



# Sustainable Remediation of Historical Point Pollution.... at the Landscape Scale

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# Context - landfill

- Landfill now considered the least acceptable option for waste disposal but a long legacy to deal with;
- EU Landfill Directive a big driver for change and UK waking up late (politically & operationally) to the implications;
- We have to find alternatives to landfill (and incineration) for municipal (and other) waste streams;
- Supporting scientific case (for landfill) ignored in political discussion; in contrast science has underpinned a consensus approach to con land - e.g. Risk Based Land Management;
- Today's landfill is tomorrow's contaminated land - should approaches be more compatible?

# Context - contaminated land

- Contaminated land has traditionally been considered a human health, environmental harm or water pollution problem, at the local scale;
- There are many sites, but where are the real problems;




# Scale of the Contaminated Land "Problem"

- Wide variation of estimates of the extent of land "affected by contamination" in England & Wales from - 50,000 to 300,000 hectares, relating to c. 100,000 sites.
- Of the latter, between 5,000 to 20,000 may be considered to be "problem" sites, (i.e. need action to ensure they don't pose an unacceptable risk to human health - or the environment.)... but what's the real environmental impact?
- In UK individual cases seldom hit the headlines - are acute issues more newsworthy?

# Context - contaminated land

- Contaminated land has traditionally been considered a human health, environmental harm or water pollution problem, at the local scale;
- Many sites but where are the real problems;
- Over the last 2 years contaminated land issues have slipped down the UK's environmental political & regulatory agenda.
- Landfill remains the (much) preferred "treatment" option for contaminated sites in the UK;
- The Water Framework Directive is the new environmental driver in Europe; emphasis on aquatic ecosystems impact (rather than concentration exceedance) - at the landscape scale.

An aerial photograph showing a landscape with a road and agricultural fields. The road is a dark, winding line that runs through the center of the image. The fields are green and rectangular, with some areas appearing darker, possibly due to shadows or different crop types. The overall scene is a mix of natural and human-made elements.

... at the landscape scale point sources of pollution do not appear so significant. Diffuse sources dominate.

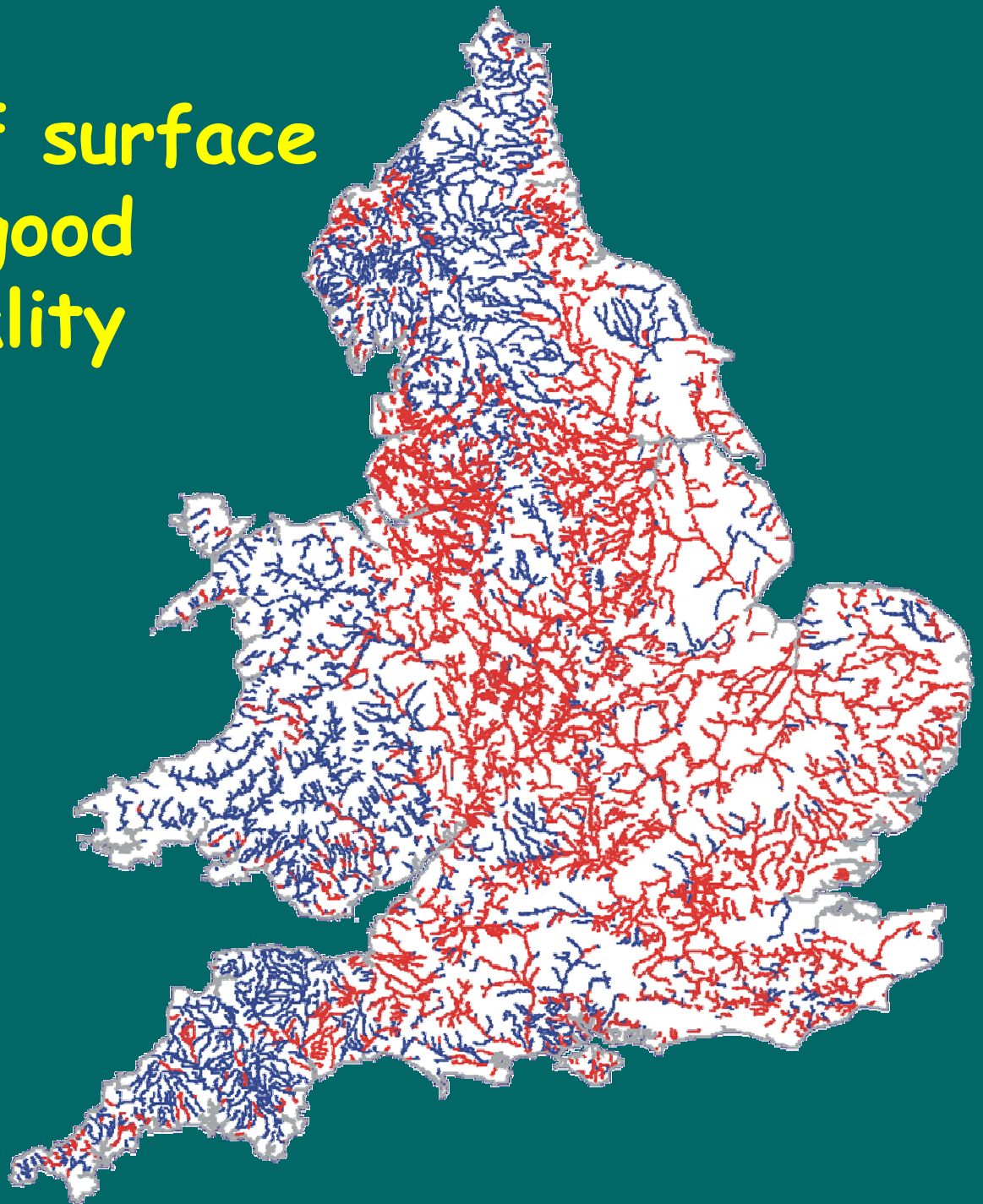
# Water Framework Directive

- This new EU Directive uses the measure of good aquatic ecosystems as a surrogate indicator of a clean & healthy environment;
- EU Member States have to assess and report on the status of (groundwater and surface) water bodies and manage through River Basin Plans to deliver good status;
- It will bring (agricultural) diffuse source pollution sharply into focus.
- The current situation in England & Wales.....

# Compliance of surface waters with good ecological quality

- Pass 44%
- Fail 56%

Agricultural diffuse sources dominate





# Compliance of surface waters with good ecological quality (excluding phosphate)

- Pass 81%
- Fail 19%

The old industrial and mining areas are now highlighted - *the influence of residual land and water contamination*

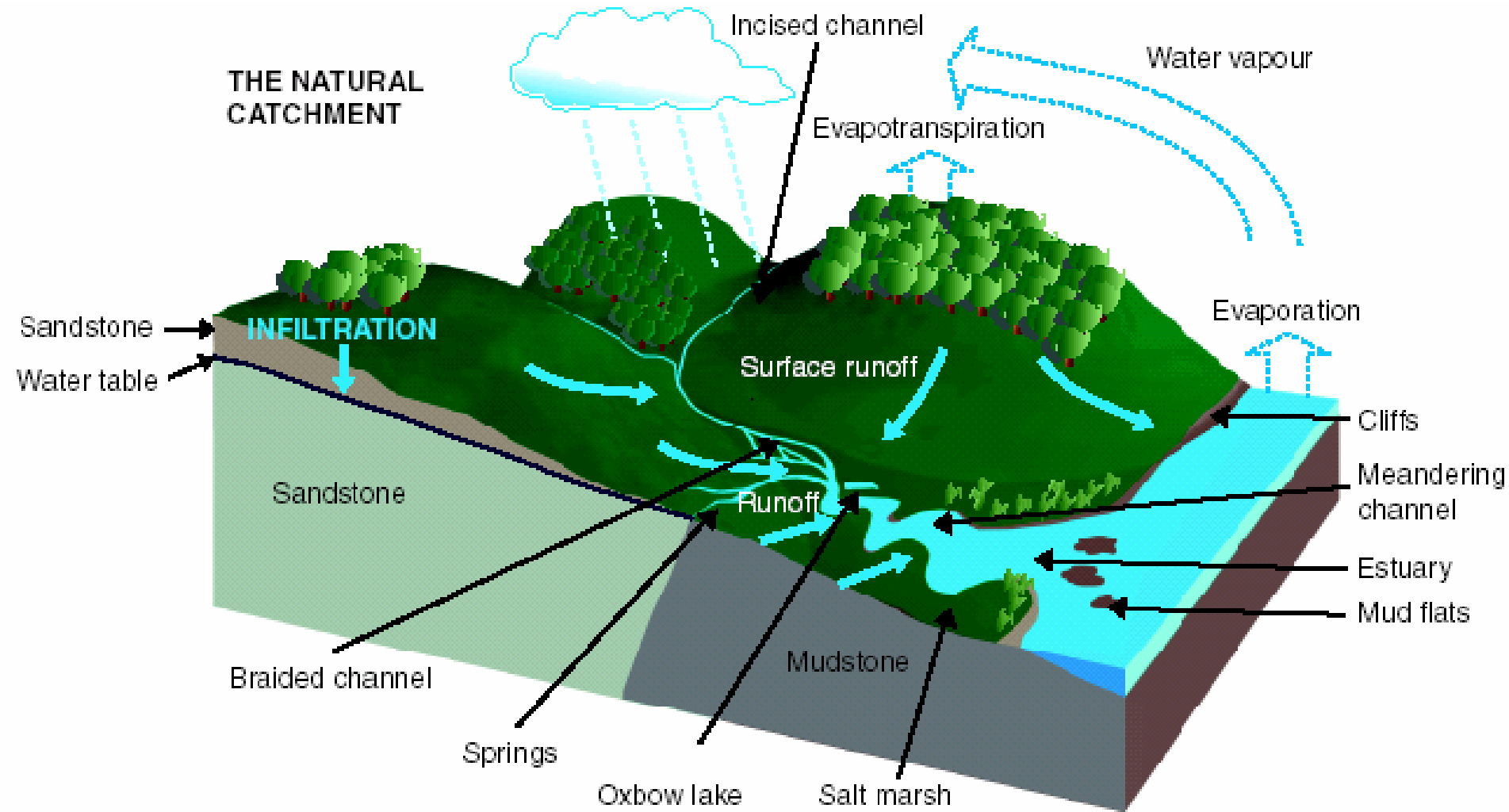


# WFD and Integrated Catchment Management

- Improvements to aquatic (eco)systems can only be realised by managing land use or remediating historical pollution. We have to:
  - **Characterise river basin catchments and then:**
  - **Manage “pressures” within them so as to:**
  - **Reduce “impacts” on ecosystems considered in a whole river basin context within a “Programme of Measures”.**
  - **Achieve good status by 2015, but a cyclical process**

# Integrated Catchment Science

- A more holistic approach is needed to understand better how river basins work, and the key geochemical fluxes & pollutant linkages which influence aquatic ecosystems. This should underpin...
- a risk-based land management approach to all activities within a spatial land-use planning framework.
- It requires closer working within and between scientific disciplines and more integrated programmes.

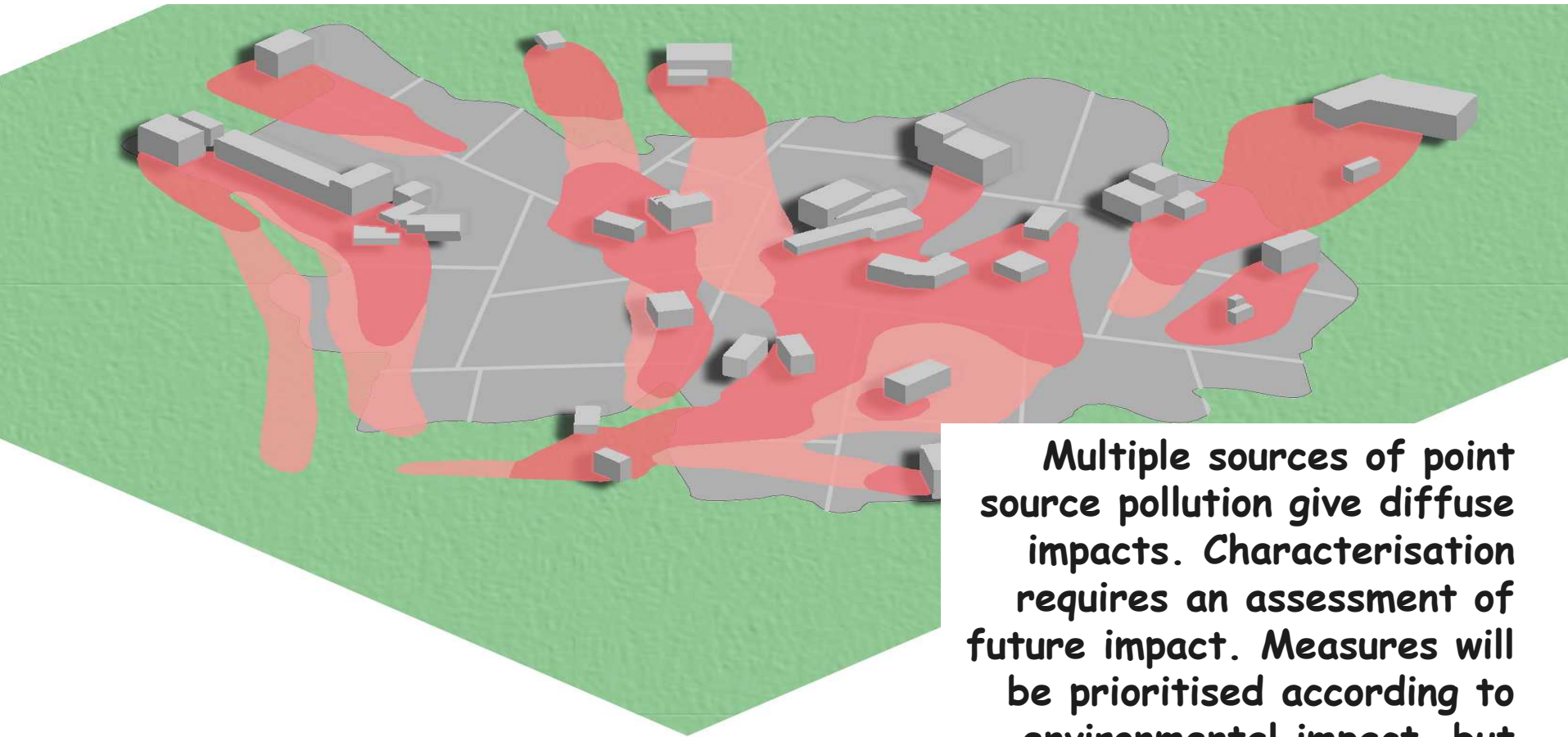


# The Natural Catchment

# The Major Problems & Solutions

- Agricultural diffuse pollution... from nitrate, phosphate & pesticides; *Radical land use change required; source control.*
- Acid drainage from historical mining activity; *Clean-up techniques for spoil and minewaters exist; possible mixture of source control, pathway interception & targeted receptor protection?*
- Megasites - i.e. large scale urban pollution; *Very difficult to deal with source but combination of pathway interception and targeted receptor protection as above*
- A (very) few specific point sources: *source control & pathway interception.*

# Urban diffuse pollution



Multiple sources of point source pollution give diffuse impacts. Characterisation requires an assessment of future impact. Measures will be prioritised according to environmental impact, but where contaminated land is inhibiting achievement of good status the WFD will be a significant new driver for remediation.



Sites of industry



Pollution plumes

Estimated future extent of pollution plumes



Urban area

# Managing the Impacts through a Knowledge and risk-based approach

- Remedial strategies must be developed in accordance with a good understanding of the risks - i.e. on a site or catchment specific basis;
- Stakeholders need to work in partnership in developing appropriate remediation options; **this becomes more necessary as the scale increases;**
- Sustainable/durable, cost-effective, least disruptive, knowledge-based solutions are best with in-situ passive techniques having an important role.

In-situ passive techniques (e.g. MNA, PRBs etc) should be considered as an integral part of “risk-based land management” for both point and diffuse source pollution.

Their widespread adoption, either as a whole, or part of, remedial solutions, is attractive because of:

- economics - cost benefit estimated at several £100s million in UK;
- sustainability;
- low impact/minimal disruption;
- potential application over wide area.



# Landfill meets Contaminated Land

- Different regulatory approaches?
- But does the science & technology differ?
- Many transferable technologies & much transferable knowledge;
- But are there different communities, speaking different languages?
- Today's contaminated land is yesterday's landfill



# Contrasts and Commonalties

- Waste - legislation more prescriptive so less able to accept risk-based approaches; however, better at:
  - engineered solutions (containment); managing (waste) streams - process engineering; gas (energy) usage;
- Contaminated land - more risk/knowledge based; better at:
  - applying risk based approaches (risk assessment/risk management)
  - understanding the basic science and applying knowledge based solutions;
- Commonalties - landfill; (pre)treatment technologies: chemical; biological (anerobic/aerobic); composting and biopiling.

# Resumé

- What is the importance of contaminated land in pollution issues at catchment scale; focus more on where we can deliver major improvements - diffuse pollution at the regional/landscape scale?
- What should drive remediation - a value being exceeded or widespread impact on ecosystem?
- How can we get better interaction between contaminated land and waste communities - both in terms of risk/knowledge based approaches and technology transfer?