# Water reuse and water quality aspects in Europe

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# Water reuse

- *A process where water is used more than one time before it passes back into the natural water cycle.*
- Recycled or reclaimed water are generally used as synonyms. The word used depends on the region.

Source: http://www.watereuse.org

# Why is water reuse important?

- offers a climate independent water source
- allows communities to become less dependent on groundwater and surface water sources
- decreases the diversion of water from sensitive ecosystems
- reduces the nutrient loads from wastewater discharges into waterways, thereby reducing and preventing pollution
- used to replenish overdrawn water sources and rejuvenate or reestablish those previously destroyed

Source: http://www.watereuse.org

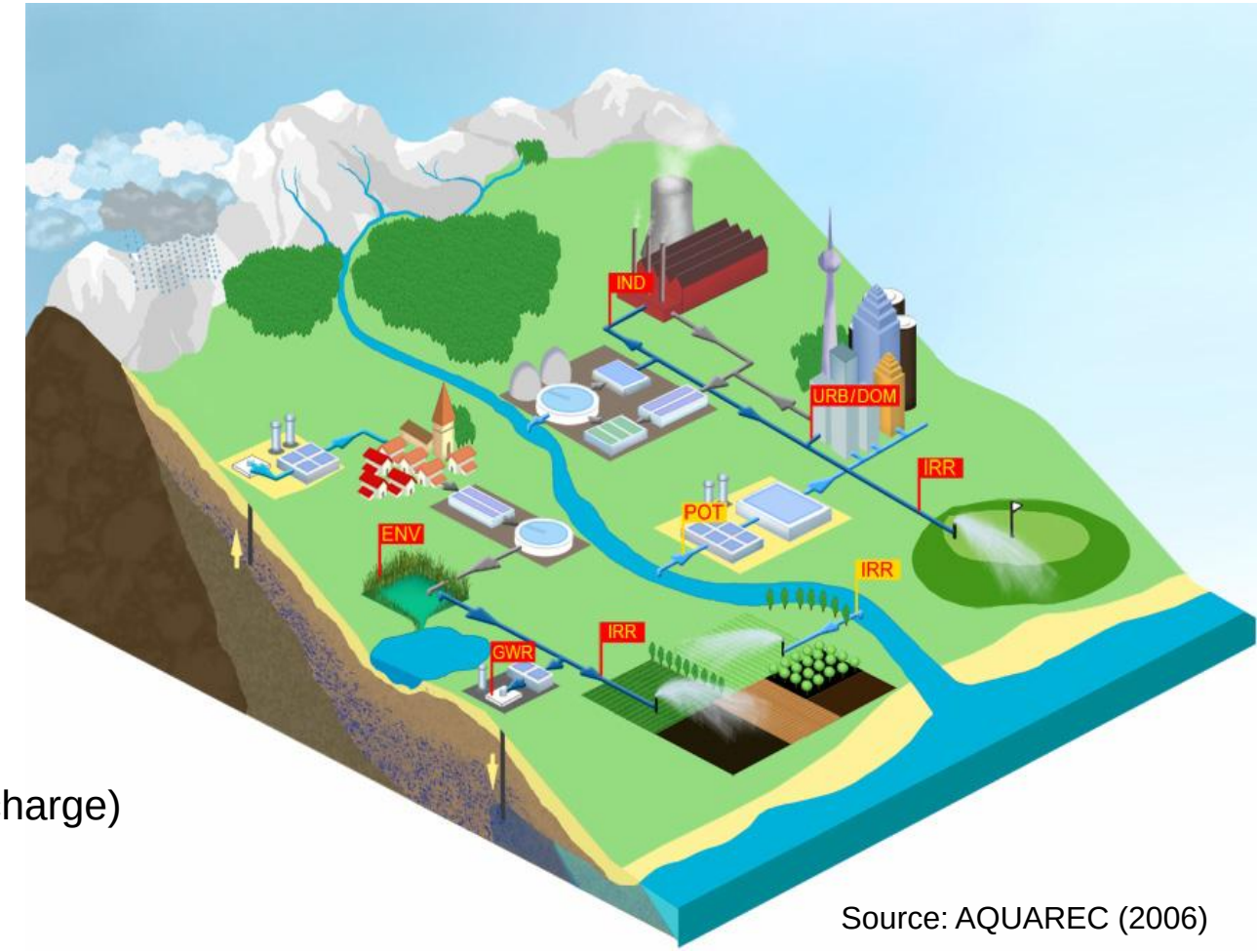
# Uses for recycled water

Direct uses

- Agriculture
- Energy
- Industry
- Urban

Indirect uses

- Irrigation
- Potable (Groundwater recharge)



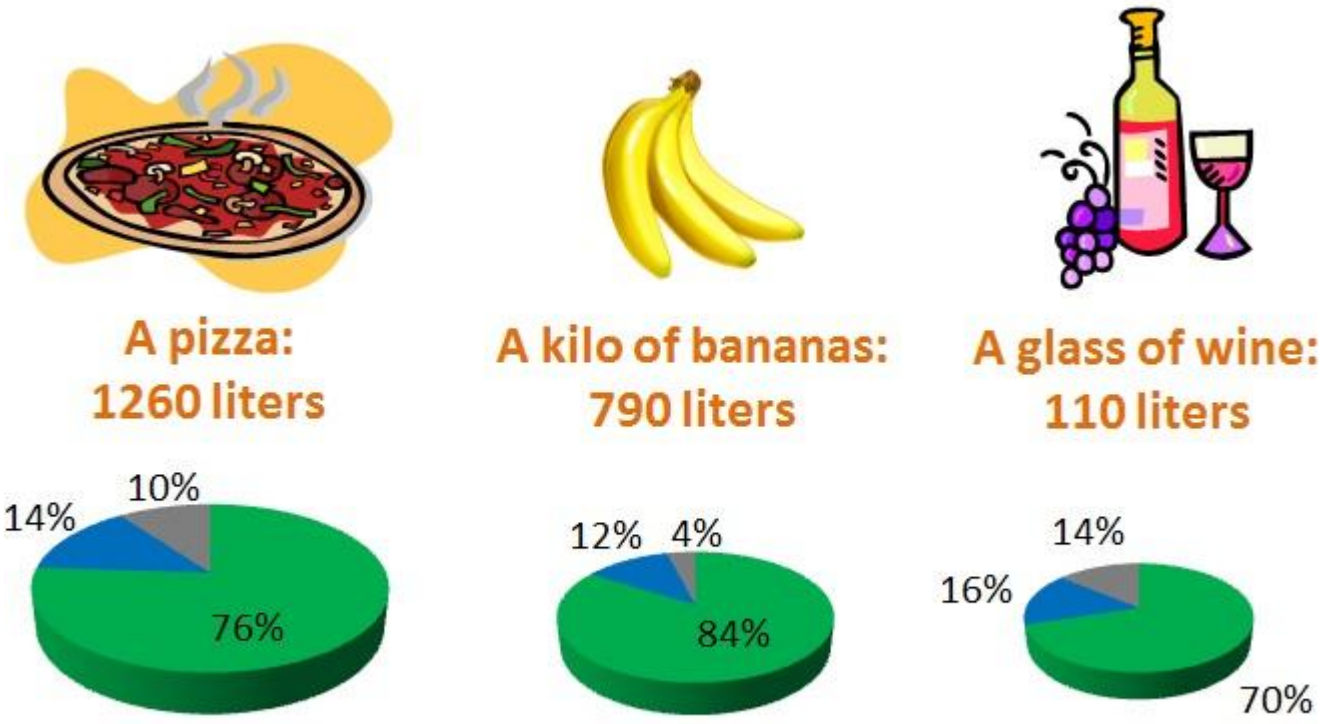

Source: AQUAREC (2006)

# Uses of recycled water

- Irrigation
  - **Crops**
  - **Pastures**
  - **Trees (no contact of reclaimed water with fruit)**
  - **Industrial non-food crops, fodder, cereals**
  - **Golf courses**
  - **Woodland and green areas not accessible to the public**
  - Private gardens
  - Urban areas
  - Ornamental flowers (no contact of reclaimed water with product)
  - Silviculture
- Aquaculture
- Industrial
  - Cleaning processes in food & non-food industry
  - Cooling towers and evaporative condensers
  - Washing of vehicles
- Environmental
- Urban
  - Supply to sanitary appliances
  - Ornamental ponds without public access
  - Street cleaning
  - Fire hydrants
- Aquifer recharge
  - Indirect potable use (example Belgium)

# Virtual water footprint (Hoekstra, 2002)

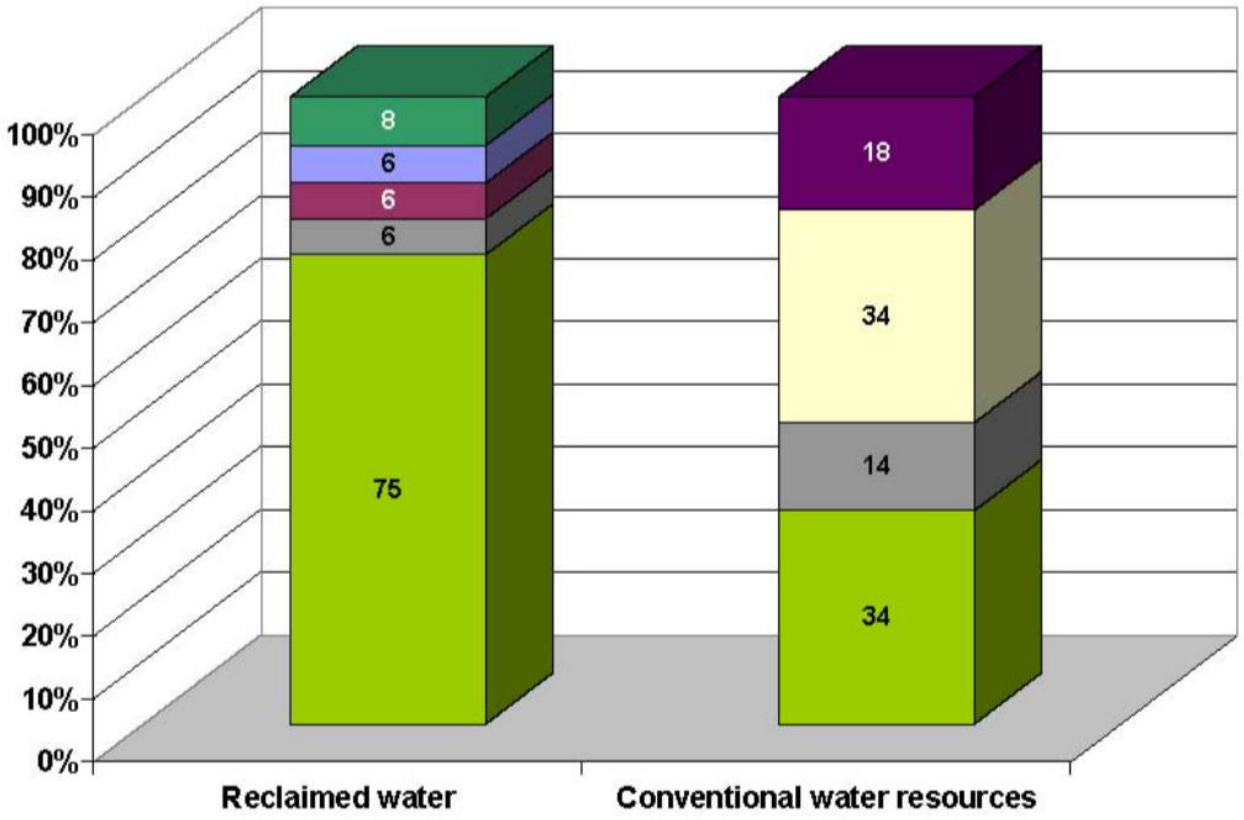
- Green / blue / grey water in food




Source: waterinfood.it

# Water use and reuse among European countries by application

- Reused water only presents a minor share of a country‘s water demand!
- In most cases, less than 1%.

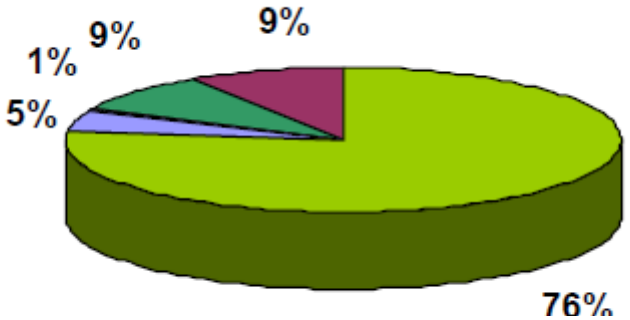



Source: AQUAREC (2006)

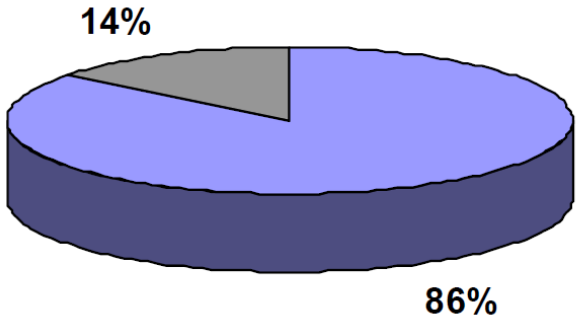
# Purpose of water reuse

- To cover an existing water demand
- To supplement uses
- To replenish natural resources

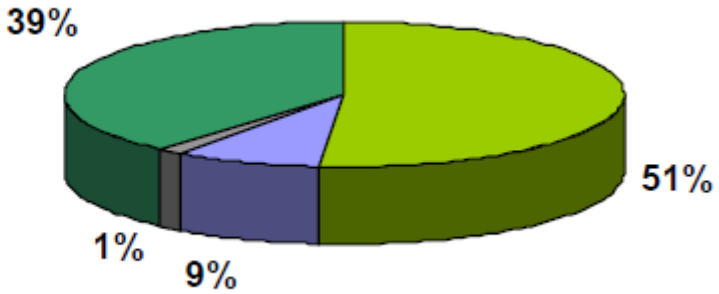
**Spain**




**Belgium**




**Germany**



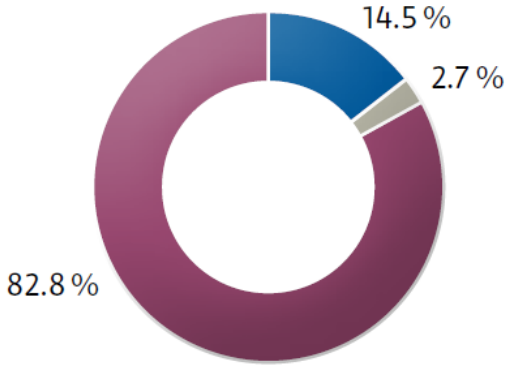

Source: AQUAREC (2006)

Agriculture | Groundwater recharge | Industry | Ecological enhancement | Urban application | Public water supply | Electricity production

# Availability and sources of water in Germany

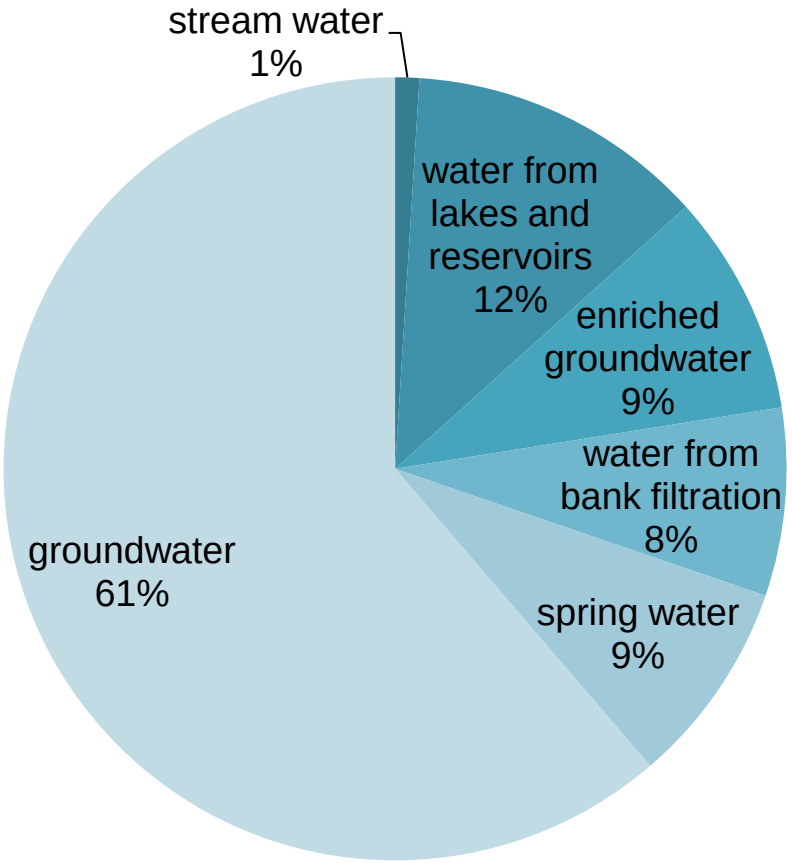
## Water utilisation in Germany in 2007

Total available water resources:
188 billion cubic metres




Total water consumption 17.2 % (32.3 billion m³)

- Non-public water supply and wastewater disposal 27.2 billion m³
- Public water supply 5.1 billion m³
- Unused 155.7 billion m³



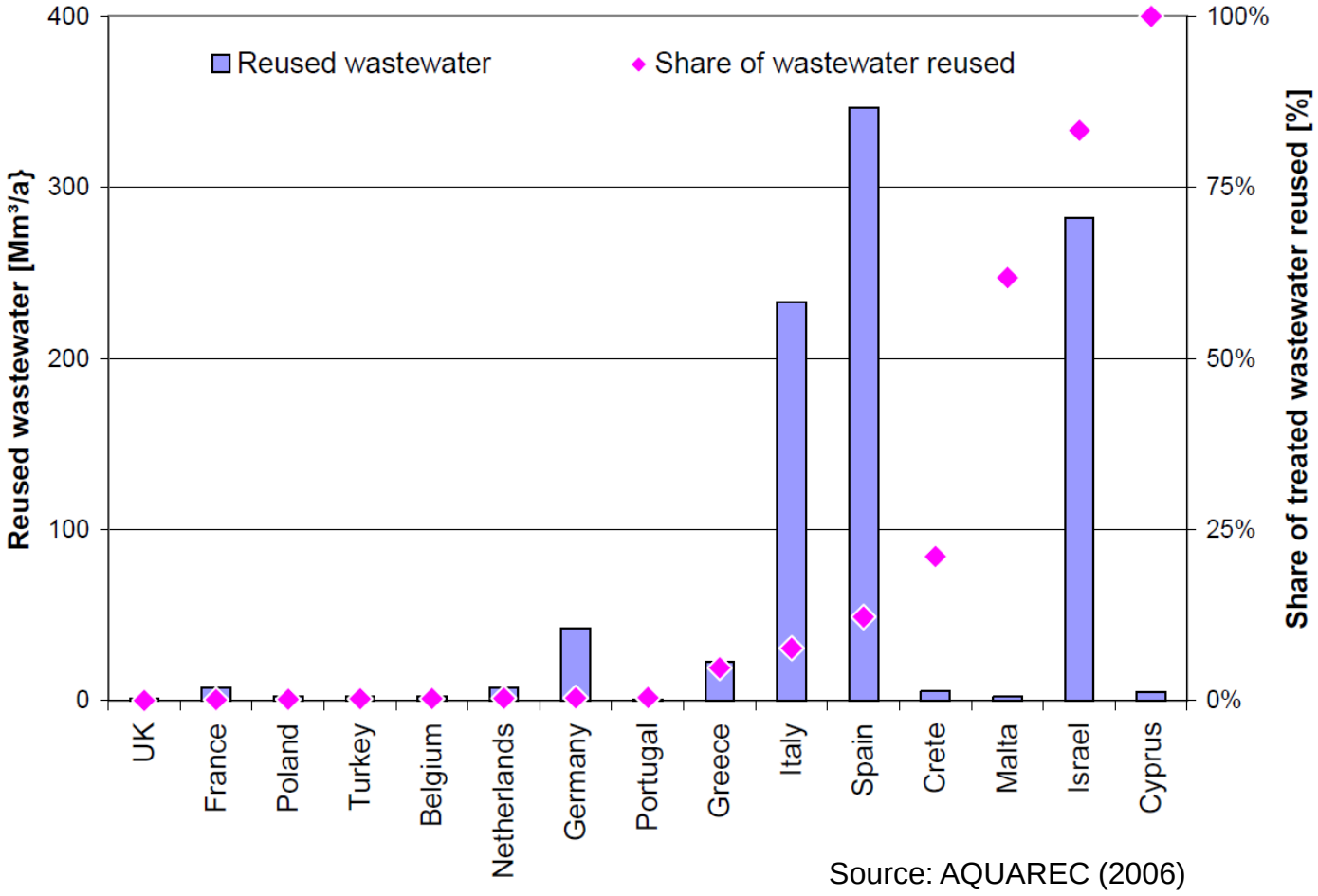

Reclaimed water is mainly used for additional purposes such as irrigation and environmental enhancement

Sources: German Federal Statistical Office (2009) in wvgw (2011); German Federal Statistical Office (2013)

# Share of water reused in different countries (EU and non-EU)

- The total reused wastewater volume in Europe: 2.4% of the treated effluent.

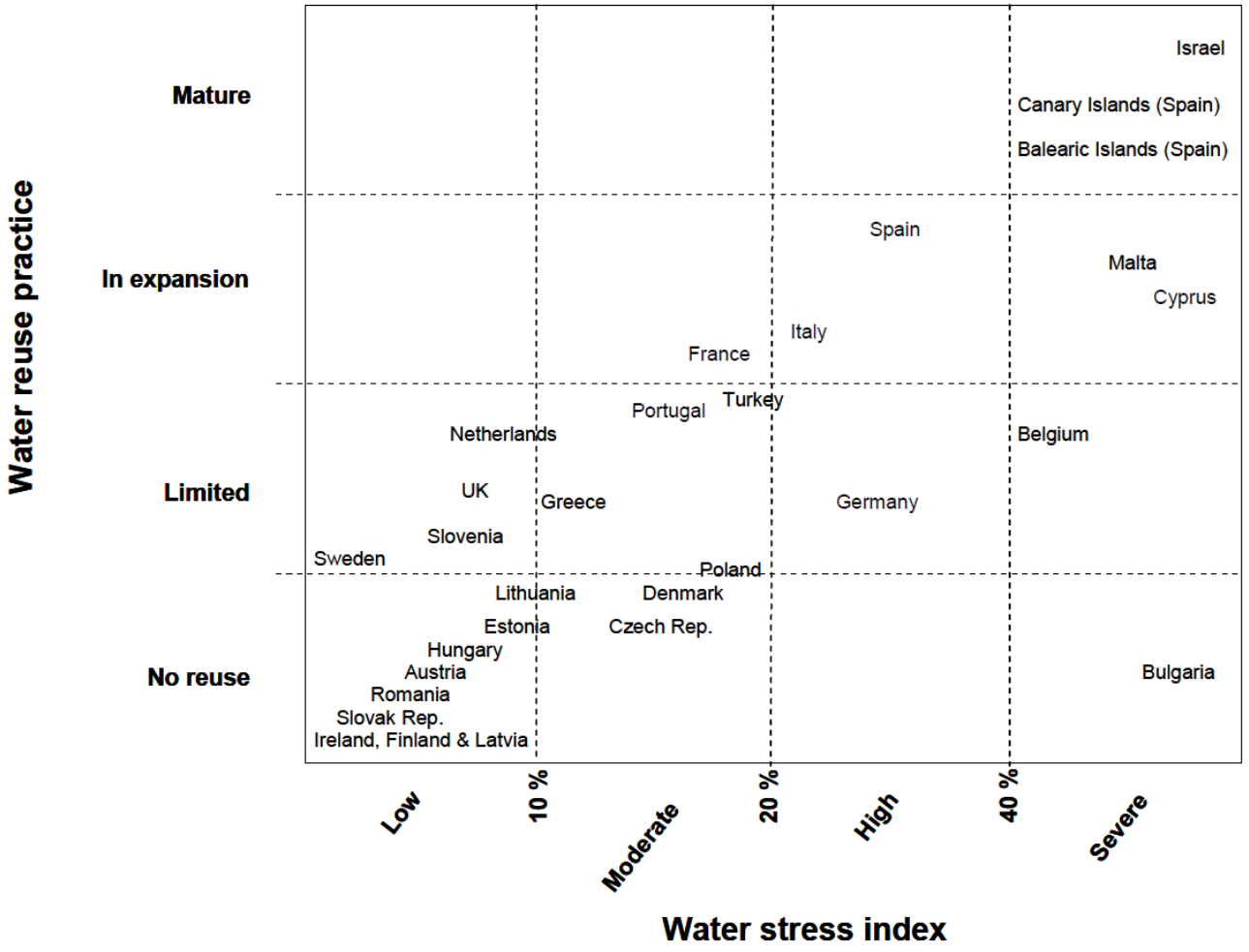
  **Question:** What explains the wide range?




Source: AQUAREC (2006)

# Extent of water reuse practice

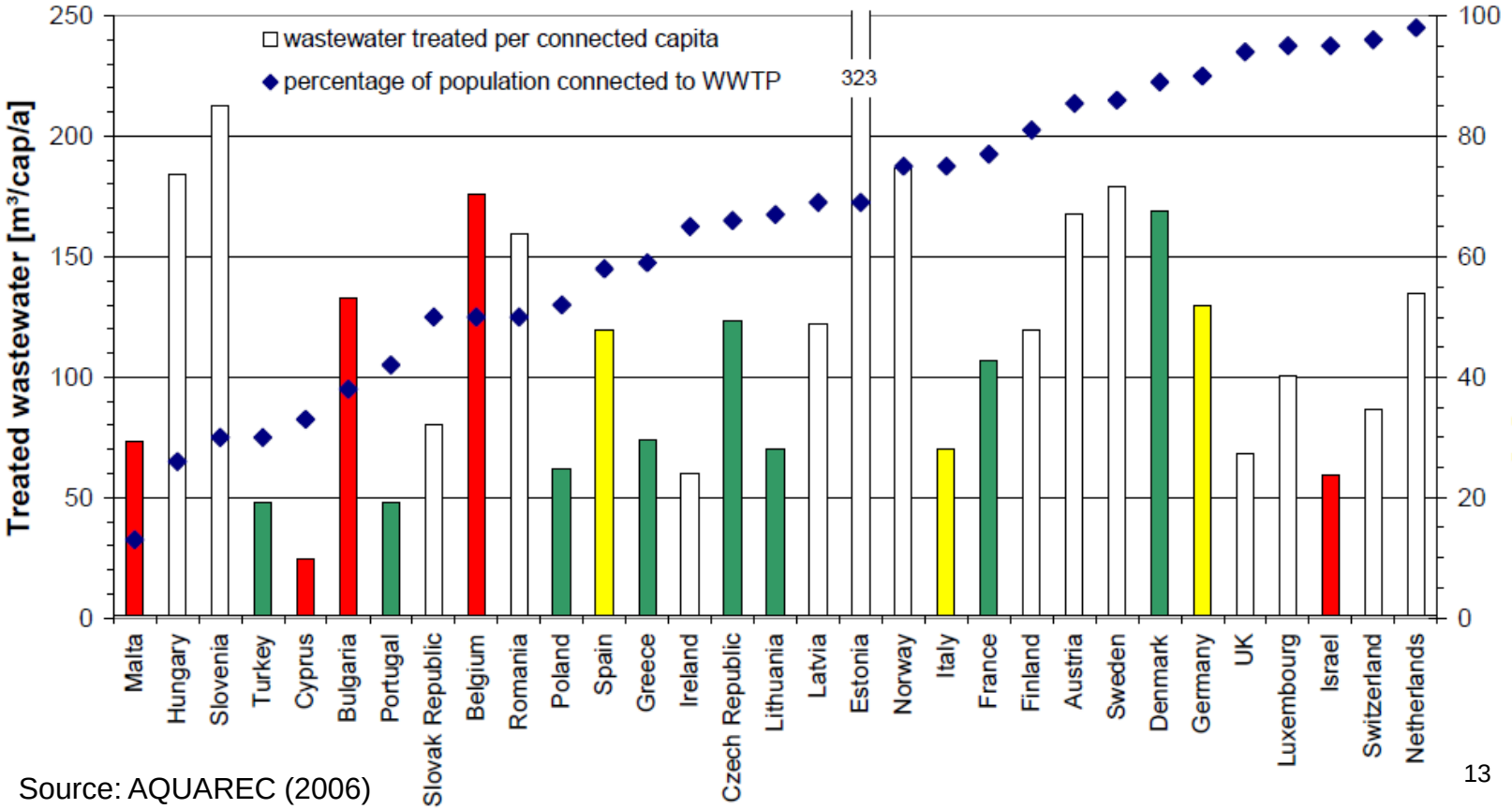
- The implementation level follows the availability of water resources




Source: Bixio et al 2006b

# Precondition for increasing water reuse: UWWTD

- Connections of households to WWT, especially in Southern and Eastern Europe

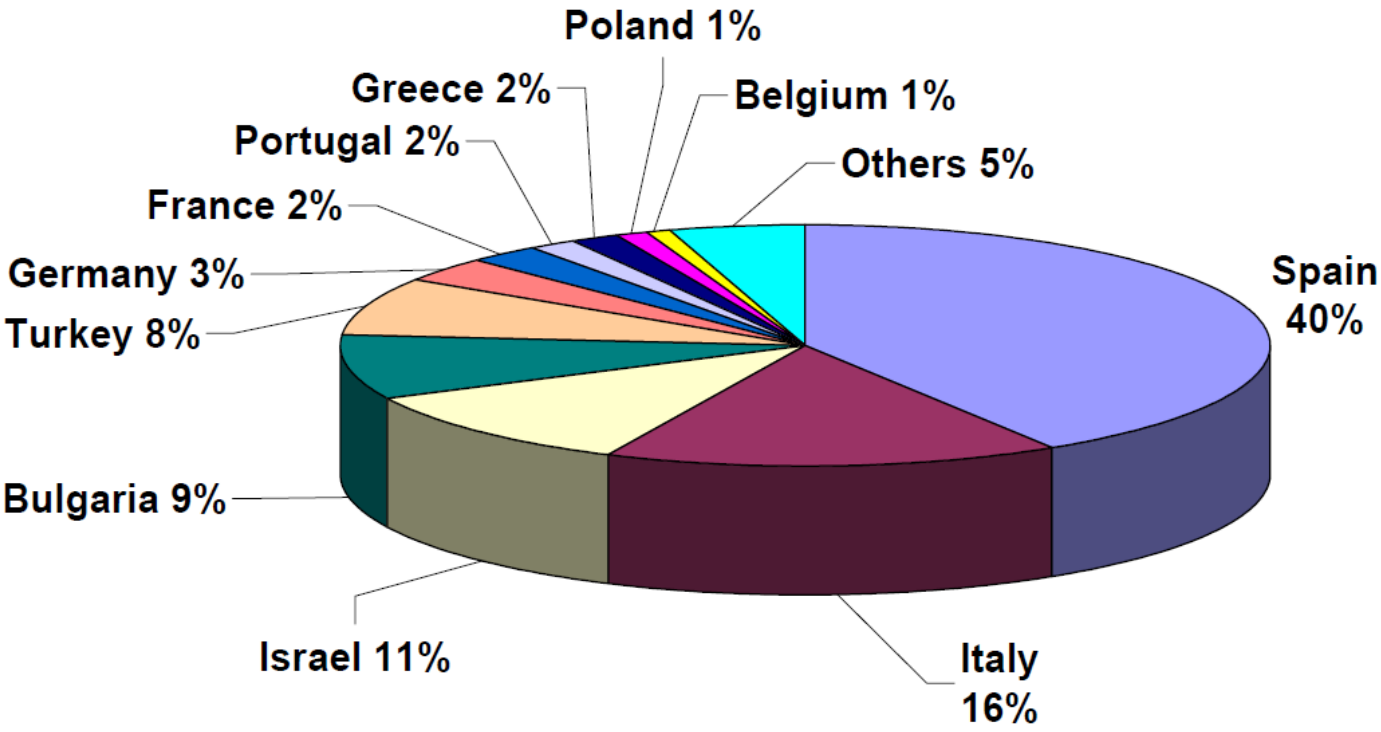



Water stress
High
Medium
Low

Source: AQUAREC (2006)

# Projected distribution of reused water volume

- Countries with highest water stress at the forefront
- Requirements: Full implementation of the UWWTD

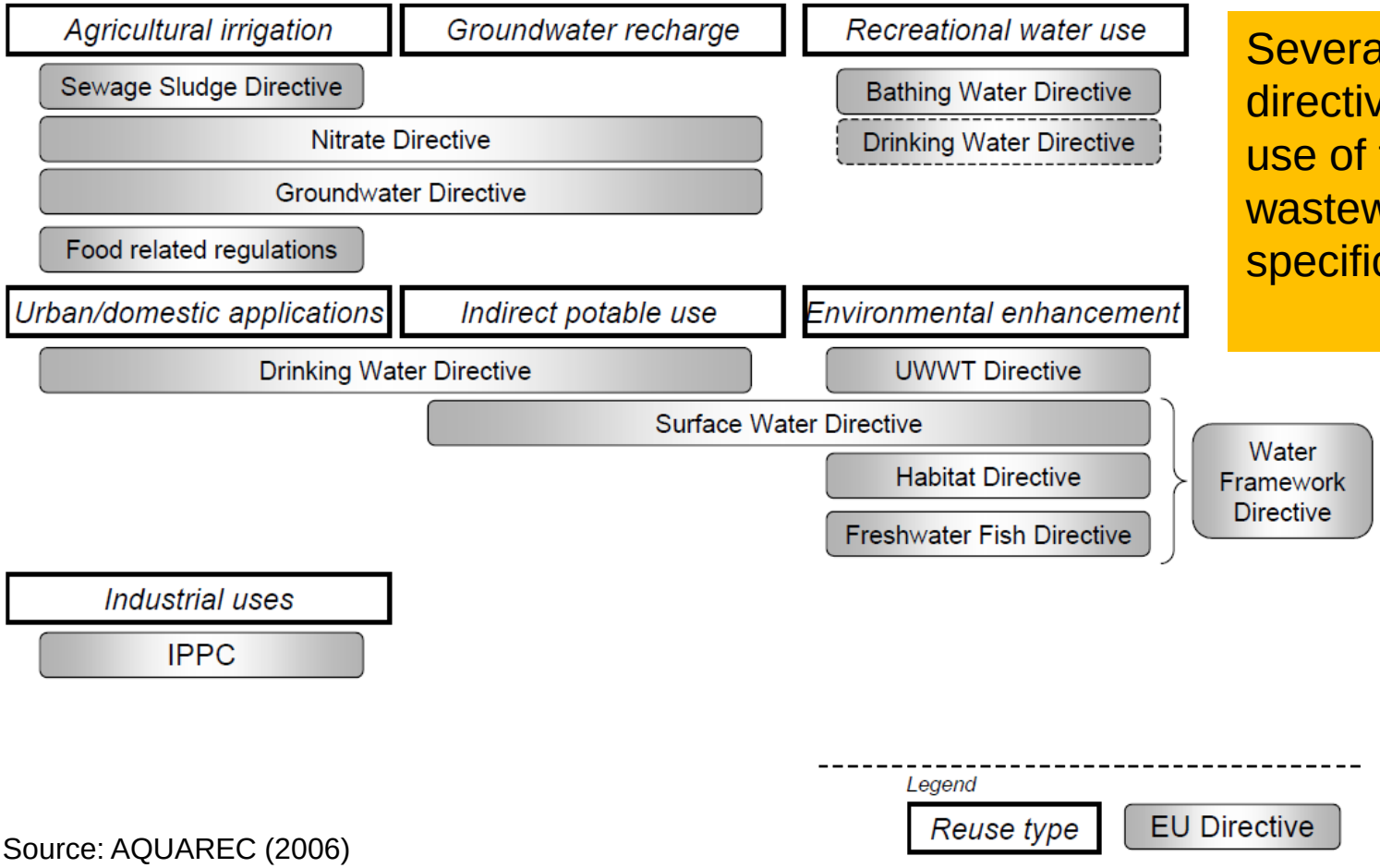



Source: AQUAREC (2006)

# Legal framework: An overview of water reuse in the EU

- Currently, no EU-wide guidelines exist that regulate water reuse : A lack of clear criteria
  - Assessment of WFD *"Blueprint to safeguard Europe's water resources"* (2012) highlights importance of water reuse for irrigation and in industry
  - Several studies have been prepared for the EC on the topic
  - Paving the way for an EU-level instrument including the possibility of a regulation establishing common standards in year ????

# Reuse types acknowledged by existing European Directives



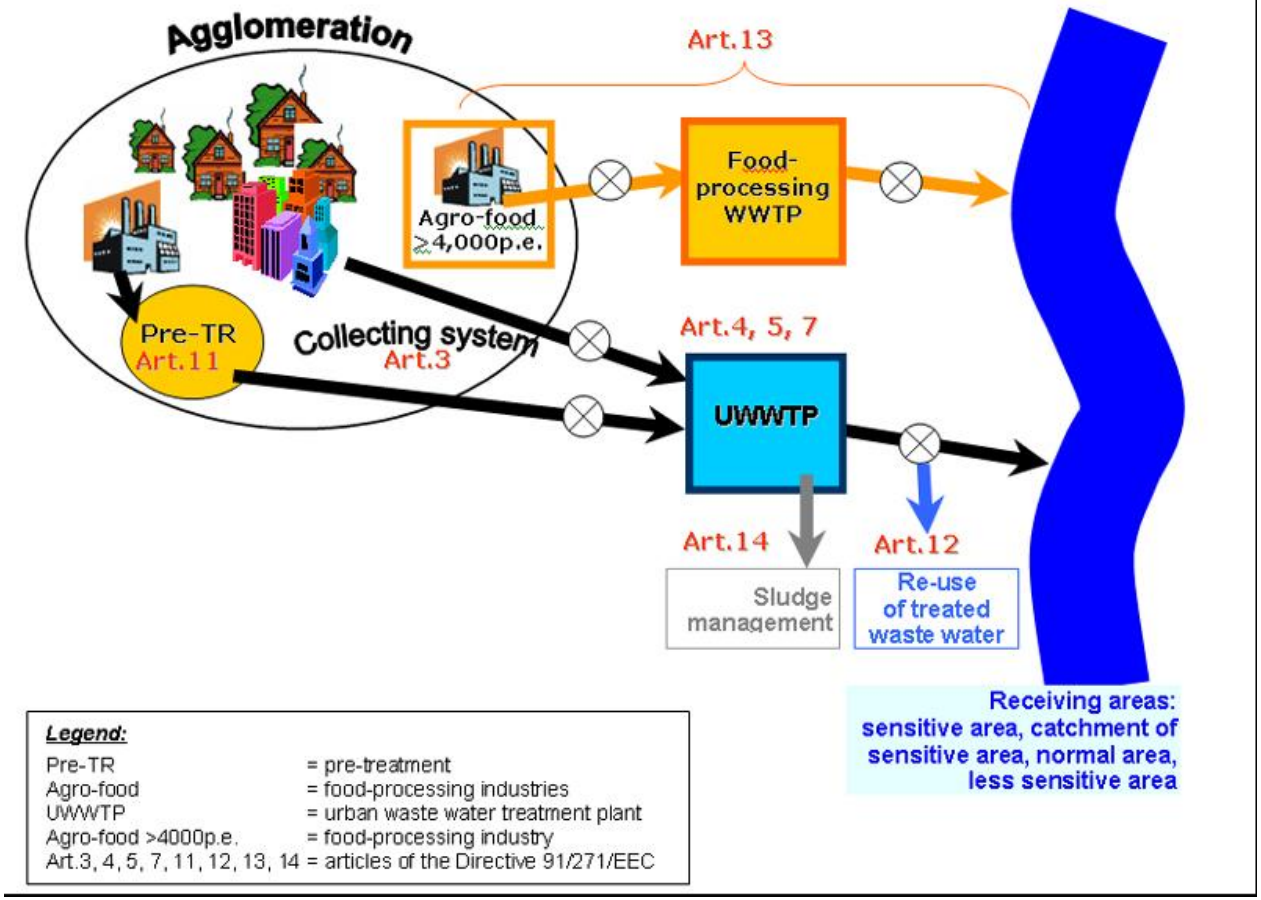

Several EU directives limit the use of treated wastewater for specific purposes

Source: AQUAREC (2006)

# Urban Waste Water Treatment Directive (UWWTD)

- Water must have a threshold quality in order to be reused or discharged

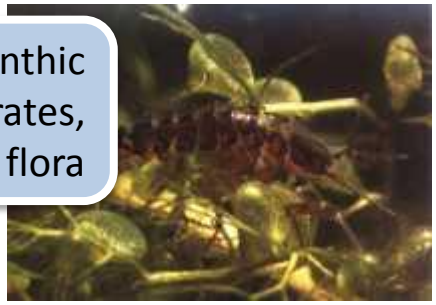
**UWWTD - Article 12**
"Treated waste water shall be reused whenever appropriate. Disposal routes shall minimize the adverse effects on the environment."




Source: http://ec.europa.eu/environment/water/water-urbanwaste/index_en.html

# The EU Water Framework Directive (WFD)

**Objective: Attaining "good ecological status" and "good chemical status" for Europe's rivers, lakes, groundwater bodies and coastal waters**



water quality

- morpho-logical: hydrological regime, morphological conditions or tidal regime
- physico-chemical: river basin specific pollutants thermal, oxygenation and nutrient conditions
- biological: fish, benthic invertebrates, aquatic flora

Source: UBA (2010)

# Legal framework: Reuse regulation in Member States

| Member state | Type of criteria | Comment |
|---|---|---|
| **Belgium: Flemish Regional Authority** | Aquafin proposal to the government (2003) | • Based on Australian EPA guidelines |
| **Cyprus** | Provisional standards (1997) | • Quality criteria for irrigation stricter than WHO standards |
| **France** | Art. 24 décret 94/469 3<br>1994 Circulaire DGS/SD1.D./91/n°51 | • Water reuse for agricultural purposes.<br>• WHO standards,<br>• additional restrictions for irrigation techniques and set-back distances |
| **Italy** | Decree of Environmental Ministry 185/2003 | • Quality requirements for: agriculture, non-potable urban and industrial.<br>• Flexibility for regional authorities |
| ***Regional authorities:*** **Sicily, Emilia Romagna and Puglia** | Guidelines | • Standards are similar Californian and WHO regulation |
| **Spain** | Law 29/1985, BOE n.189,Royal Decree 2473/1985 | • Draft legislation with standard for possible applications of treated water<br>• Standards similar to Californian regulation |
| ***Regional authorities:*** **Andalucia, Balearic Is. and Catalonia** | Guidelines from the Regional Health Authorities | • Guidelines for irrigation<br>• Follow WHO guidelines |
| **Portugal** | National Standard NP 4434 established recently | • Irrigation |


Sources: Bixio et al 2006, Marecos do Monte 2006

# Why is water reuse risky? *Concerns highlighted in EU Directives*

- Pollution from chemical- or bio-hazardous substances

  from the **environment (soil, groundwater)** and/or

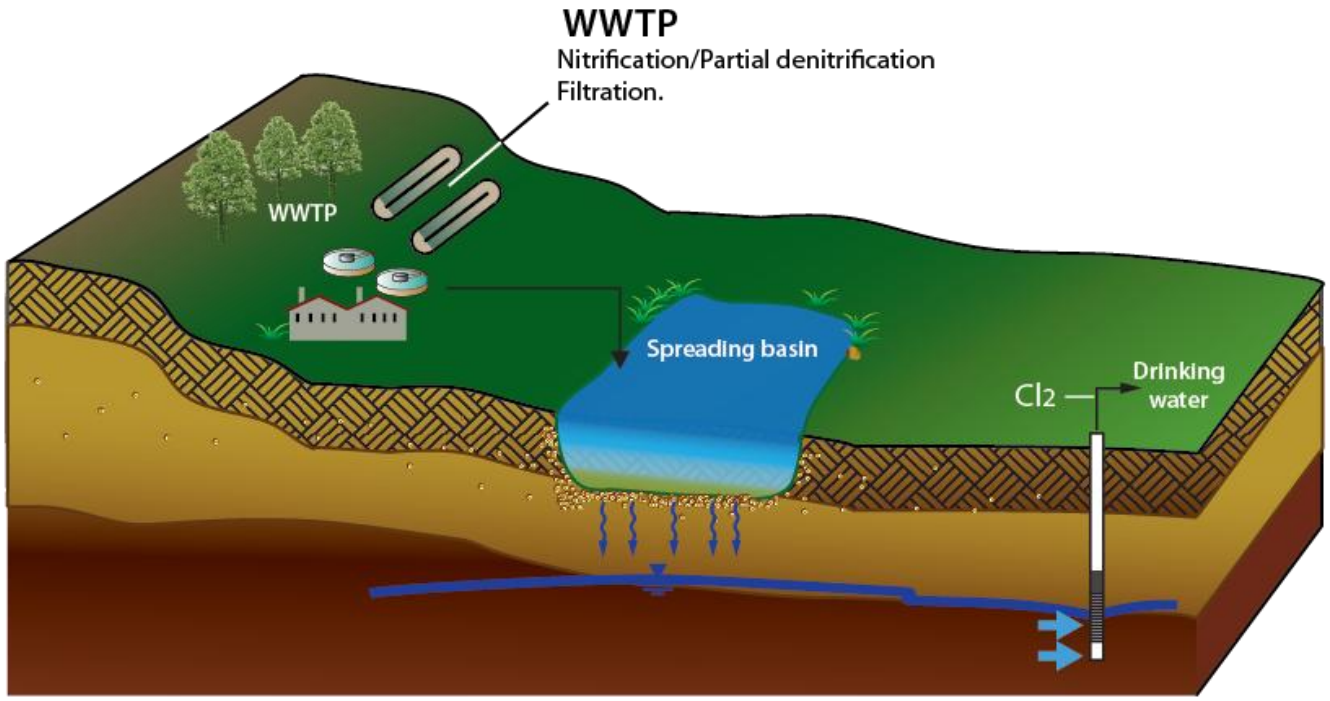
  produce
  - Discharge into receiving waters
  - Agricultural irrigation
  - Aquaculture
- **Health risks** for workers and consumer
  - Urban applications
  - Groundwater recharge
  - Indirect potable reuse
  - Recreational water use
- Harmful effects on the **biocenosis**
  - Environmental enhancement

# Why is water reuse risky? *Health risks*

- It is difficult to quantify and characterise health risks through medical or toxicological studies
- Dose-response data for human health effects are often lacking, especially for mixtures of pollutants
- DEMEAU demonstrates bioassays for a rapid toxicological assessment of health risks

# Why is water reuse risky? *Soil-Aquifer Treatment (SAT)*

- 6 month retention time in subsurface, no dilution through other groundwater
- Pollutants or pathogens may not be removed or degraded




Source: Bastian, EPA

# Is recycled/reclaimed water safe?

- Reclaimed water is highly engineered for safety and reliability
- The quality of reclaimed water is more predictable than many existing surface and groundwater sources

  → Reclaimed water is considered safe when appropriately used

Source: www.watereuse.org

# Other issues to consider...

| | |
|---|---|
| Energy? | Additional energy required to treat wastewater for recycling, but …the amount of energy required to treat and/or transport other sources of water is generally much greater. |
| Costs? | High, due to the need for a separate distribution system and higher treatment efforts |
| Timing? | Reuse may be seasonal in nature (e.g. irrigation, golf course, watering) |
| Water Quantity? | Short-term negative effects on minimum flow conditions in rivers/lakes especially in Mediterranean regions |

...

Source: http://www.sheffy6marketing.com

# Conclusions

- **Water reuse is an important and forward-looking water strategy**
- **Hindering factors**
  - Clear EU-wide guidelines and/or regulations are needed
  - Benefits of water reuse are undervalued
  - Potable and wastewater are treated as if they were unrelated subjects
  - Open questions on health and environmental risks still need to be answered

# Thank you for listening.

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