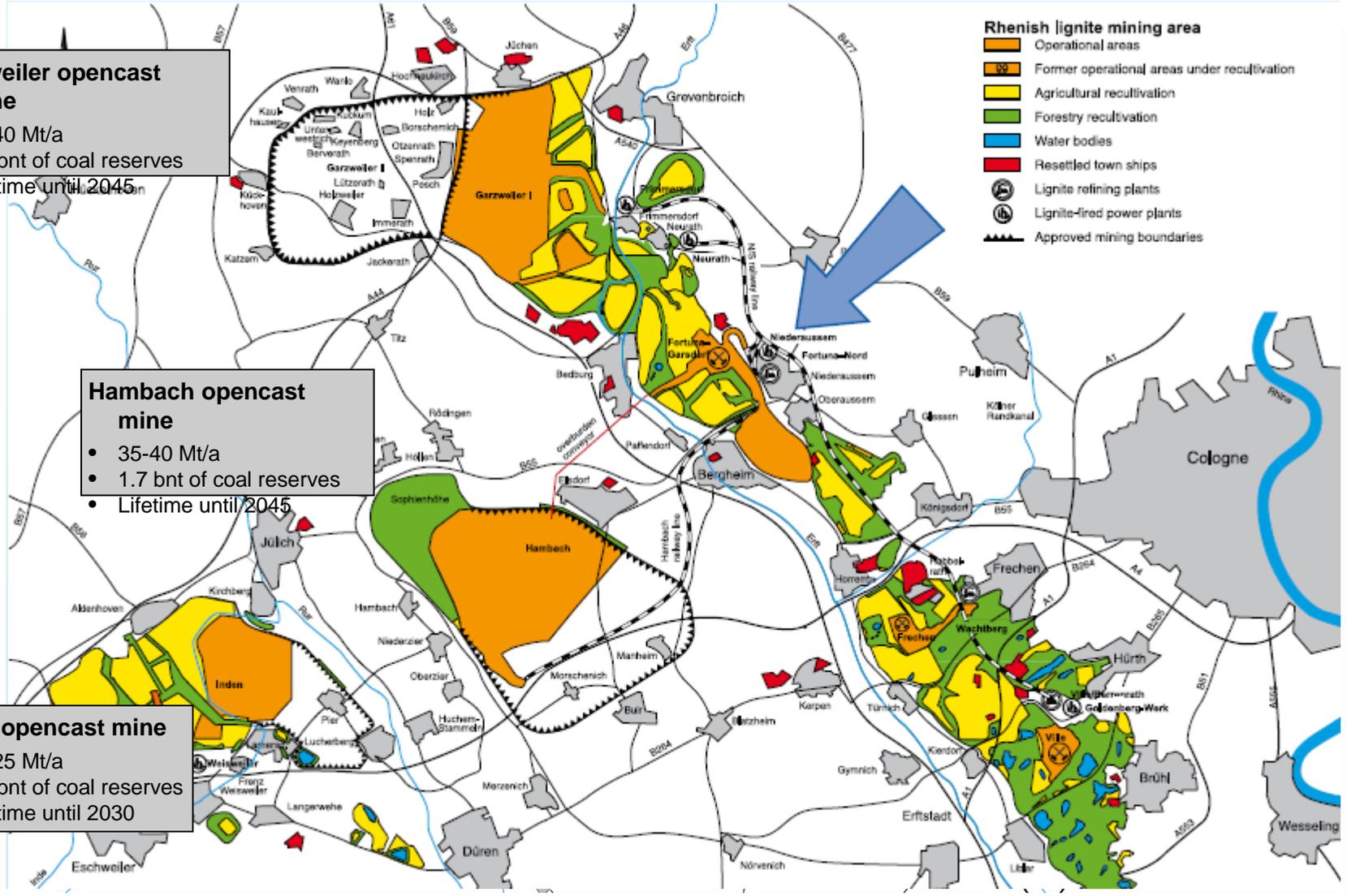
- 35-40 Mt/a
- 1.3 bnt of coal reserves
- Lifetime until 2045

Hambach opencast mine

- 35-40 Mt/a
- 1.7 bnt of coal reserves
- Lifetime until 2045

Inden opencast mine

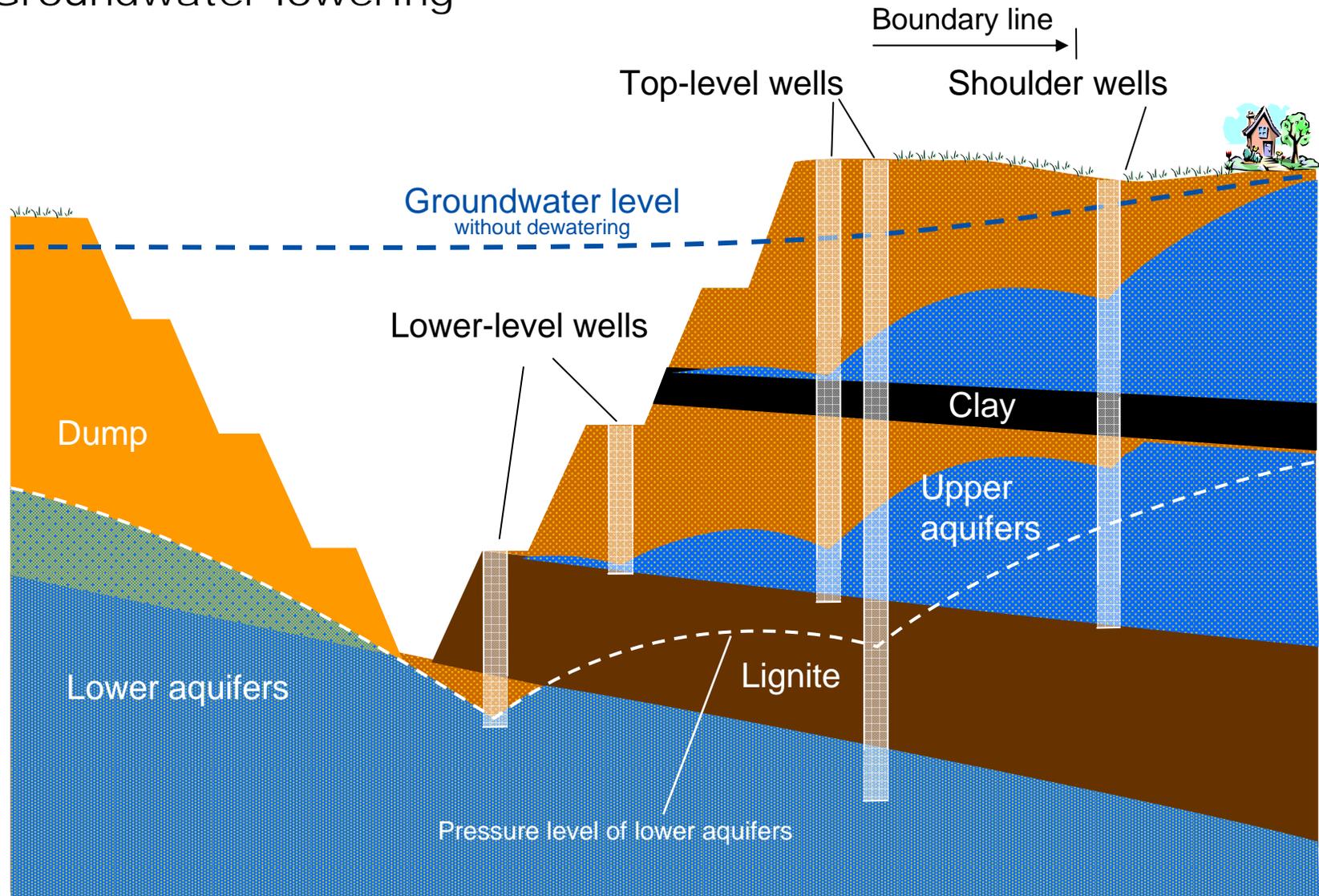
- 20-25 Mt/a
- 0.5 bnt of coal reserves
- Lifetime until 2030



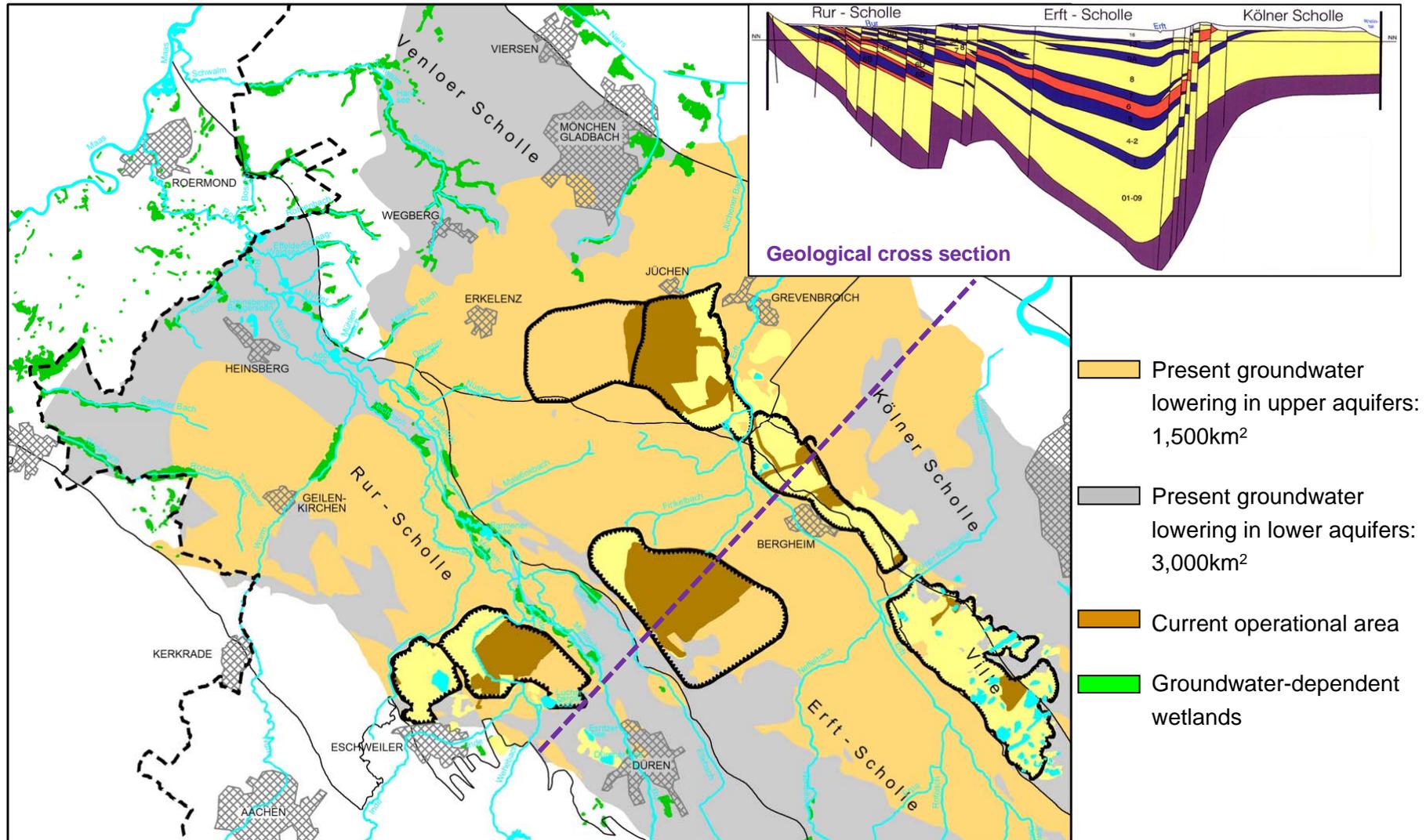
Opencast lignite mines in the Rhenish lignite mining area



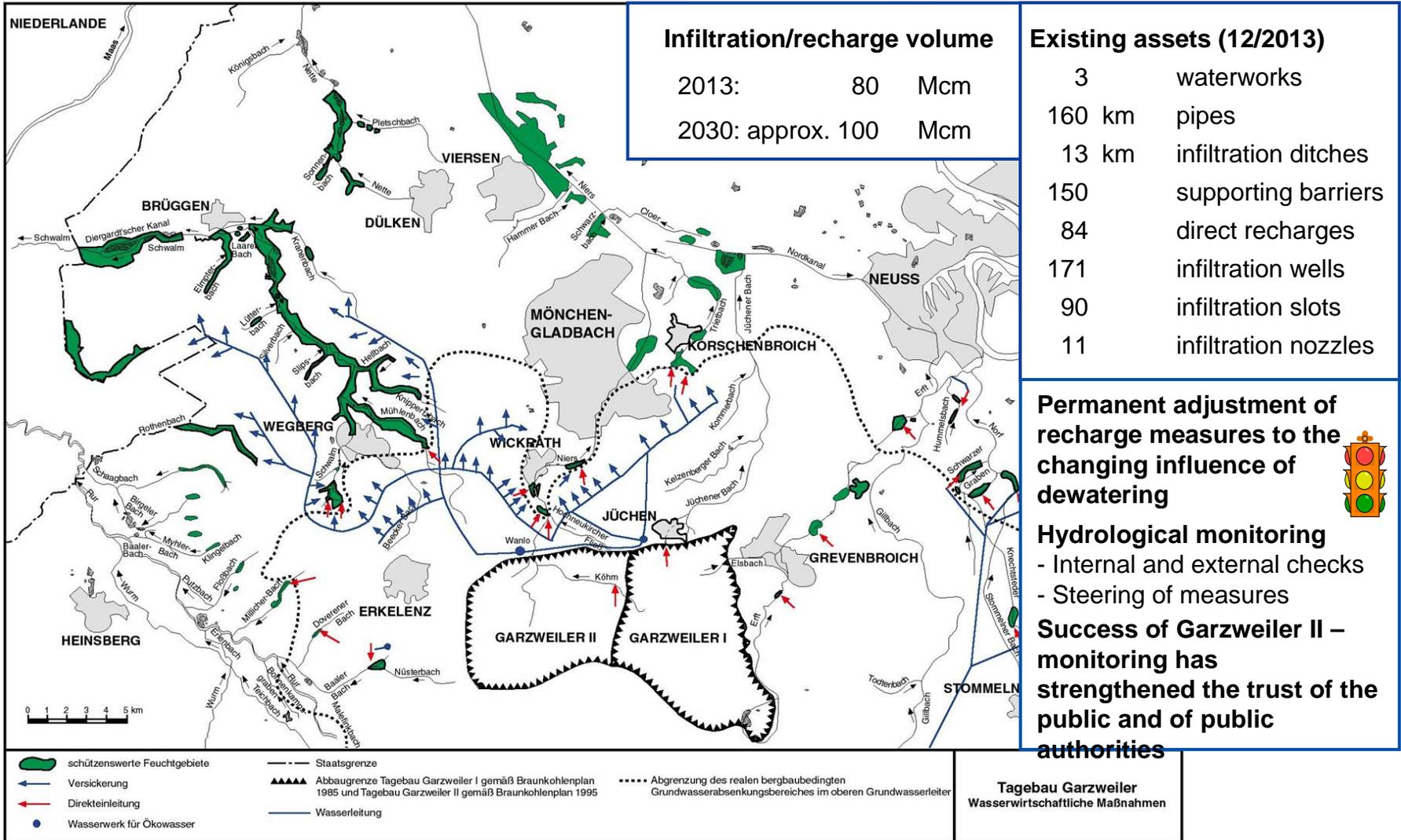
Groundwater lowering



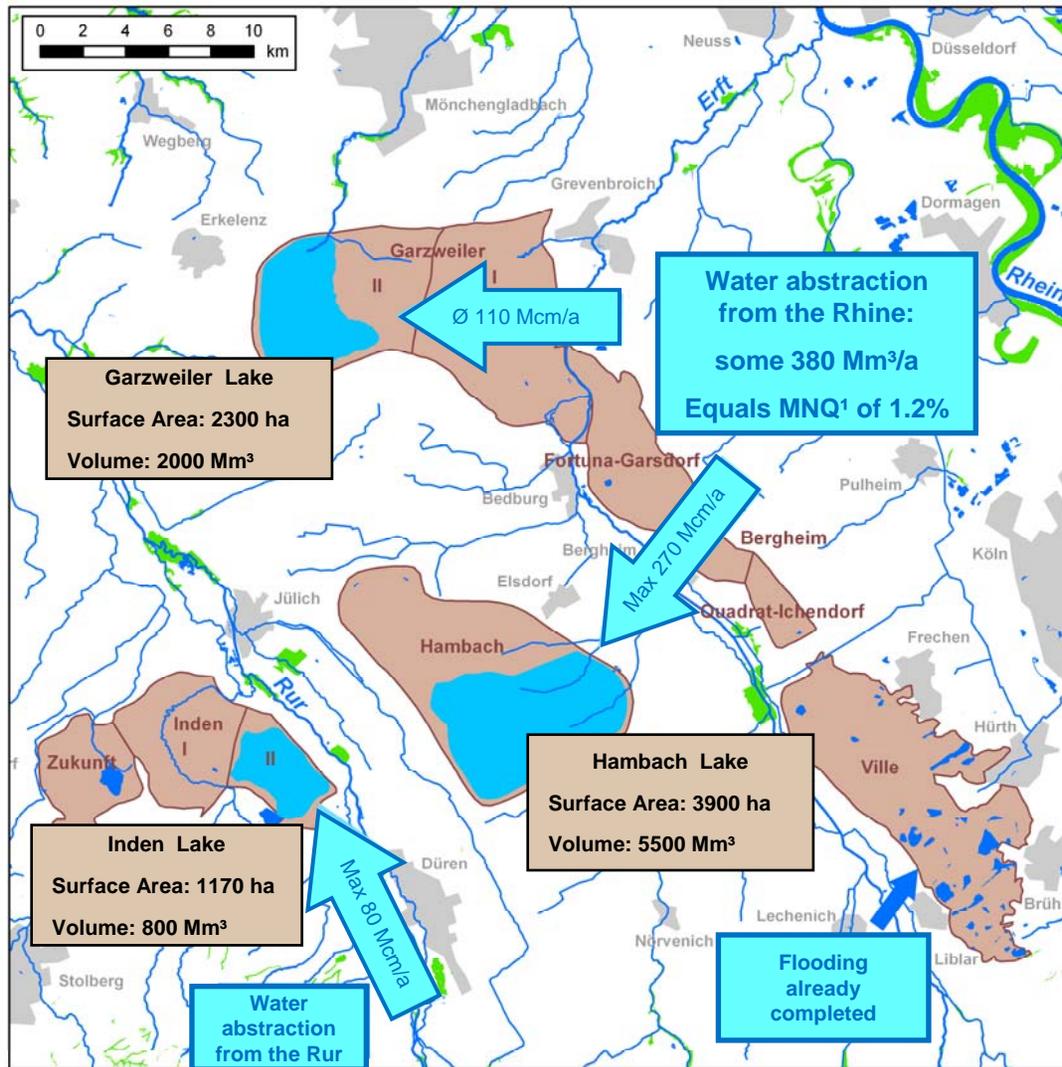
Large-scale lowering of groundwater



Groundwater recharge: wetlands in the northern part of the Rhenish mining area



Flooding of the residual lakes in the Rhenish lignite mining area



Flooding of residual lakes

- Opencast lignite mines
- Water bodies
- Future residual lakes
- Surface waters
- Wetlands
- Districts

¹Average low-water discharge

Approval situation

- The water supply for the wetlands situated in the northern part of the Rhenish mining area and the flooding of the residual lake with water from the Rhine have already been laid down in the Garzweiler II Lignite Mining Plan of 1995. It includes the following arrangements:

Upon completion of the mining operations at the Garzweiler II opencast mine the final void is to be used to create a lake. The flooding of the lake is to be completed within 40 years after termination of the mining operations at Garzweiler II. The lake is to be flooded with water from the Rhine.

- Also the flooding of the Hambach residual lake with water from the Rhine has already been incorporated into the Hambach Lignite Mining Plan of 1976.
- According to the 2009 amendment to the Inden II Lignite Mining Plan the Inden residual lake is to be flooded with water from the Rur.

Diagram of the development in water volume (Garzweiler opencast mine)

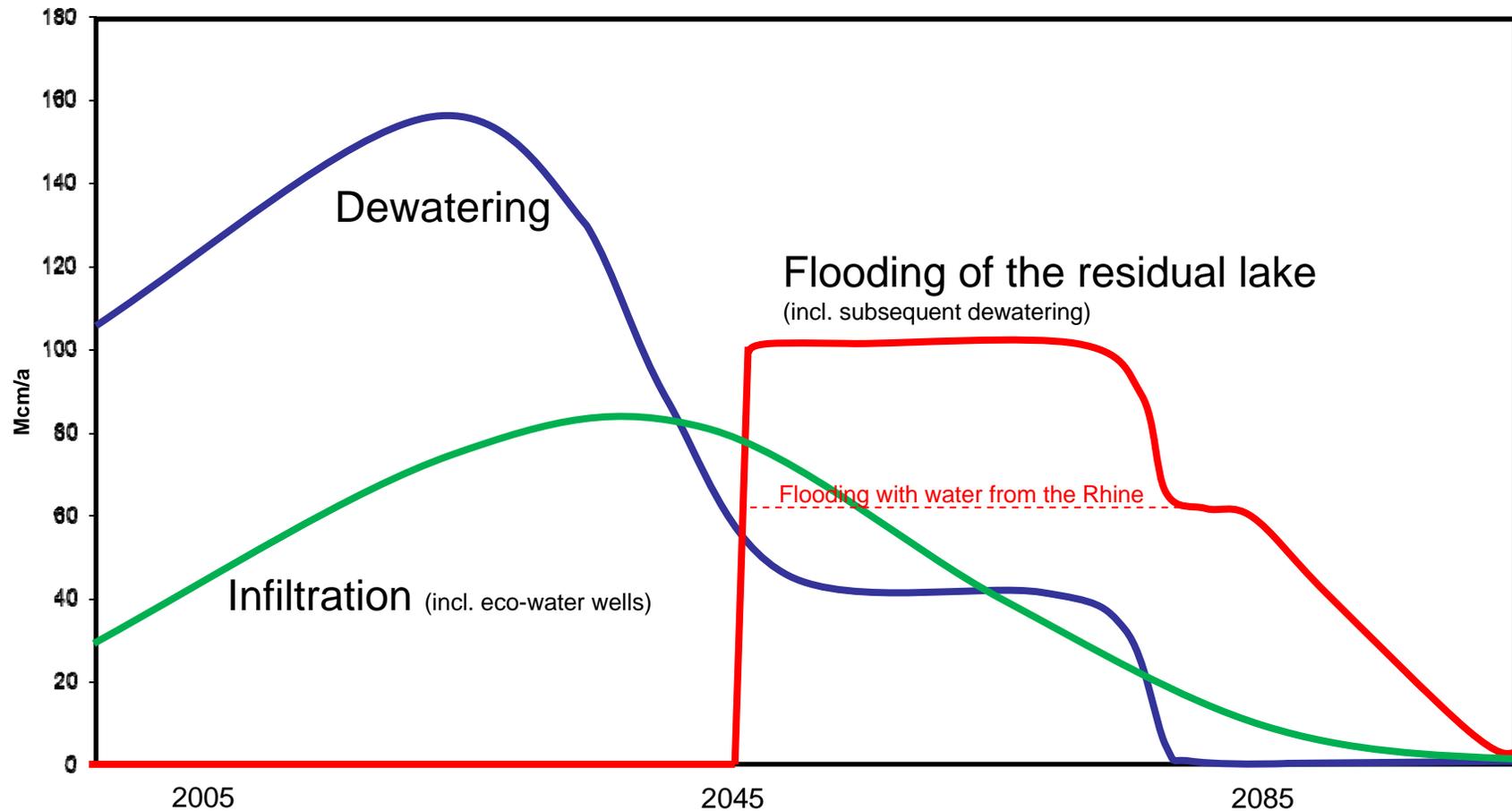
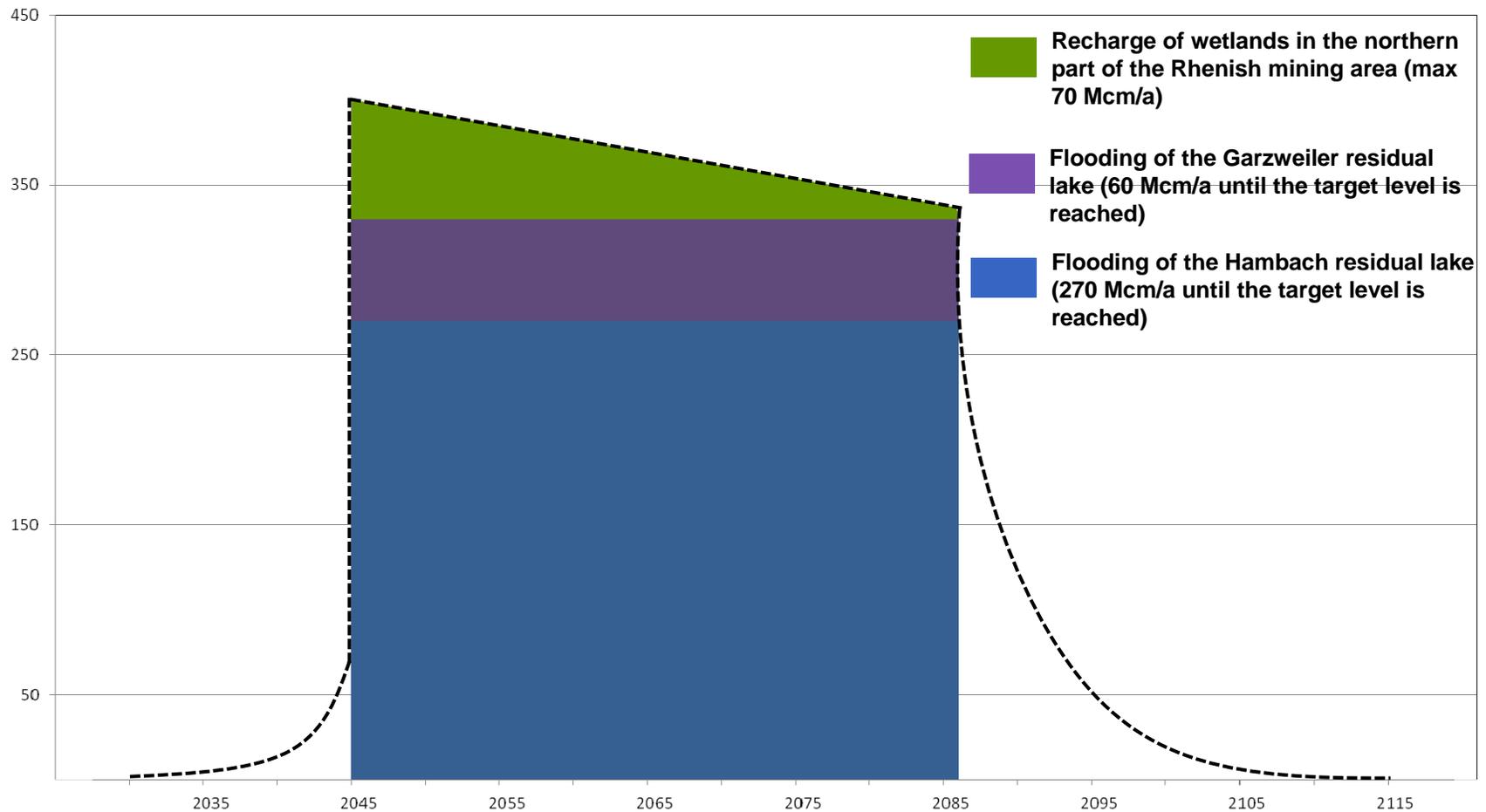


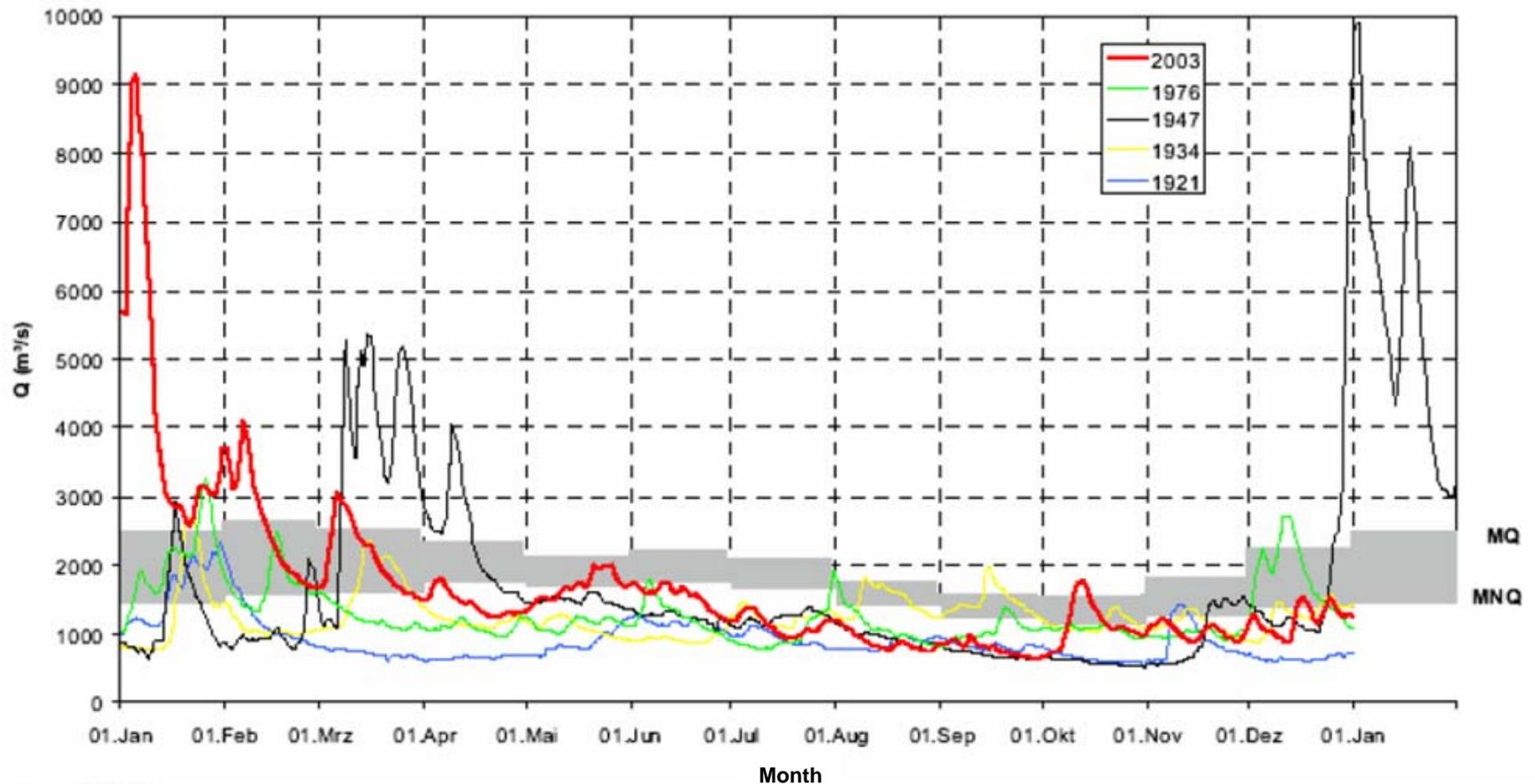
Diagram of water-abstraction volumes from the Rhine

Mcm/a



Flow rate of the Rhine measured at the Cologne gauging station (2003 low water)

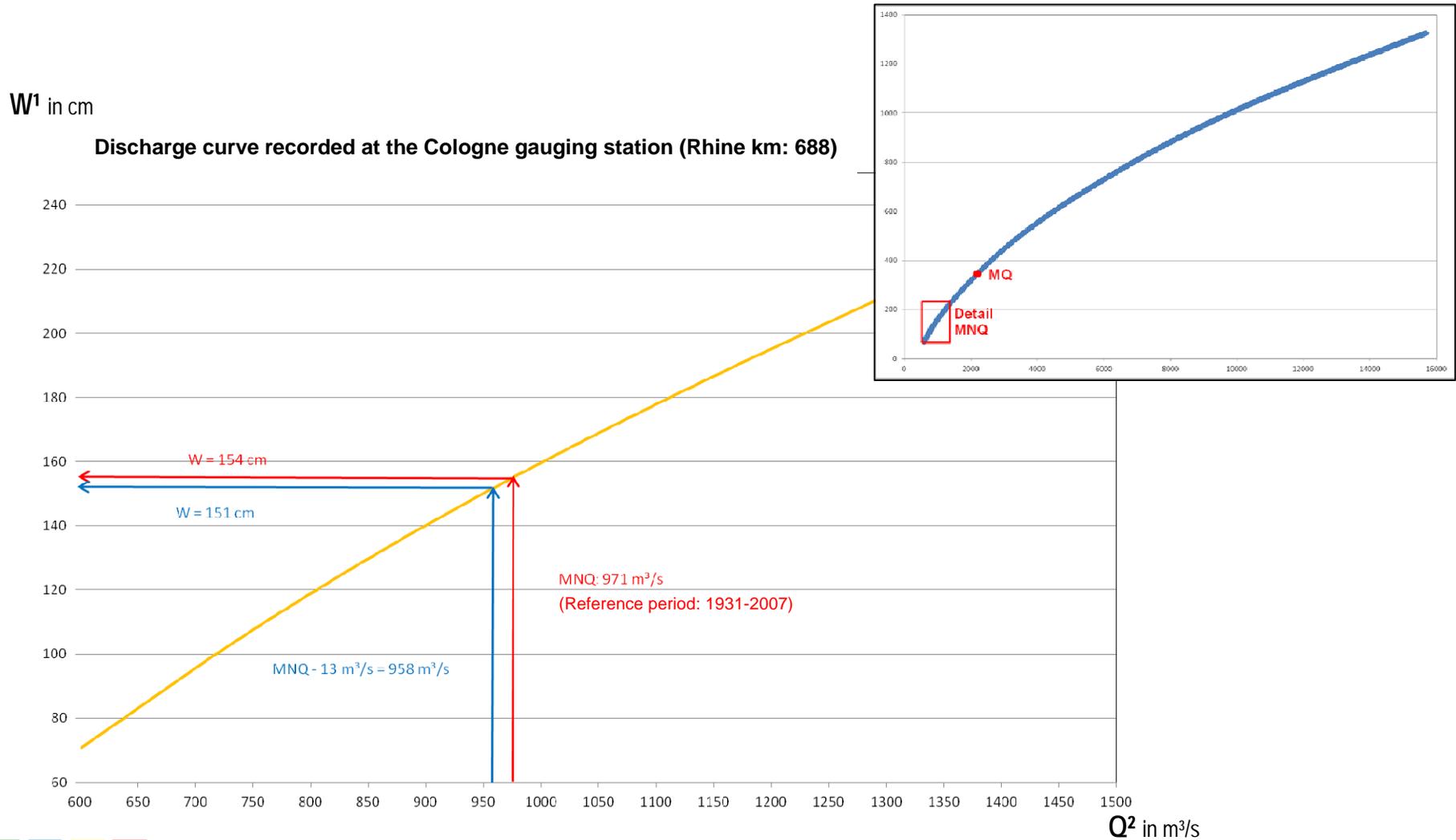
Hydrographs measured at the Cologne/Rhine gauging station
MQ¹/MNQ², 1930-2002



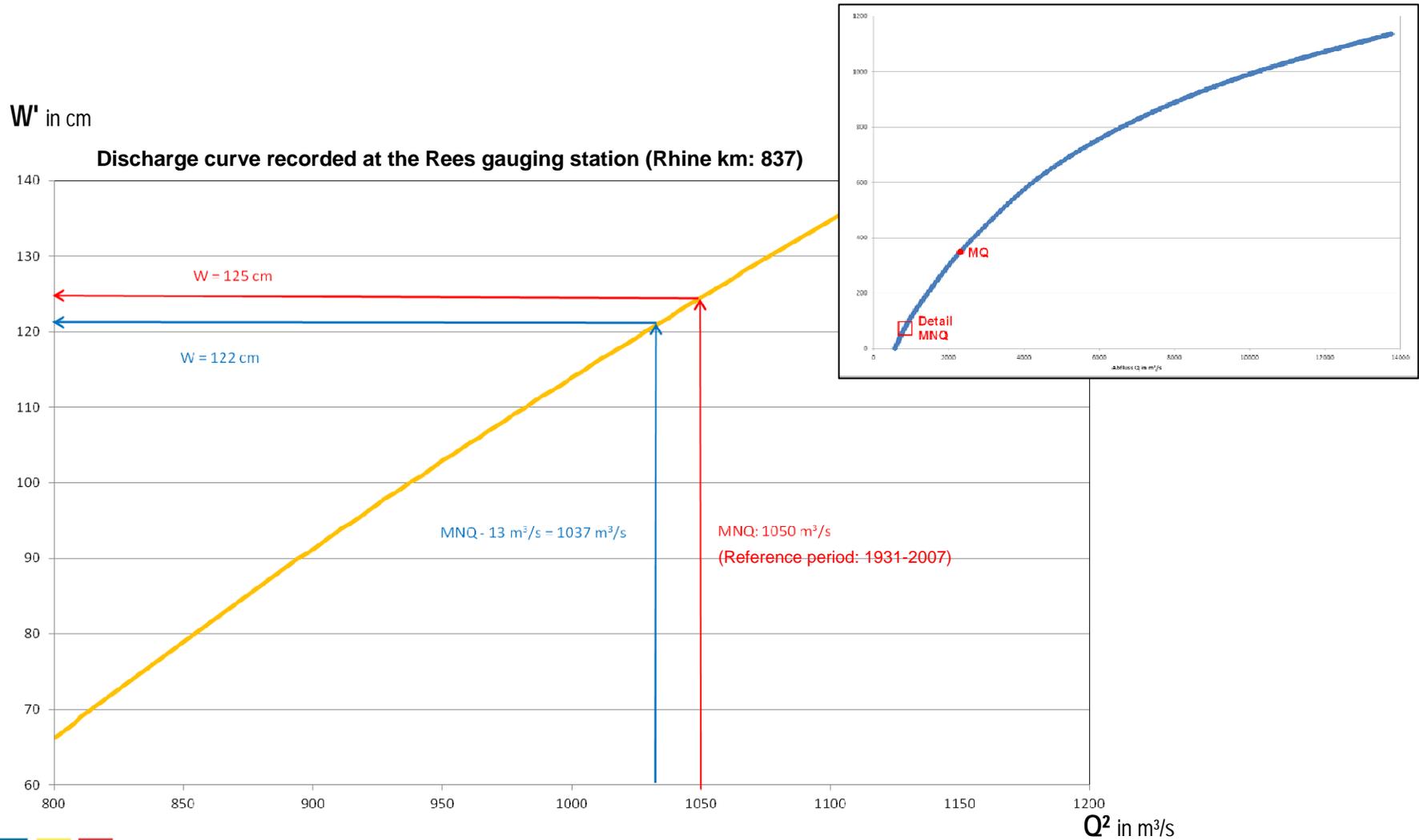
Belz, 2005



Impact of water abstraction in the amount of 13 m³/s on the Rhine

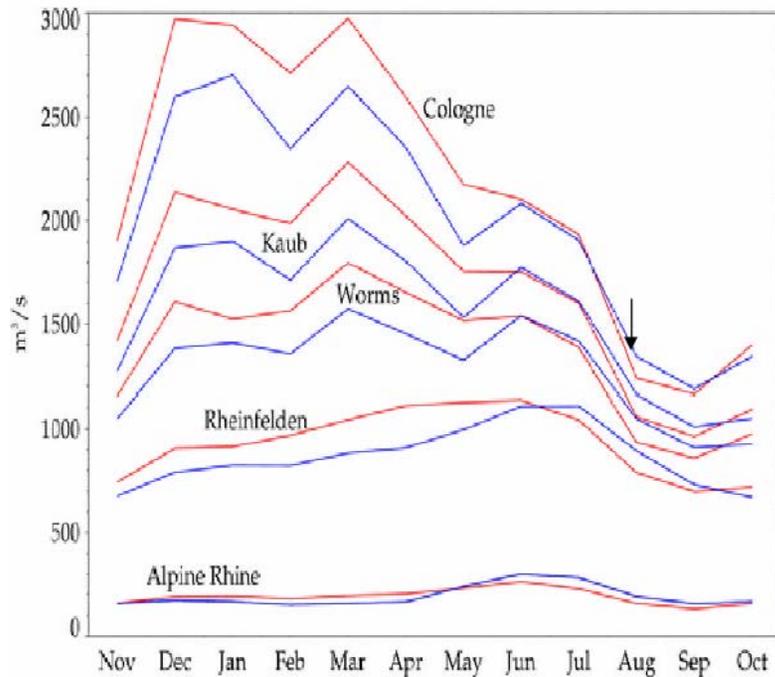


Impact of water abstraction in the amount of 13m³/s on the Rhine



¹Water level
²Discharge

Climate projections and implications for the discharge of the Rhine



Significant increase in discharge during the winter months; no substantial reduction in average discharge during the summer months

Cologne gauging station

- Max reduction in discharge to some 1,200m³/s in August

- Average discharge of some 1,150m³/s in September with hardly any reduction

Change in the discharge regime along the Rhine if the temperature increases by 2°K – actual condition in blue, scenario in red (Kleinn, 2002)

Particularly in the summer months the Lower Rhine feeds from groundwater inflow during periods of low precipitation. This reservoir is filled up during hydrological winter which is increasingly wet, so that there is rather a reduction in extreme low-water levels due to the buffering effect in groundwater and surface water bodies.

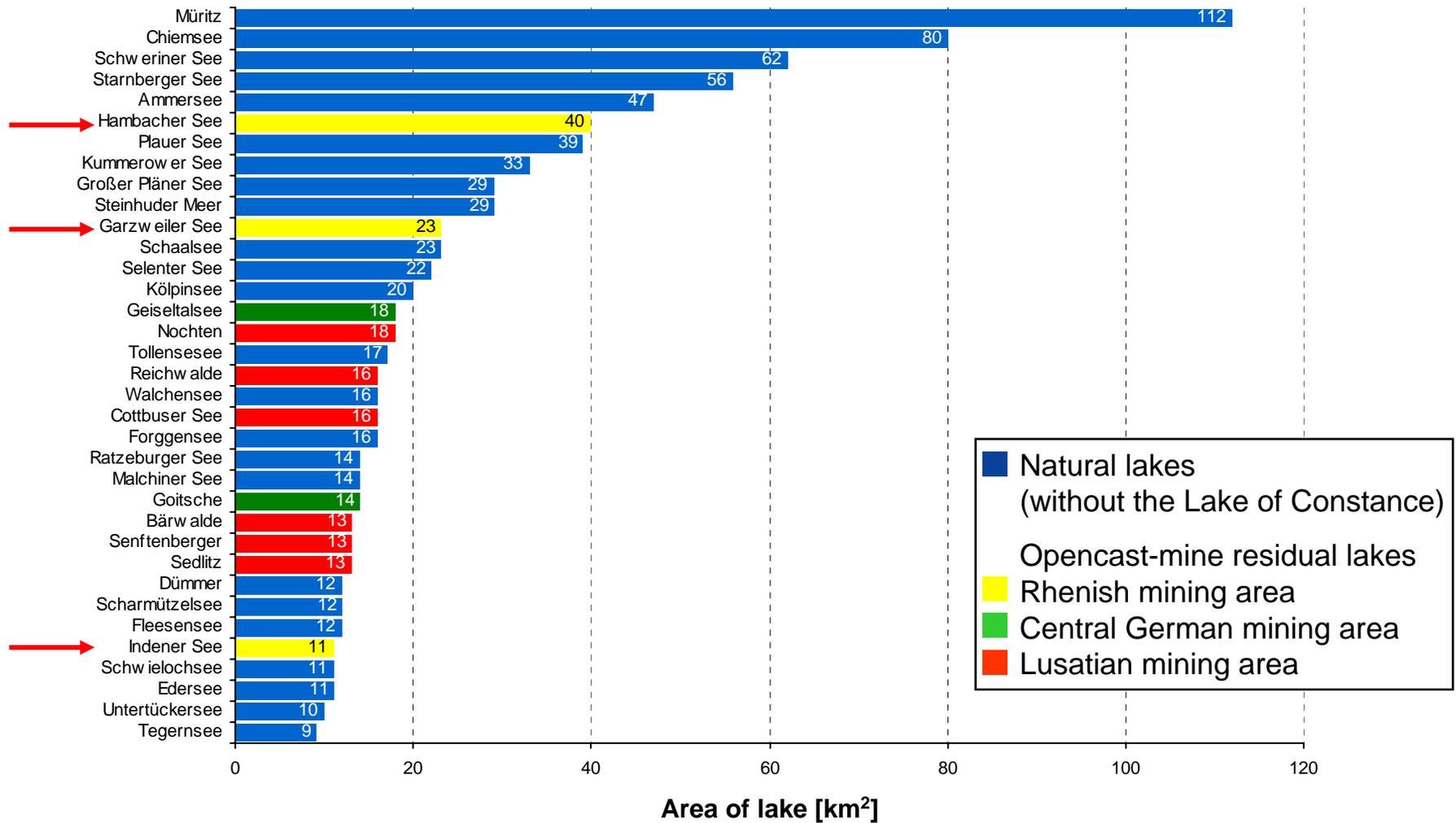
Conclusions

- Even if account is taken of climate-change aspects **we have no significant indication** that the abstraction of up to 13 m³/s of water at the Lower Rhine for the purpose of flooding the residual lakes of the Garzweiler and Hambach opencast lignite mines **will exacerbate low-water situations at the Lower Rhine.**
- A reduction in discharge by 13 m³/s will **lower Rhine's water level by some 3 cm** based on an average low-water discharge at the Cologne and Rees gauging stations. This equally applies if discharge is even lower, say in the order of the 2003 low water.
- The details of the envisaged water abstractions from the Rhine will be defined later in specific approval procedures with the involvement of the authorities and public-interest bodies.

Backup



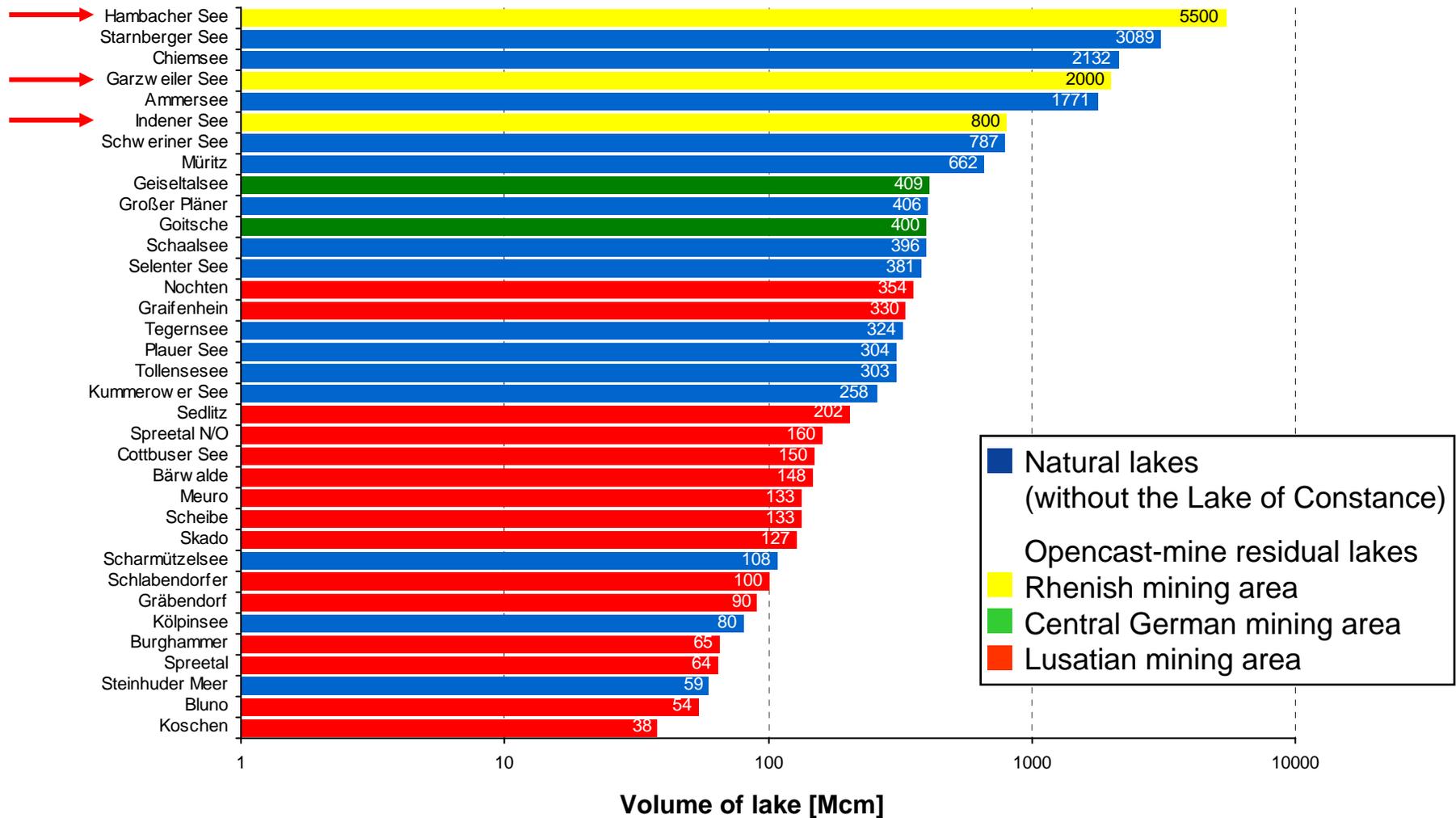
Comparison of the areas of Germany's largest lakes



Source: based on BTU, Cottbus



Comparison of the volumes of Germany's largest lakes



Source: based on BTU, Cottbus



Recharge of wetlands in the northern Rhenish mining area (Garzweiler opencast mine)

