Increasing pressures on groundwater resources

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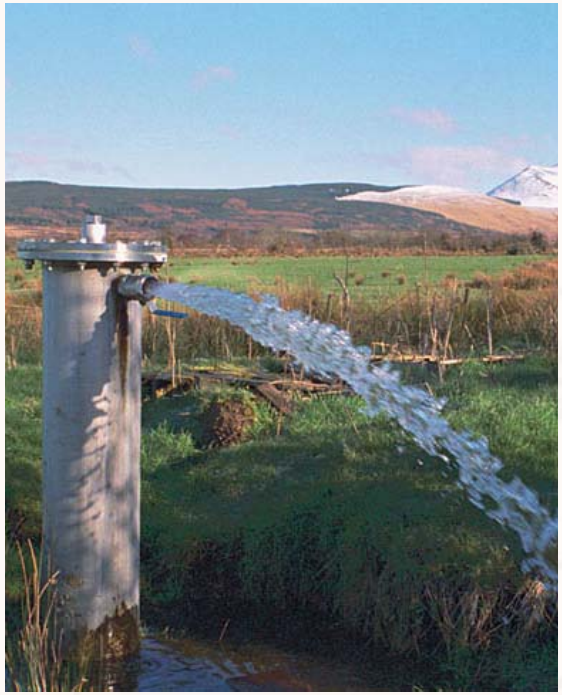
NATURAL ENVIRONMENT RESEARCH COUNCIL

What are the pressures?

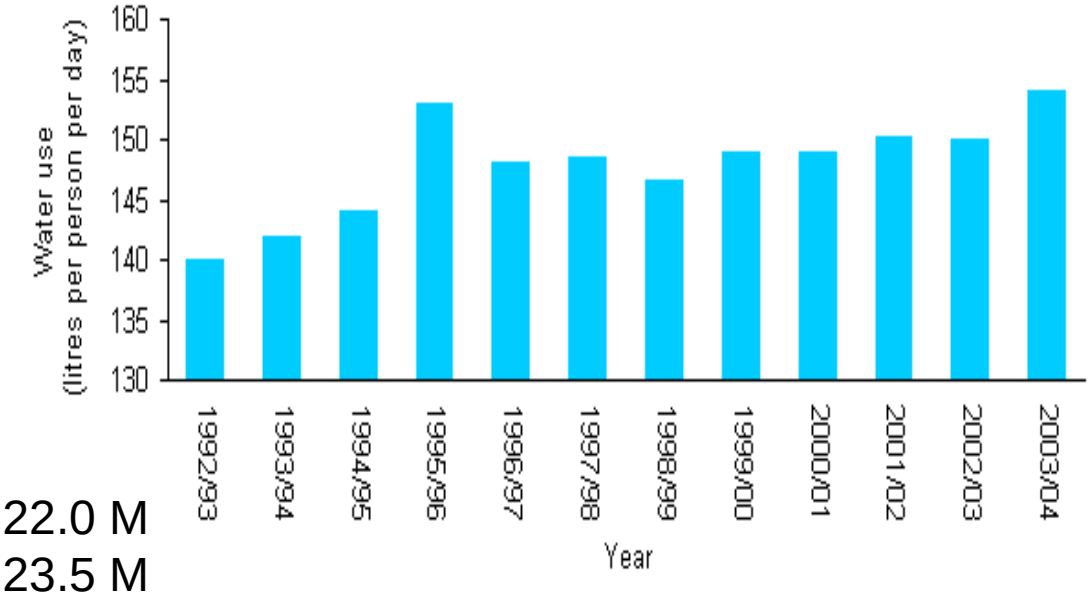
- Increasing demand
- Deteriorating groundwater quality
- Stricter water quality standards
- Land use change
- Addressing environment needs
- Changing climate



Derek Ball, BGS © NERC 1999

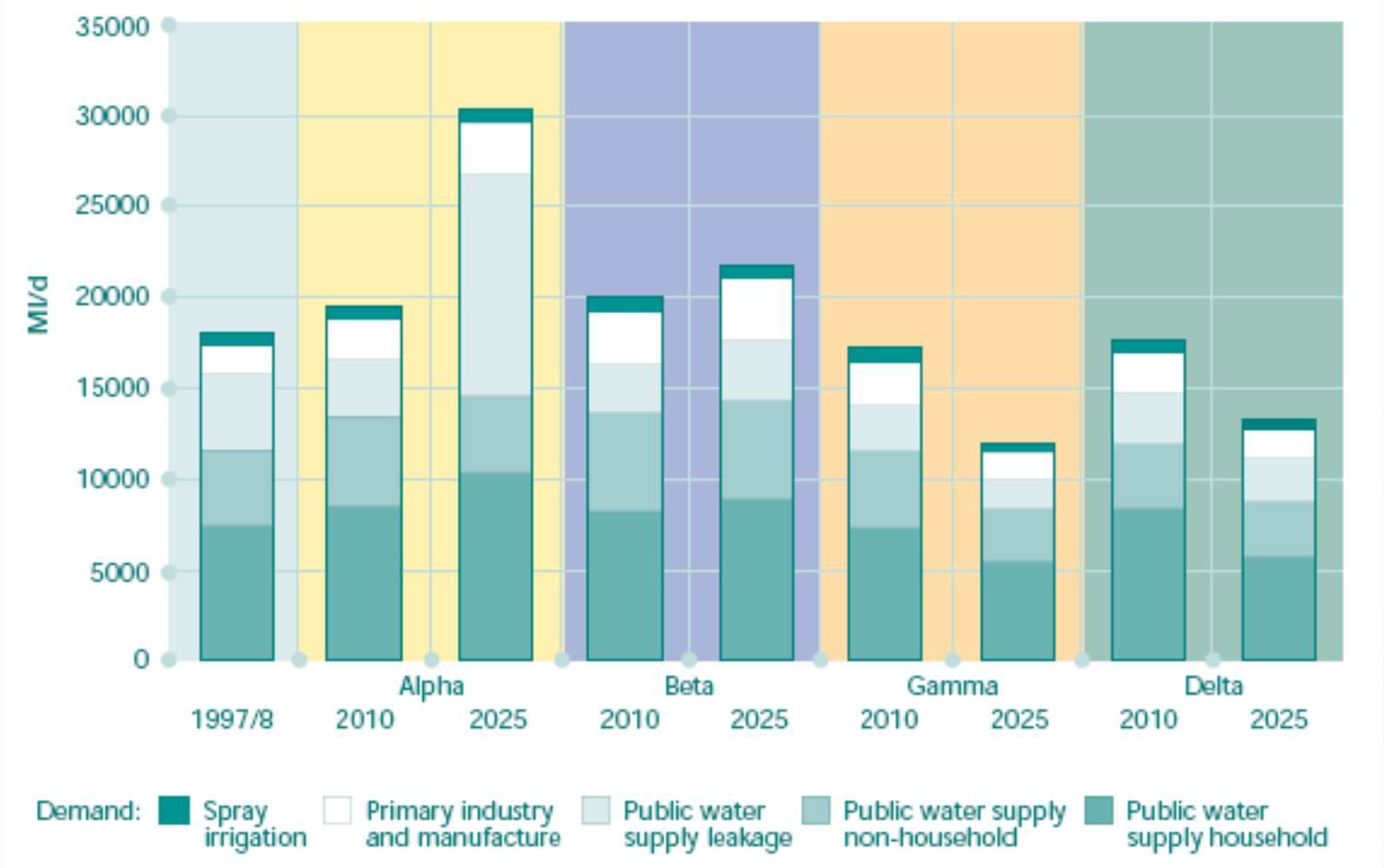
Household water demand

- Household water consumption up by 70% over the past 30 years - mainly due to increasing use of water demanding appliances
- water consumption per person in households increased by 7% between 1992 and 2001 in E&W
- 2001: pop. 52.0 M/ households 22.0 M
  2011: pop. 55.0 M/ households 23.5 M
  2021: pop. 57.8 M/ households 25.1 M



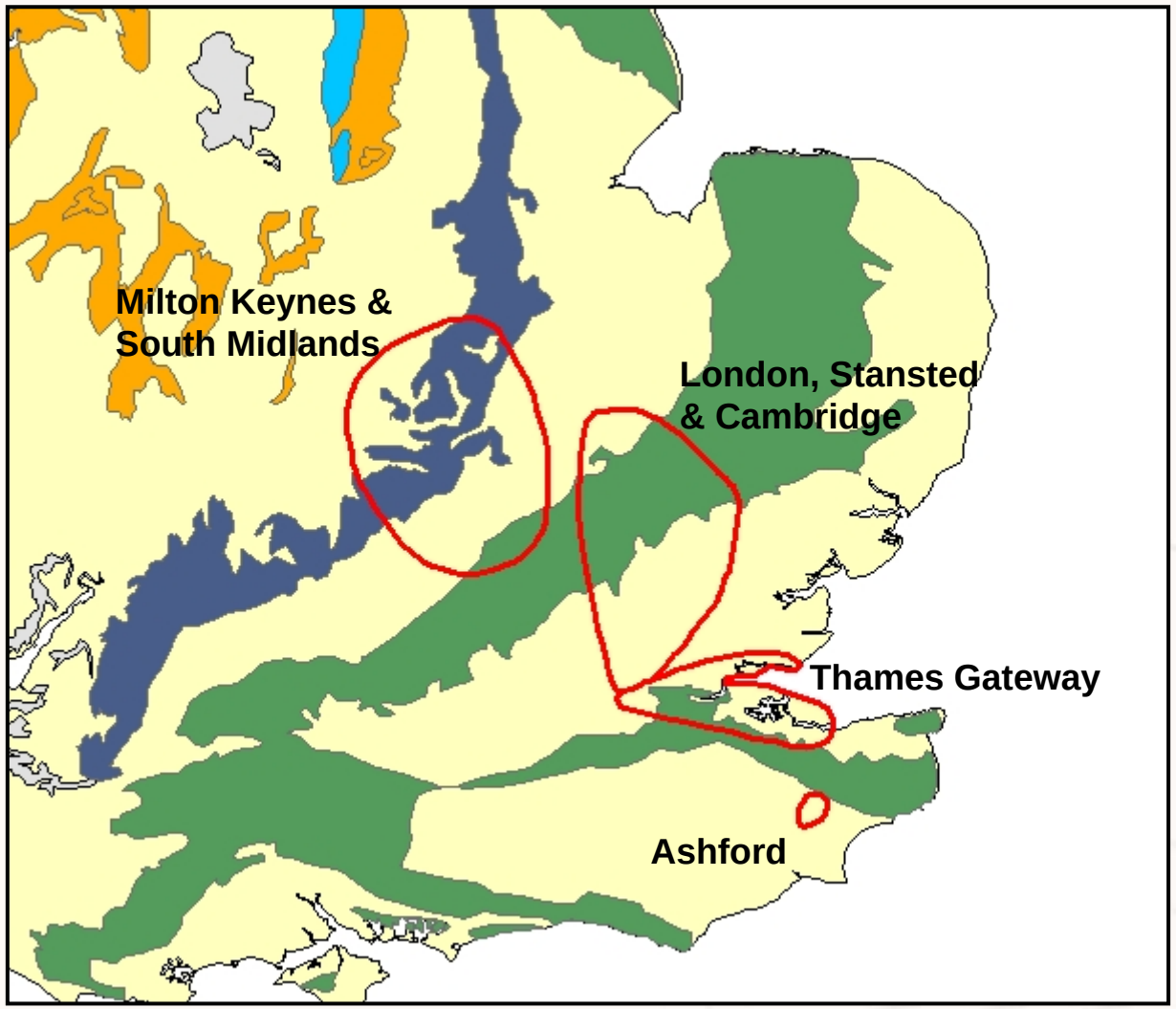
Source: Office of Water Services

Environment Agency projected demand (EA, 2001)



Changing population densities:

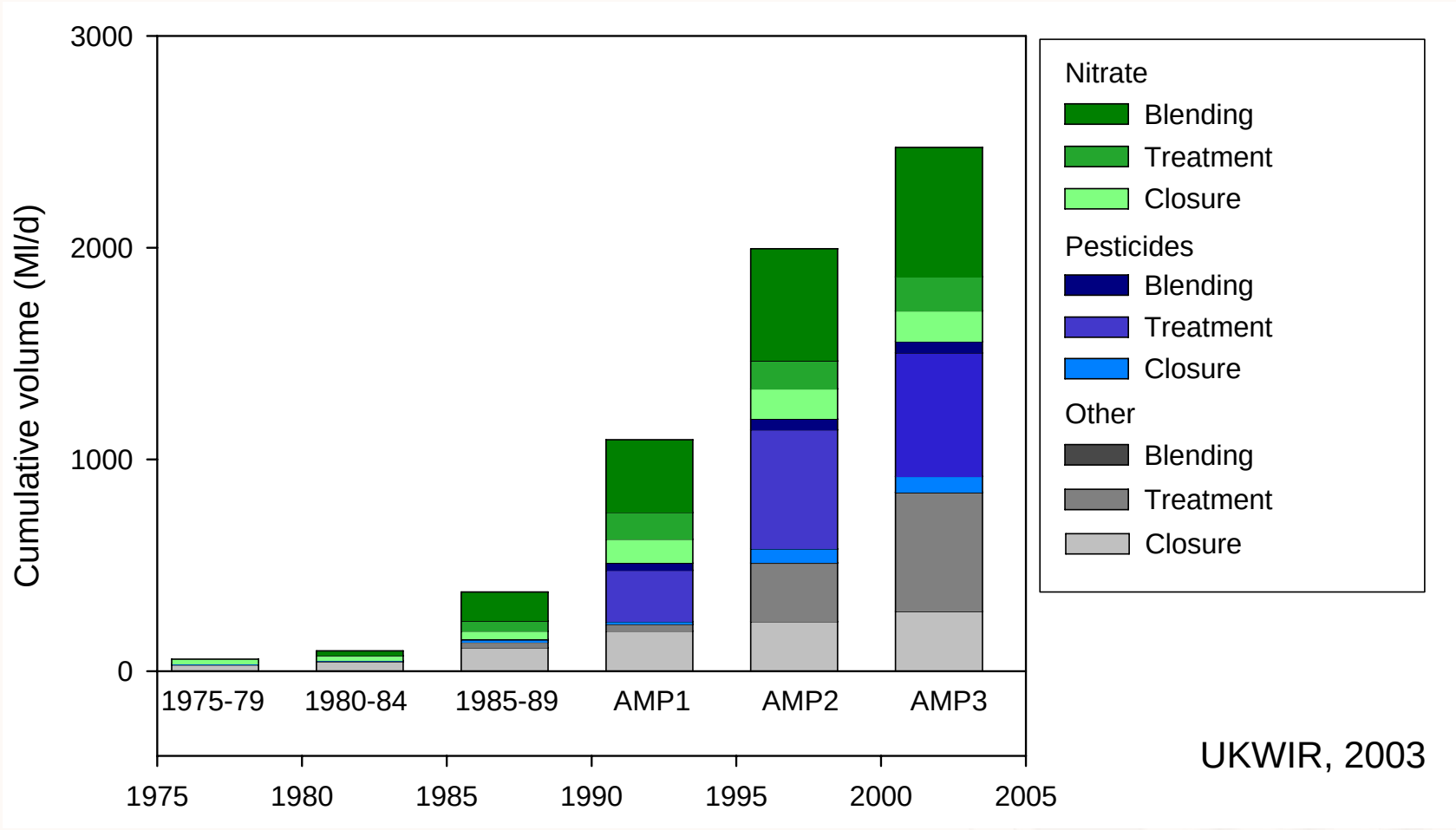
areas for new housing under Government's Sustainable Communities Plan



Deteriorating groundwater quality

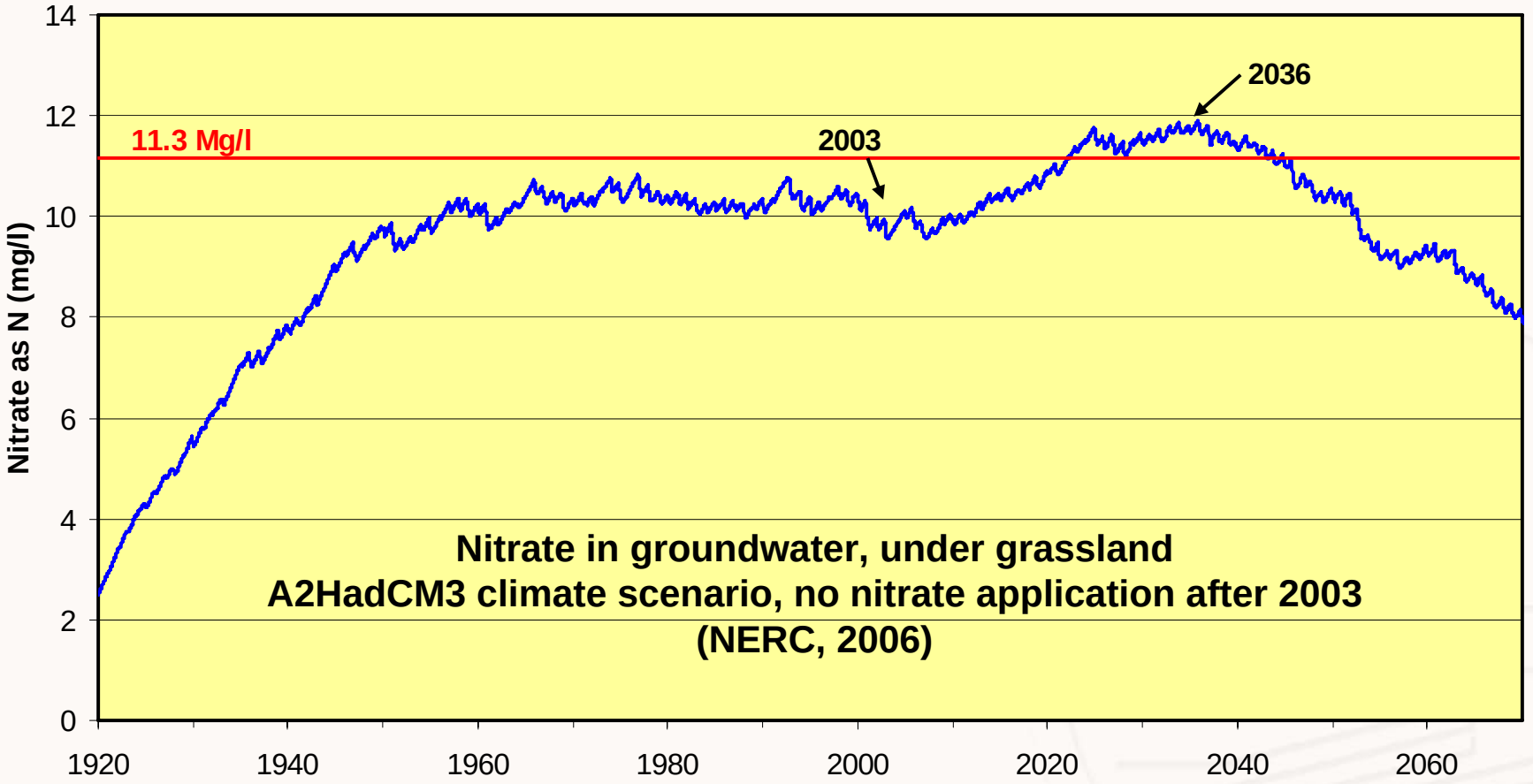
- Groundwater quality problems cost UK over £¾ billion since 1975 (87% capital investment) – UKWIR (2003)
  - £436M treatment schemes/£134M blending/£184M replacement
- Almost 50% (2450 Ml/d) groundwater for public supply affected by quality problems (deterioration & more stringent standards)
  - Nitrate, pesticides, *Crypto*, arsenic and hydrocarbons/solvents
- Over next 20 years, capital costs of the order of £2 billion possible

Volumes of PWS affected by poor groundwater quality and stricter standards



UKWIR, 2003

Timescale for reversal of trends



Land-use change

- Reform of Common Agricultural Policy
  - Environmental requirements a condition of receiving support
  - Links to EU water quality legislation - beneficial in terms of diffuse pollution
  - Emphasis on afforestation, some support for renewable energies
- Environment Agency recognises afforestation, bio-energy crops and urbanisation as major land use change issues affecting groundwater

© Defra 2006

Land-use change

- Afforestation
  - In addition to CAP reform, 1995 Rural White Paper proposed doubling of area of lowland forest within England by the year 2045 (from 7-14%)
  - Could cause significant local reduction in groundwater recharge
- Bio-energy crops
  - Impact on recharge variable
  - Potential for this to be significant as higher yield crops introduced
- Urbanisation
  - Reduced groundwater recharge
  - Source of (non-ag) diffuse pollution
- Land-use change associated with climate change

Addressing environment needs

- Habitats Directive (HD) - need to show 'no significant impact'
- To meet HD at Natura 2000 sites: licensed abstraction reduced by ~250 Ml/d (EA, 2001)
- £1.5M for each Ml/d revoked
- Although only 1.5% of PWS in E&W, potential local difficulties

	Environmental need in Ml/d	
	2010	2025
Anglian	42	210
Midlands	110	200
North East	25	25
North West	0	0
South West	14	14
Southern	20	80
Thames	46	187
Environment Agency Wales	0	0
Total	**257**	**716**

Addressing environment needs

- Water Framework Directive: water bodies can fail to reach ‘good status’ when too much water is abstracted, thereby reducing water flows and impairing ecological quality
- 26% of groundwater bodies in E&W ‘probably at risk’ or ‘at risk’ due to abstraction

Terry Marsh, CEH © NERC 1991

Changing climate

Uncertainty over the impact but it is likely to mean winters generally wetter and summers substantially warmer (UKCIP). There is likely to be a greater frequency of extreme events.

The uncertainty is a major constraint on planning

- Potential indirect impacts on groundwater resources:
  - Greater overall demand for water
  - Changing population densities affecting demand pattern
  - Greater reliance on groundwater resources due to its storage
  - Land-use change affecting recharge and abstraction

Increased demand due to climate change

Stockholm Environment Institute – Oxford (2003) – percentage increase in demand in England & Wales (in addition to EA (2001) demand scenarios)

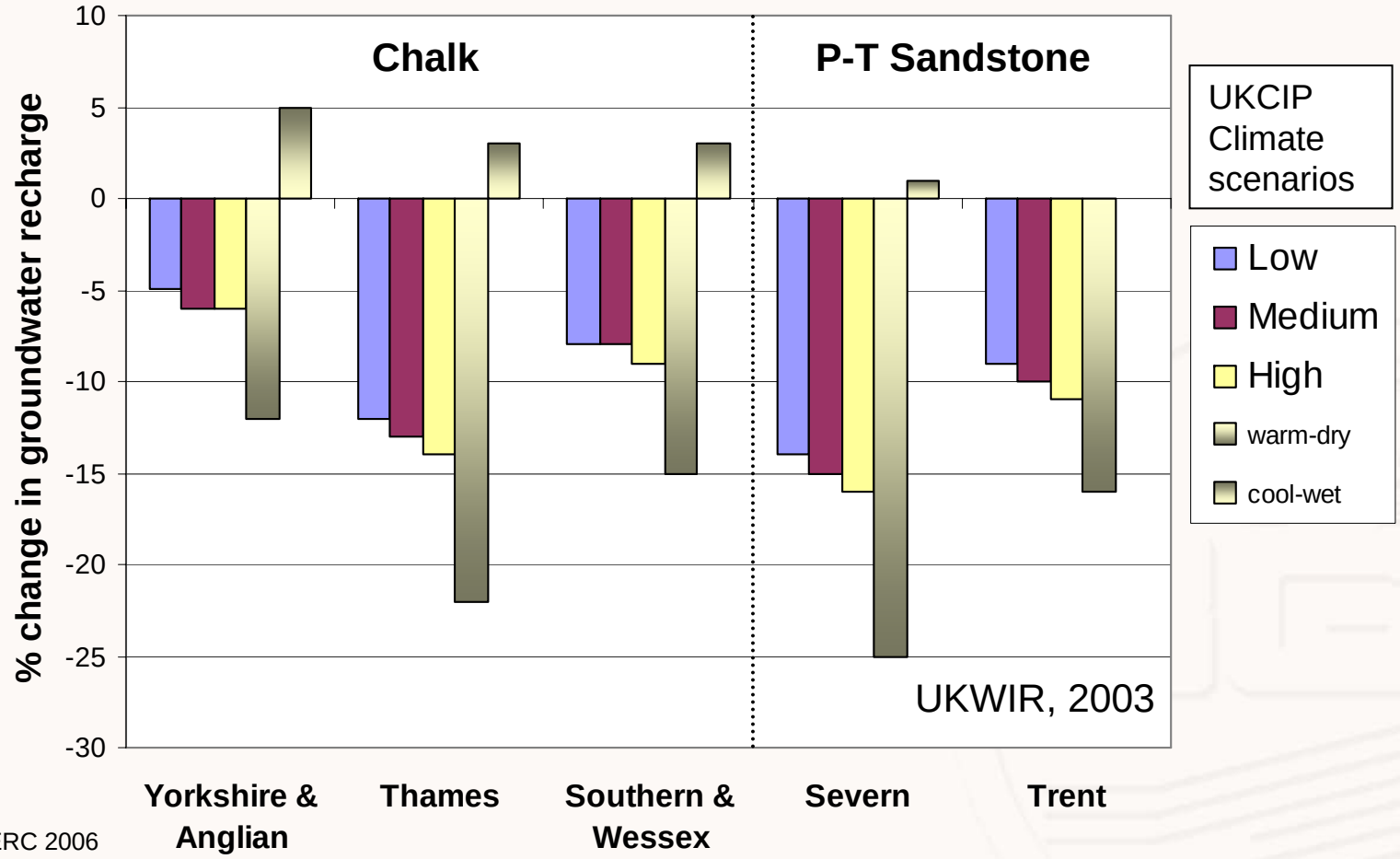
	UKCIP climate change scenario		
EA demand scenario	Low (2020s)	Med high (2020s)	Med High (2050s)
Alpha		1.4%	
Beta		2.0%	3.8%
Gamma	1.8%	2.0%	
Delta		1.8%	

regional impacts vary from 1.3% in the North West to 3.9% in the Anglian region, where spray irrigation is a major factor (Beta reference scenario and Medium-High climate scenario)

Changing climate

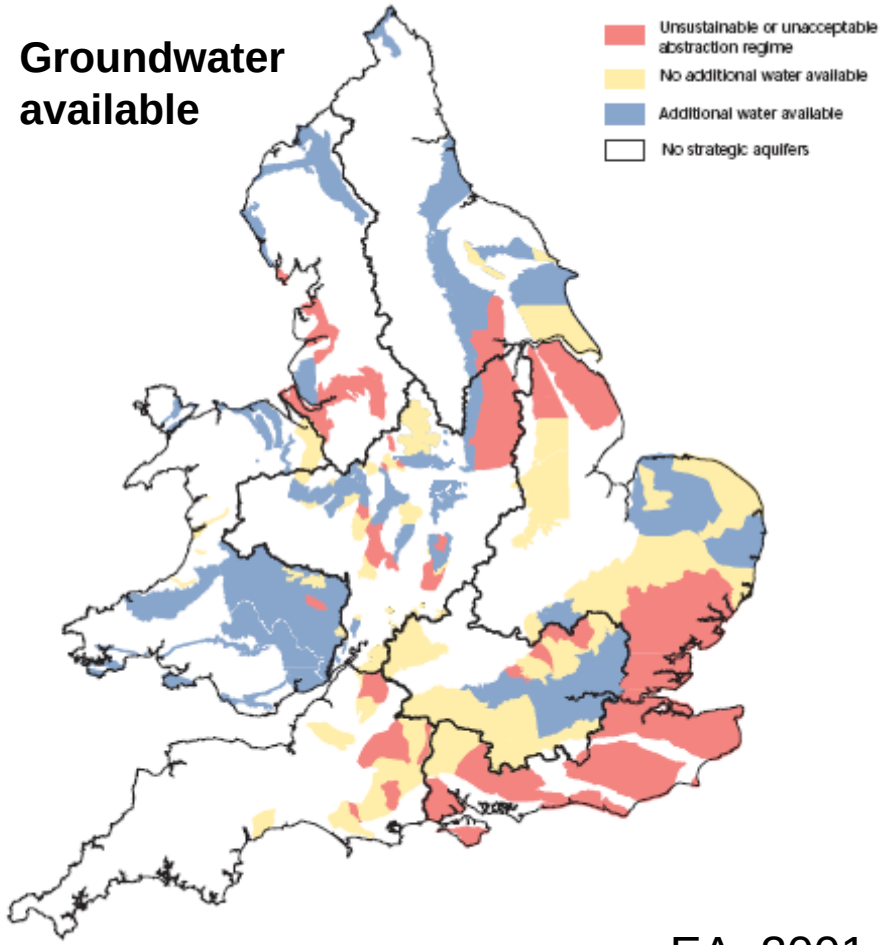
- Potential direct impacts on groundwater resources:
  - increases or decreases in total rainfall will influence the available resources
  - variability and extreme events – very dry or very wet periods become more common
  - wetter winters - increased recharge?
  - more intense rainfall - reduced recharge?
  - increases in temperature may result in increased evaporation/evapotranspiration – shorter recharge period?
  - mobilisation of pollutants due to seasonally high water tables?
  - saline intrusion in coastal aquifers

Possible change in groundwater recharge by 2020s



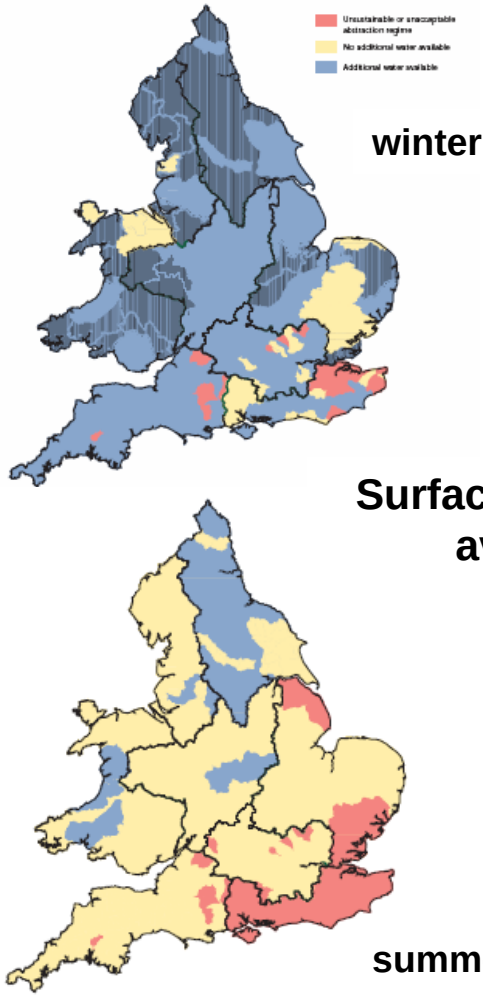
Where can the extra water come from?

Groundwater available



EA, 2001

Surface water available



The challenge

- Can we reduce demand sufficiently?
- What do we do until measures to control diffuse pollution become effective?
- Are there alternative sources?
- Do we understand our hydrological and ecological systems well enough to plan and manage properly?
- How certain are our predictions?

In the end will a compromise have to be made between groundwater for public water supply and to support the environment?

2006 Drought – Chilterns Chalk borehole @ Stonor