



British
Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth

The role of groundwater in nutrient transport

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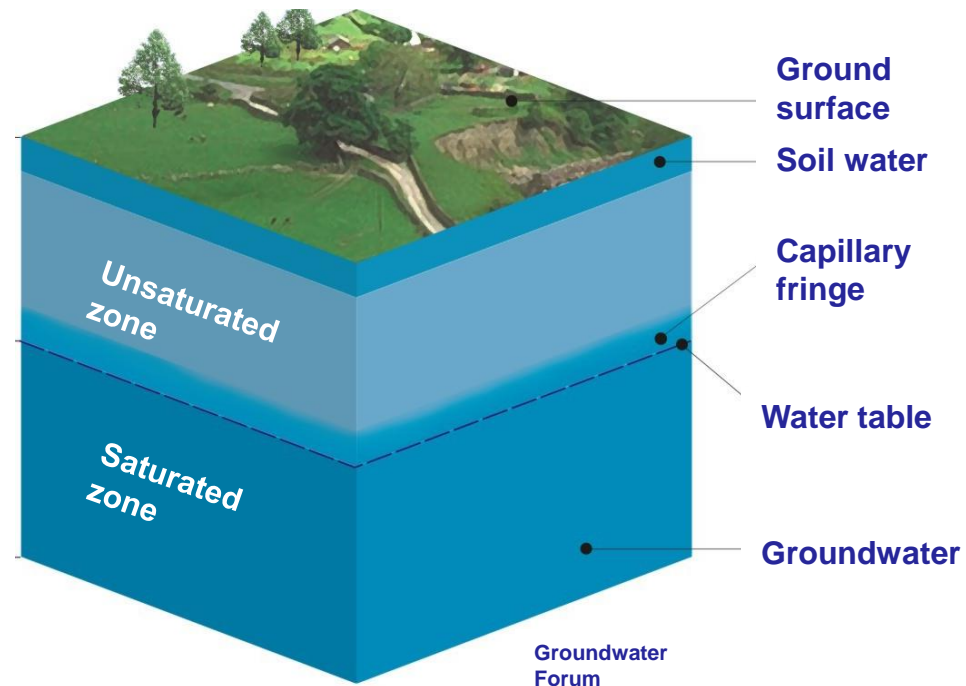
Groundwater Science Directorate

British Geological Survey



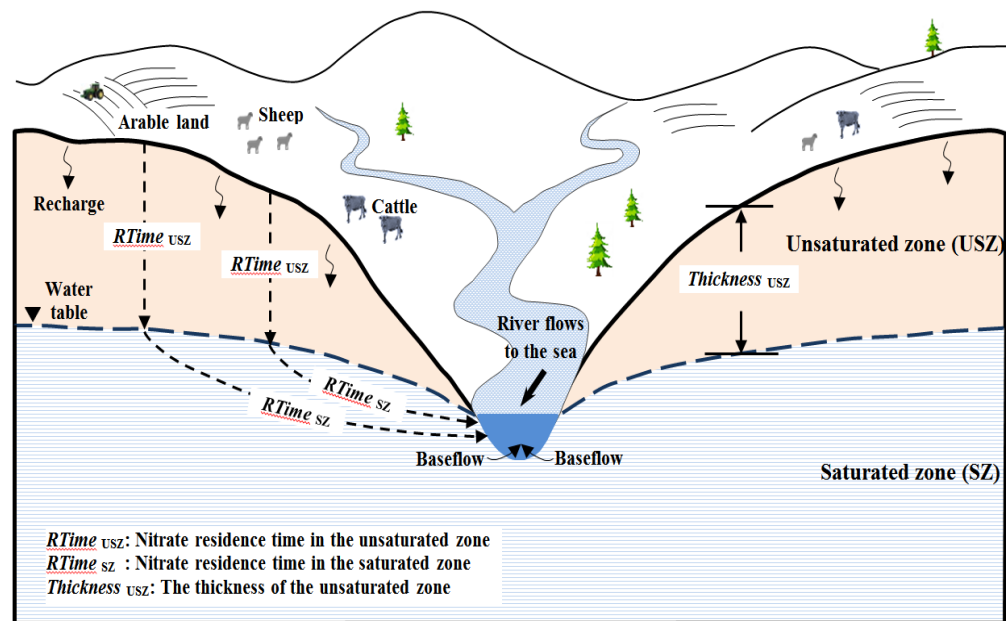
Groundwater

- Largest freshwater resource
- Slowly changing pool
- Infiltration carries solutes from the soil zone through the unsaturated zone to the saturated zone
- Water then flows laterally to an outlet or to the sea
- Key groundwater receptors include:
 - Rivers and lakes
 - Groundwater-supported wetlands
 - Public and private water supply
 - Marine ecosystems



Key knowledge gaps addressed

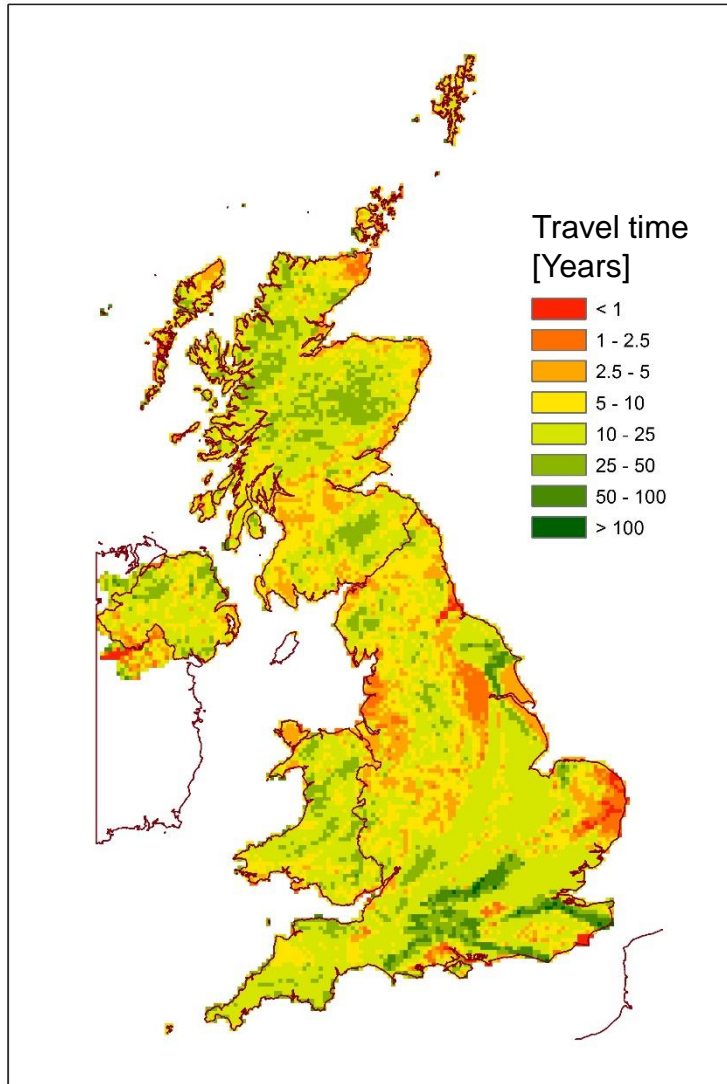
- Assessment of baseline N, P and C concentrations in groundwater
- National scale assessment of unsaturated zone delay in N arrival at the groundwater table
- Accounting for mains water leakage for P source apportionment



What we need to consider to estimate nitrate residence time in groundwater

Nitrate transport in groundwater

Time taken for recharge to reach the groundwater table across UK

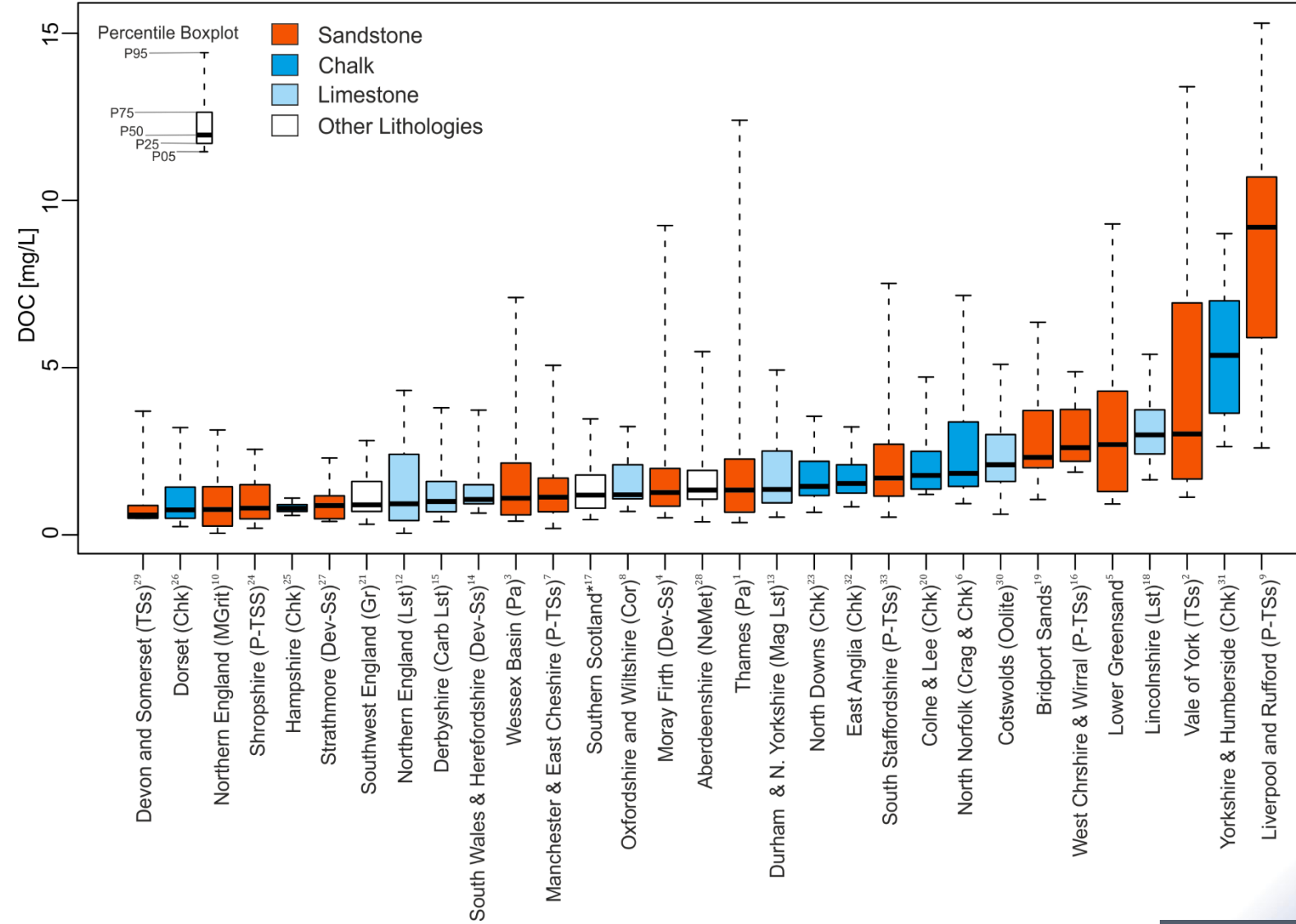


- Green areas are where retardation is significant
- These areas often have high BFI
- This model helps us to understand how solutes may persist in the system despite changes at the surface
- This works well for nitrate which can be assumed to be conservative

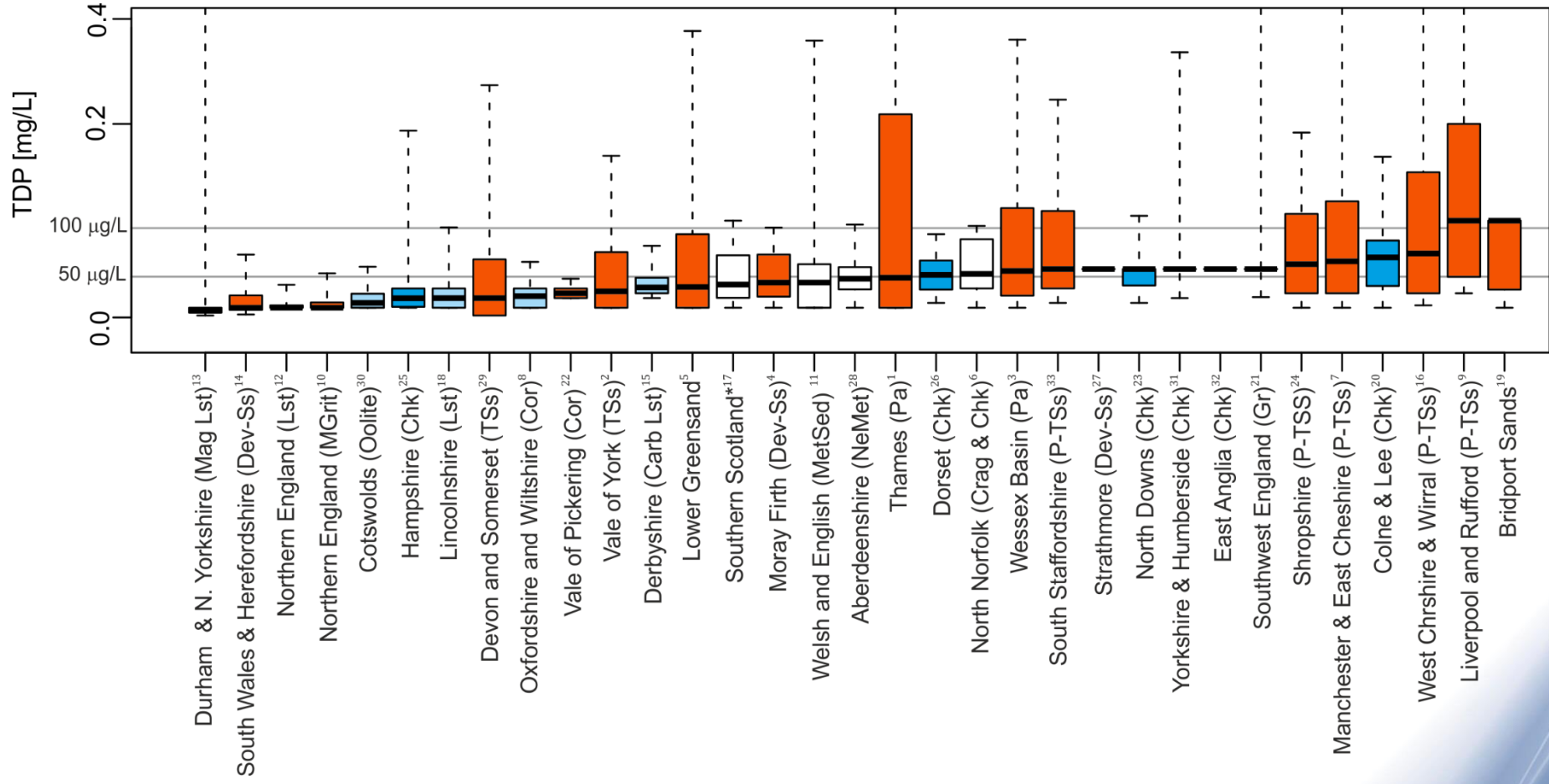
P & DOC in the groundwater pool

- Unlike N these are more reactive in the subsurface
 - have both anthropogenic and natural sources in aquifers
 - are relatively poorly characterised
- P concentrations can be significant relative to surface water (up to 1 mg/L) :
 - Phosphate minerals and plumbosolvency agents in mains leakage can contribute
 - P will be retarded in the unsaturated zone but is also affected by sources and sinks in aquifers
- DOC is less variable:
 - Typical ranges (0.5 – 2 mg/L)

DOC concentrations in groundwater

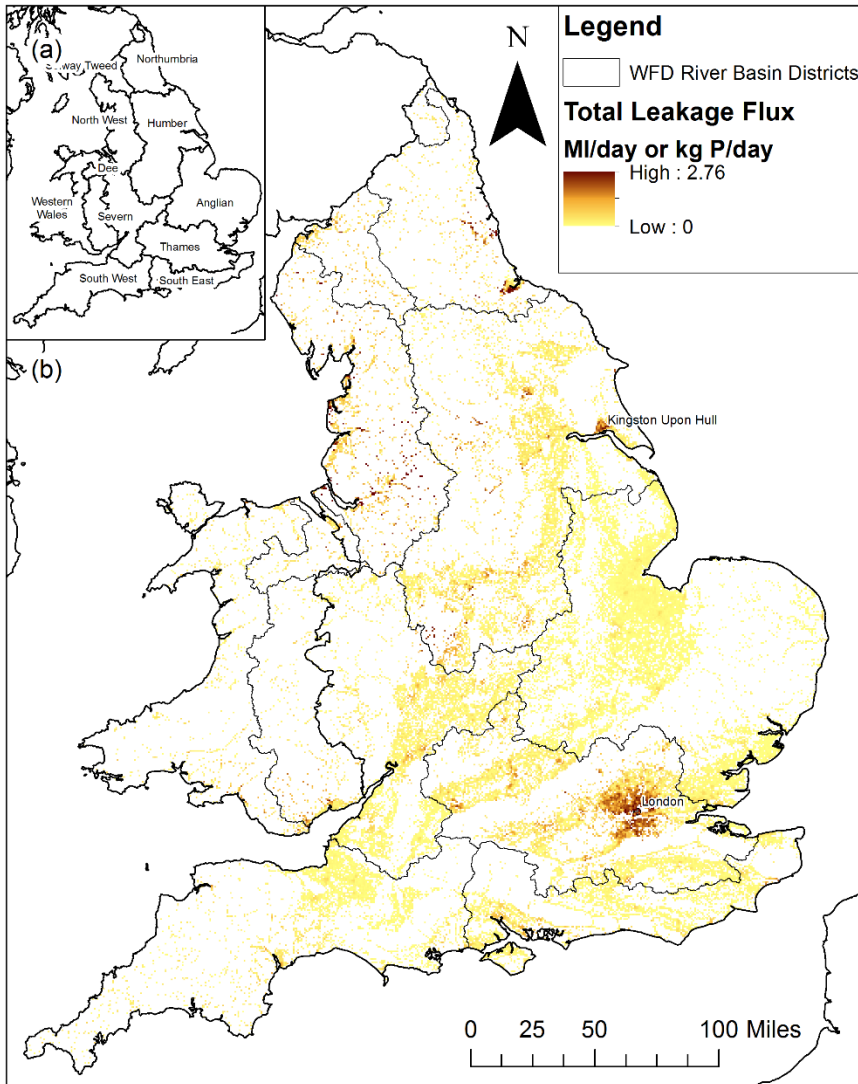


P concentrations in groundwater



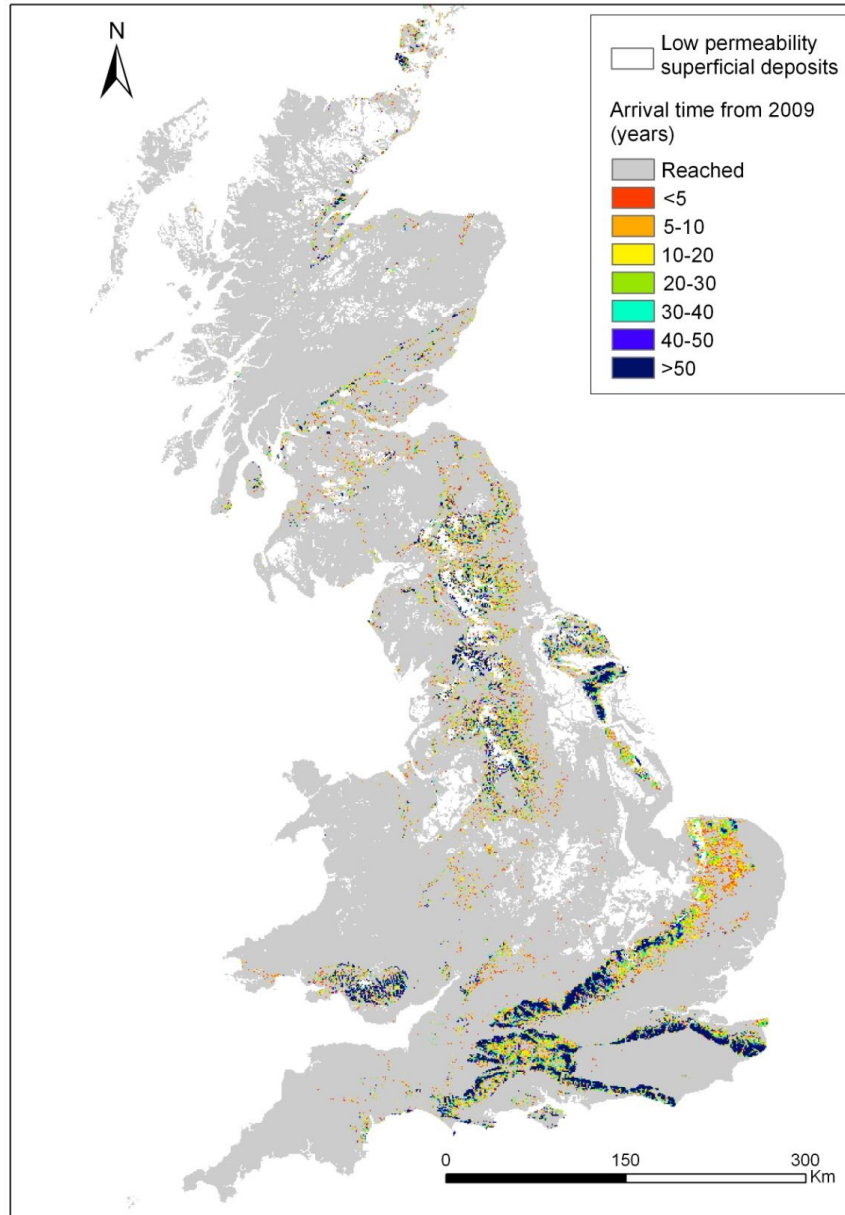
P input to the environment from mains water leakage (MWL)

- The national scale P flux from leaking water mains to the environment quantified
- Annual flux to be 1.2 kt P/yr
- 69% of the flux is to surface water due to high leakage susceptibility on non-aquifers
- Urban areas may be a significant contributor to P flux due to high pipe density
- Thames catchment: MWL= **40%** of sewerage inputs and **25%** of agricultural inputs to the environment

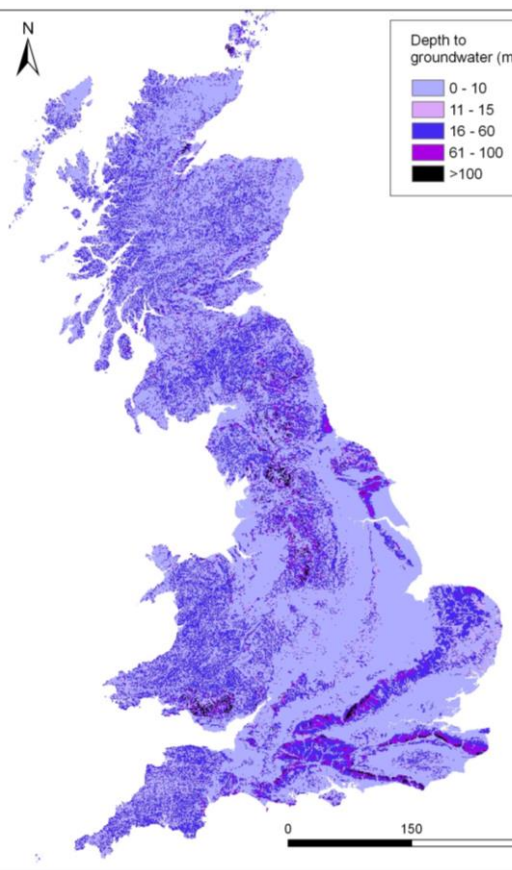


Spare slides in case of questions

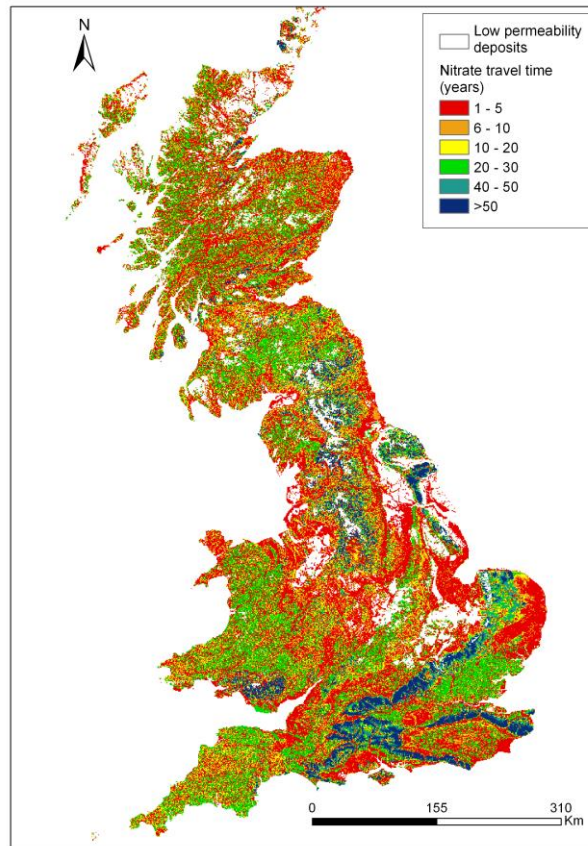
UK unsaturated zone N delay



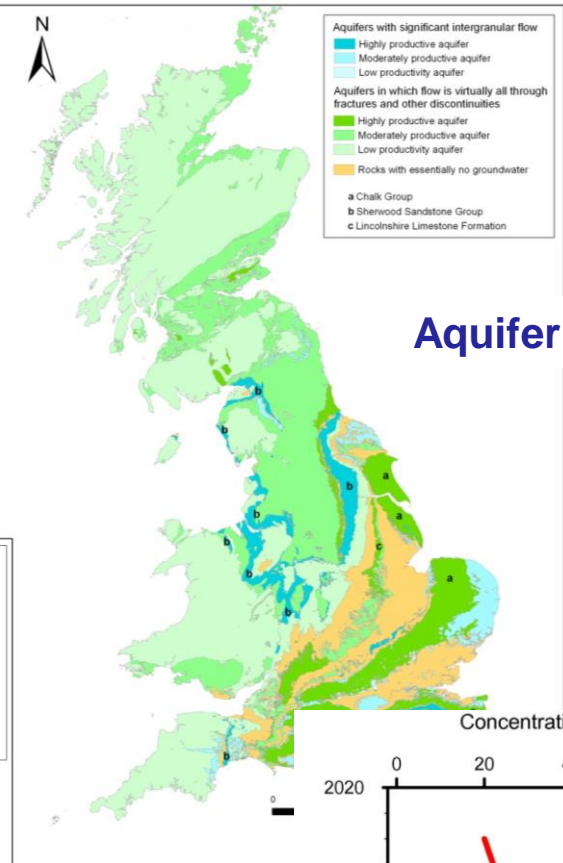
NTB model elements



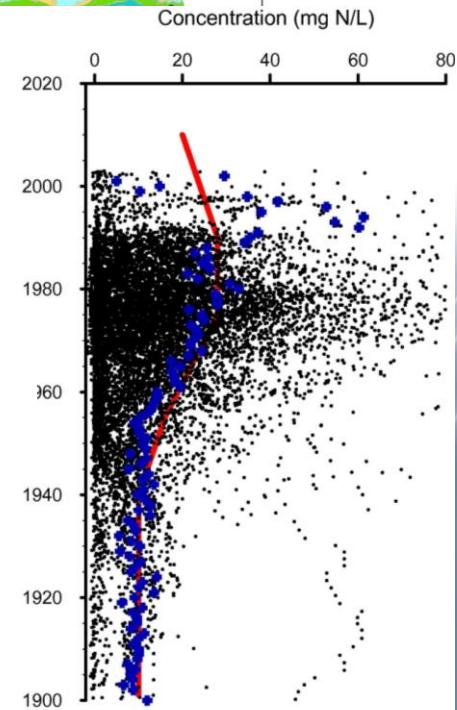
Depth to water



Travel time



Historical profiles



P leakage input to the environment from mains water

