



Climate change *and the impact on drinking water supply in the* **Meuse river basin**



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Outline of presentation



- RIWA and drinking water: an overview
- Water quantity en quality
- Climate change: what's the issue?
- Amice study *'Impacts of future low flows'*
- RIVM study *'Effects of climate change on water quality'*
- Conclusions and recommendations

RIWA



- Association of water companies that use river water for the production of drinking water
- **Sources:** rivers Rhine, Meuse and Scheldt
- **RIWA Meuse:** members supply drinking water to 6 million consumers in B and NL



Our mission statement



- We want the water quality in the river Meuse to be such that it can be purified to drinking water using natural treatment

Article 7 Water Framework Directive

- avoid deterioration of water quality in order to reduce the level of purification treatment required in the production of drinking water

The Meuse Basin

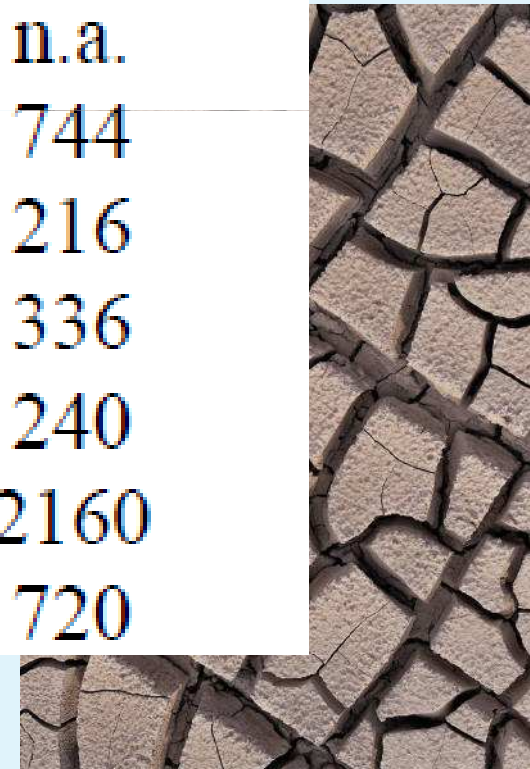


- Surface: **36 000 km²**
- Length: **925 km**
- Average flow: **230 m³/s**
- Abstraction for drinking water production 2011: **482 Mm³** (= 15.3 m³/s or 6.6% of average flow)
 - 1976: 120 m³/s (15.3 m³/s = 12.7%)
 - 2003: 125 m³/s (15.3 m³/s = 12.2%)
- Drinking water source for 6 million consumers in B and NL

Bridging periods in low/no flow conditions

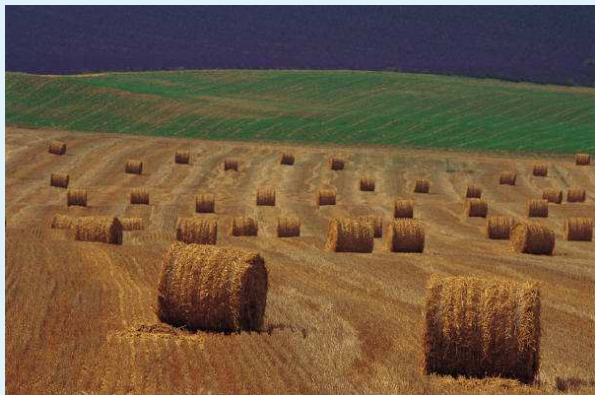


Location	Maximum bridging period	
	days	hours
Tailfer	n.a.	n.a.
Broechem	31	744
Lier	9	216
Heel	14	336
Brakel	10	240
Keizersveer	90	2160
Scheelhoek	30	720



Water quality: substances relevant for drinking water

- Pesticides, like glyphosate, metolachlor
- Industrial substances, like Fluoride, Dipe
- Emerging substances, like pharmaceuticals, X-ray contrast media



Climate change: an issue for drinking water



- Reduced availability in time periods with increased demand
- Deterioration of water quality due to reduced dilution of effluent



Amice: impacts of future low flow situations



- Decrease low flow by 10-40% (MAM7)
- Consequences only calculated for annual averages, but not for daily/monthly time periods
- Bridging and storage capacity too limited
- Risk of water shortages and economic impacts



An example from Amice: frequency 1/30 yrs



Flow MAM7 at Monsin: 28 m³/s

- Decrease of flow due to climate change 10-40%: 21 m³/s
- For longer period: 20-30 m³/s
- Flow divided over Albert Canal and Meuse
- Needed just for drinking water: 15-20 m³/s
- So: tension will arise!

RIVM study *Effects on water quality*



- Focus on pesticides and carbamazepine as an example for pharmaceutical
- W_{plus} scenario of KNMI (Royal Netherlands Meteorological Institute)
- Calculates periods in which standards are breached by 2050 for
 - a dry year (frequency every 5 yr)
 - a very dry year (frequency every 80 yr)

Number of days per year with a risk of breaching the water quality standard or the humane risk threshold at intake points in the River Meuse basin for various scenarios by transboundary emissions

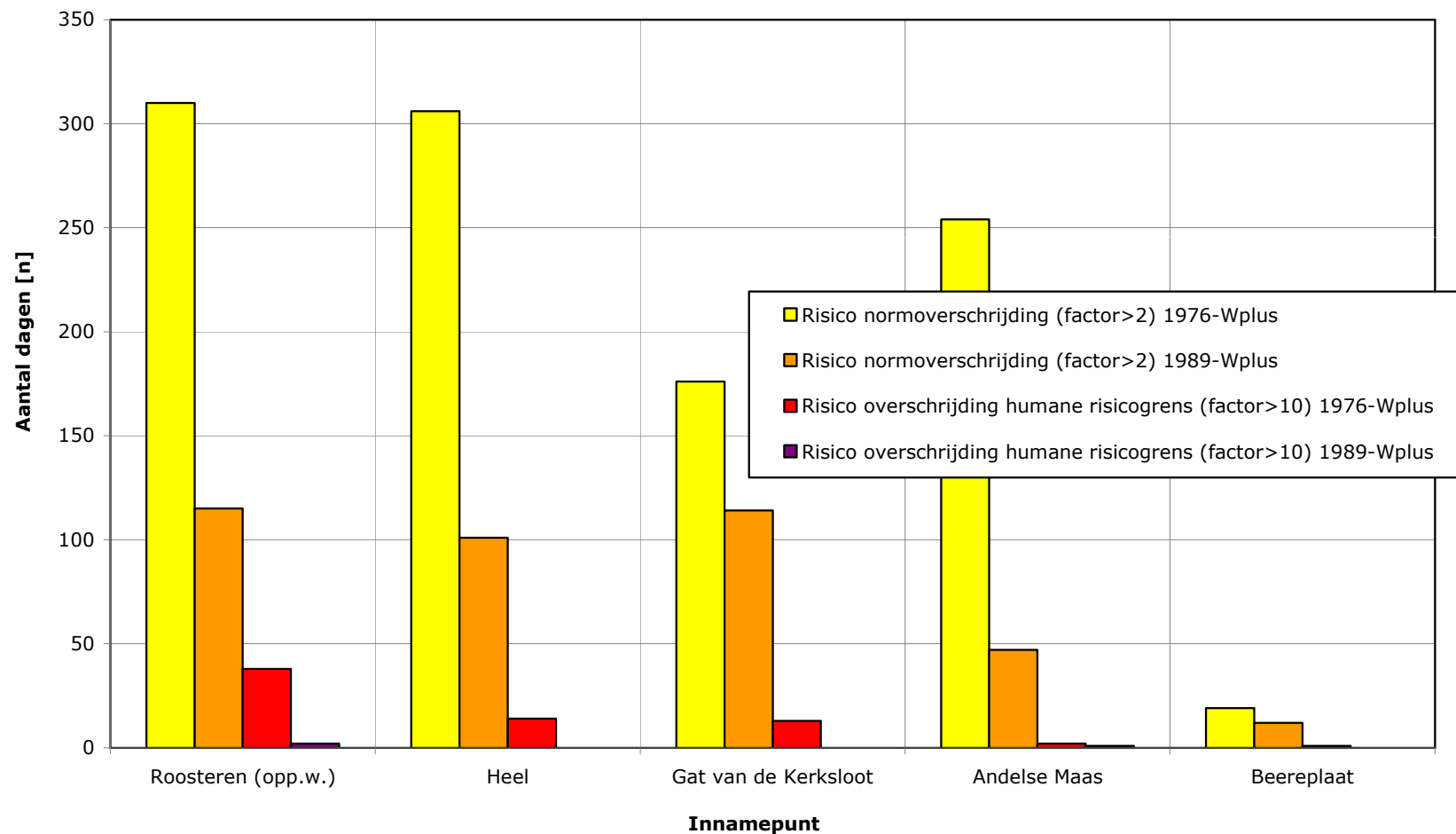




Table 3. Calculated number of days and the longest continuous period with risk of breaching water quality standards at intake points in a dry year and fast climate change (1989 – 2050W_{plus}) (Modified from: Wuijts et al., 2012).

Intake point	Risk of breaching standards in a dry year (1989) [days]				Current bridging capacity [days]
	Transboundary		Dutch WWTPs		
	Total	Longest	Total	Longest	
Roosteren	115	85	121	86	Bank filtration
Heel	101	76	128	95	21 – 120
Gat van de Kerksloot	114	47	234	179	60 – 90
Brakel	47	17	103	103	10 – 28

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**Longest intake stop at
Gat van de Kerksloot
until now: 48 days (1993)**



Conclusions



- Future drought leads to periods of shortage and economic impact for drinking water
- Flow rates of 20 m³/s are equal to only drinking water demand
- There is no picture of total water demand against availability
- Water quality is an issue, standards can be breached for longer periods of time

Recommendations



There should be a follow up project

- Identify periods of water shortage and develop adaptation strategy
- Identify total water demand by all sectors
- Determine impact of lower flow rates on water quality
- Incorporate water quality in adaptation strategy: emission reduction!

