Significant Damage to Groundwater-dependent Terrestrial Ecosystems: Good Regulation or Lack of Information?

Hydrogeology Meets Hydroecology
Geological Society 22nd May 2008

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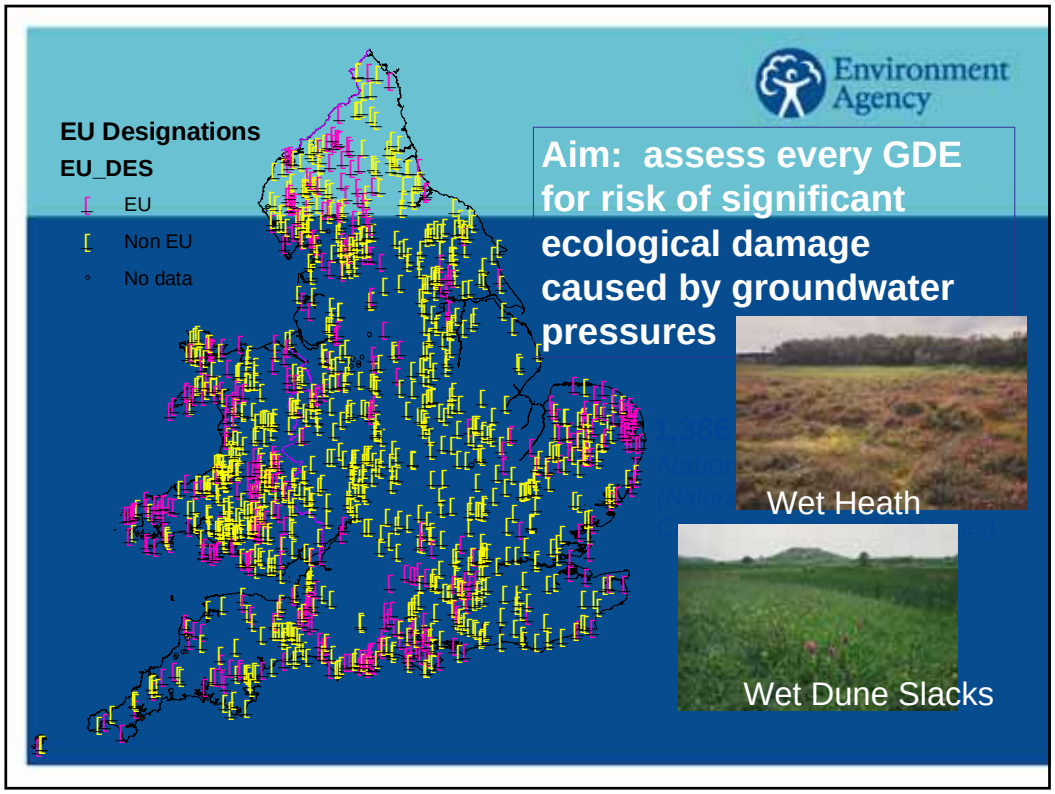
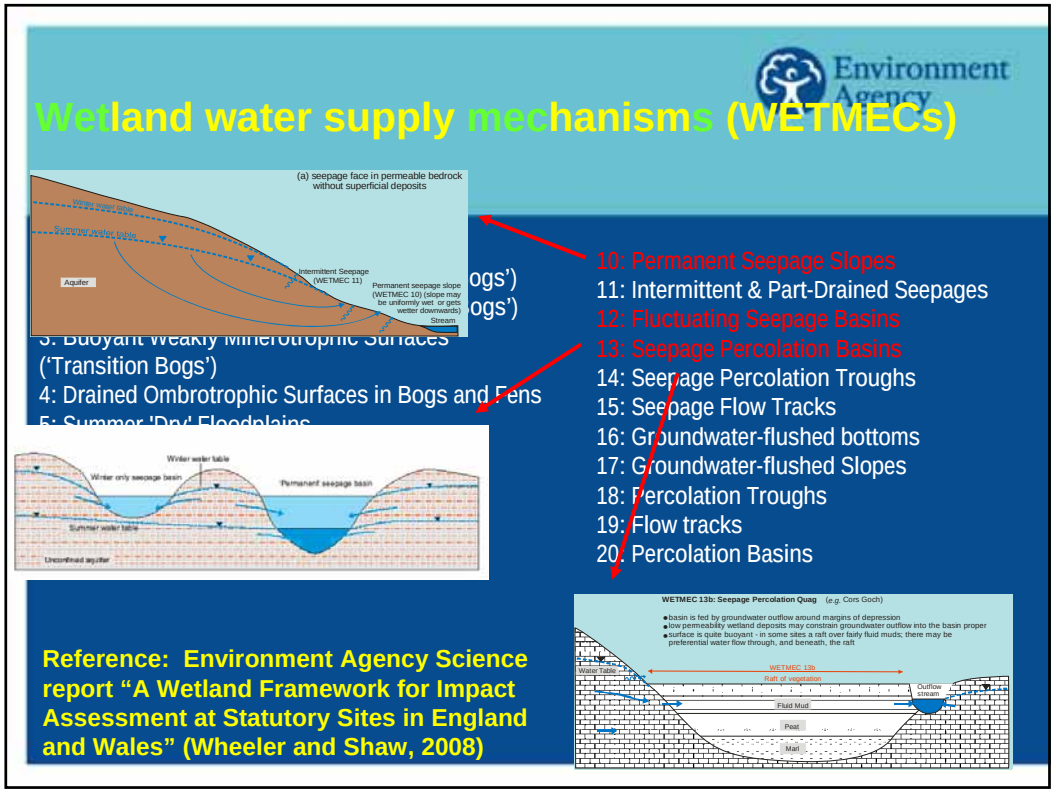
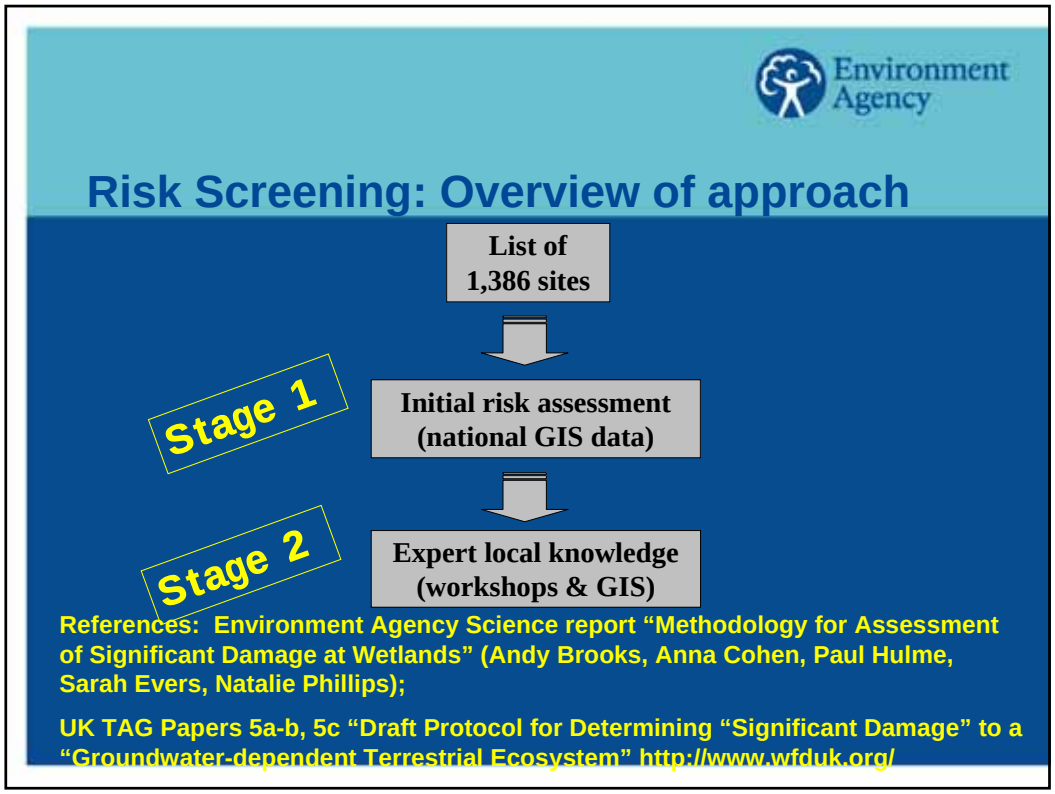
Bryan Wheeler

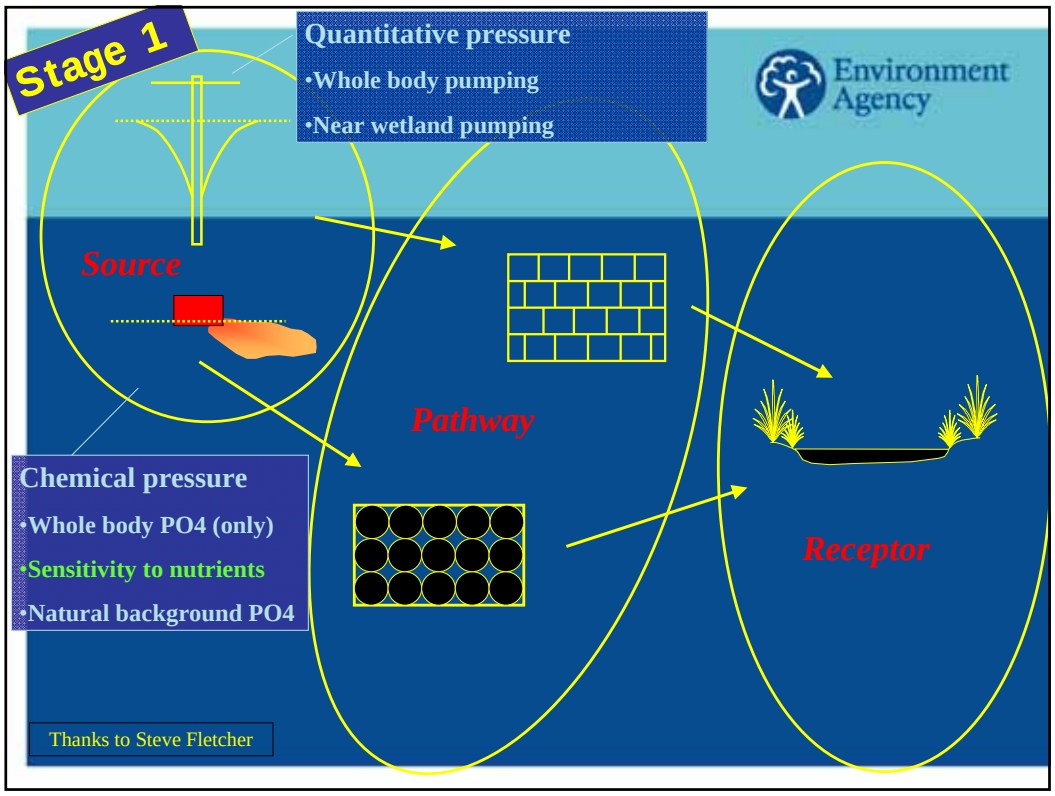
Objectives of Talk

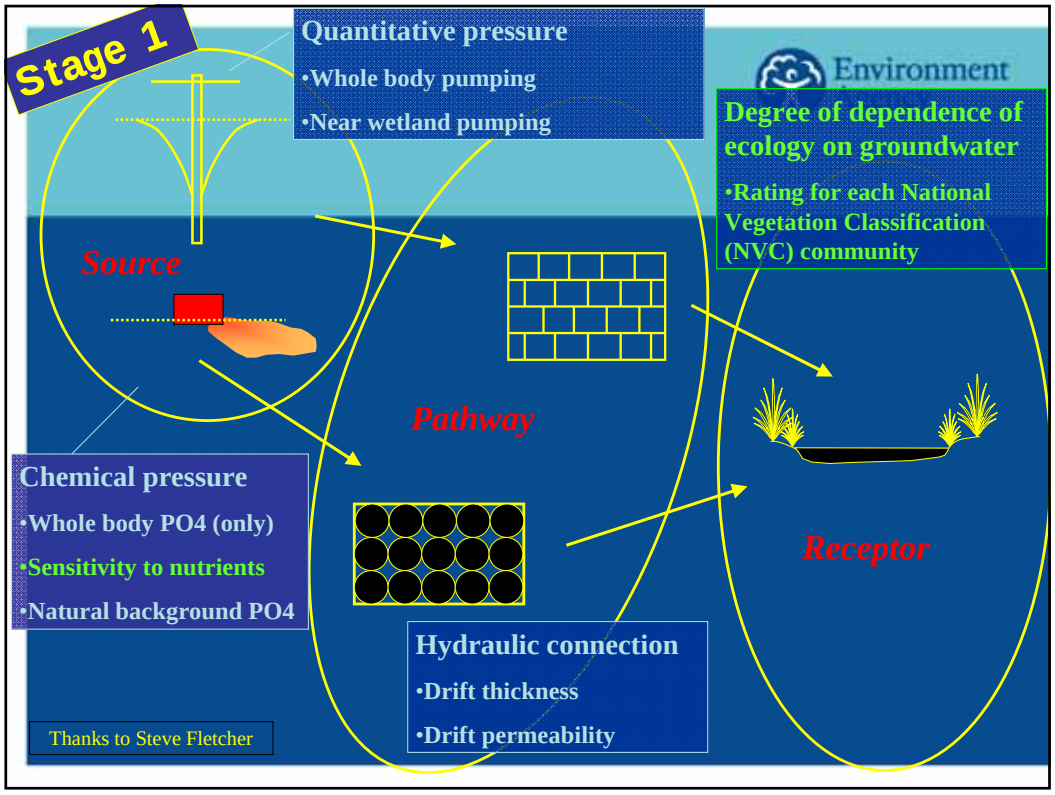
- Linking ecological damage and groundwater pressures
- Risk screening (ecologists & hydrogeologists)
- Site-specific assessment (classification)
- Issues – reducing uncertainty
- What's next?

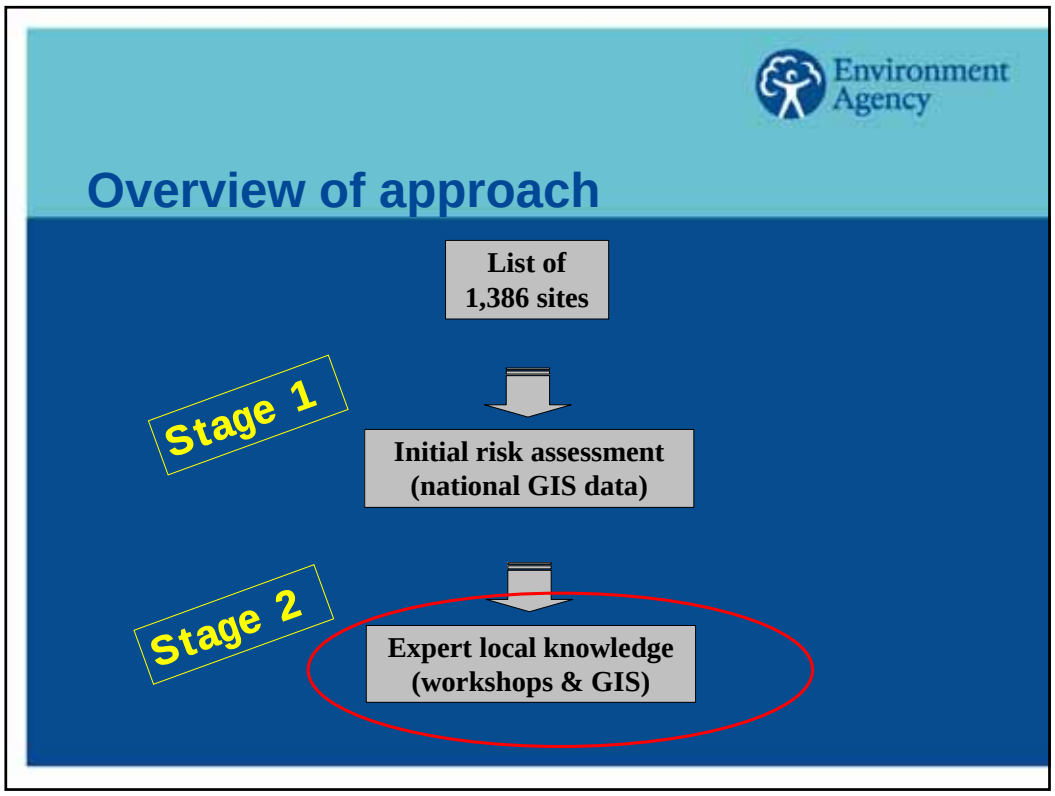

EU Designations
EU_DES
EU
Non EU
No data
Environment Agency
Aim: assess every GDE for risk of significant ecological damage caused by groundwater pressures
Wet Heath
Wet Dune Slacks


Environment Agency
Wetland water supply mechanisms (WETMECs)
(a) seepage face in permeable bedrock without superficial deposits
Aquifer
Intermittent Seepage (WETMEC 11)
Stream
('Transition Bogs')
4: Drained Ombrotrophic Surfaces in Bogs and Fens
10: Permanent Seepage Slopes
11: Intermittent & Part-Drained Seepages
12: Fluctuating Seepage Basins
13: Seepage Percolation Basins
14: Seepage Percolation Troughs
15: Seepage Flow Tracks
16: Groundwater-flushed bottoms
17: Groundwater-flushed Slopes
18: Percolation Troughs
19: Flow tracks
20: Percolation Basins
Reference: Environment Agency Science report "A Wetland Framework for Impact Assessment at Statutory Sites in England and Wales" (Wheeler and Shaw, 2008)


Environment Agency
Risk Screening: Overview of approach
List of 1,386 sites
Stage 1
Initial risk assessment (national GIS data)
Stage 2
Expert local knowledge (workshops & GIS)
References: Environment Agency Science report "Methodology for Assessment of Significant Damage at Wetlands" (Andy Brooks, Anna Cohen, Paul Hulme, Sarah Evers, Natalie Phillips);
UK TAG Papers 5a-b, 5c "Draft Protocol for Determining "Significant Damage" to a "Groundwater-dependent Terrestrial Ecosystem" http://www.wfduk.org/


Stage 1
Quantitative pressure
•Whole body pumping
•Near wetland pumping
Environment Agency
Source
Pathway
Receptor
Chemical pressure
•Whole body PO4 (only)
•Sensitivity to nutrients
•Natural background PO4
Thanks to Steve Fletcher


Stage 1
Quantitative pressure
•Whole body pumping
•Near wetland pumping
Environment
Degree of dependence of ecology on groundwater
•Rating for each National Vegetation Classification (NVC) community
Source
Pathway
Receptor
Chemical pressure
•Whole body PO4 (only)
•Sensitivity to nutrients
•Natural background PO4
Hydraulic connection
•Drift thickness
•Drift permeability
Thanks to Steve Fletcher


Environment Agency
Overview of approach
List of 1,386 sites
Stage 1
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Stage 2
Expert local knowledge (workshops & GIS)

Classification – GWDTE Test

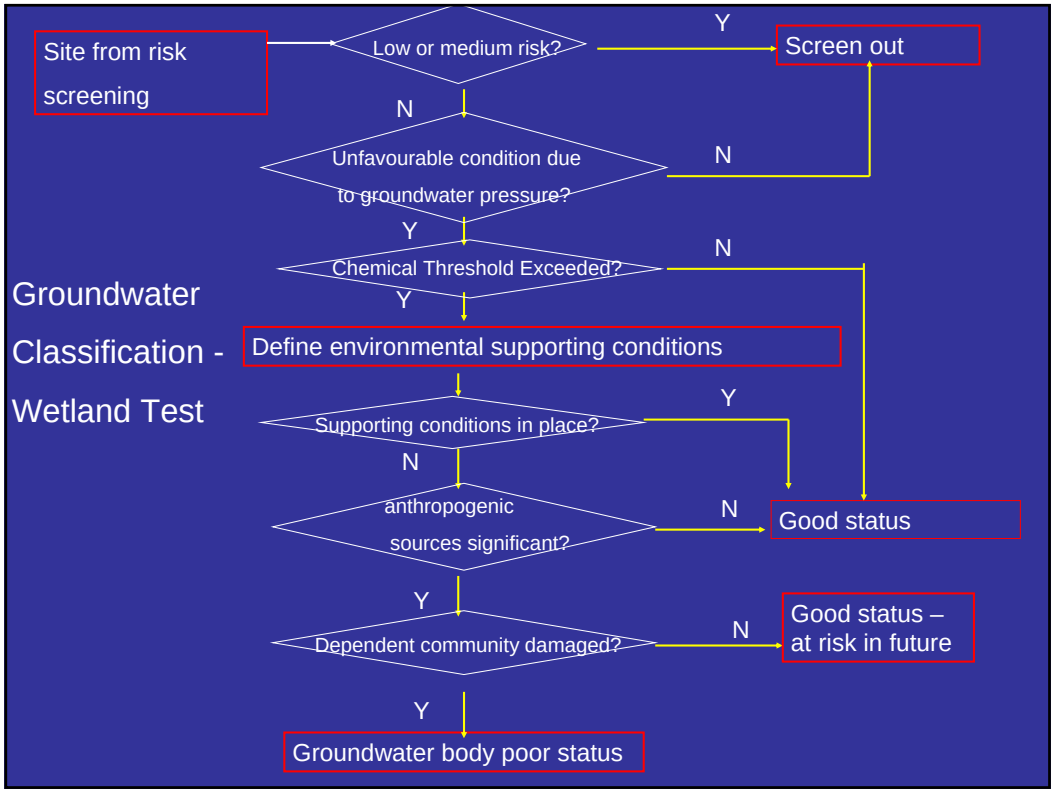
- Classified each groundwater body in England and Wales at either good or poor status according to whether groundwater-dependent terrestrial ecosystems (GWDTEs) are significantly damaged.
- Reference: UKTAG paper "Proposals for a Groundwater Classification System and its Application in Regulation" (October 2007)

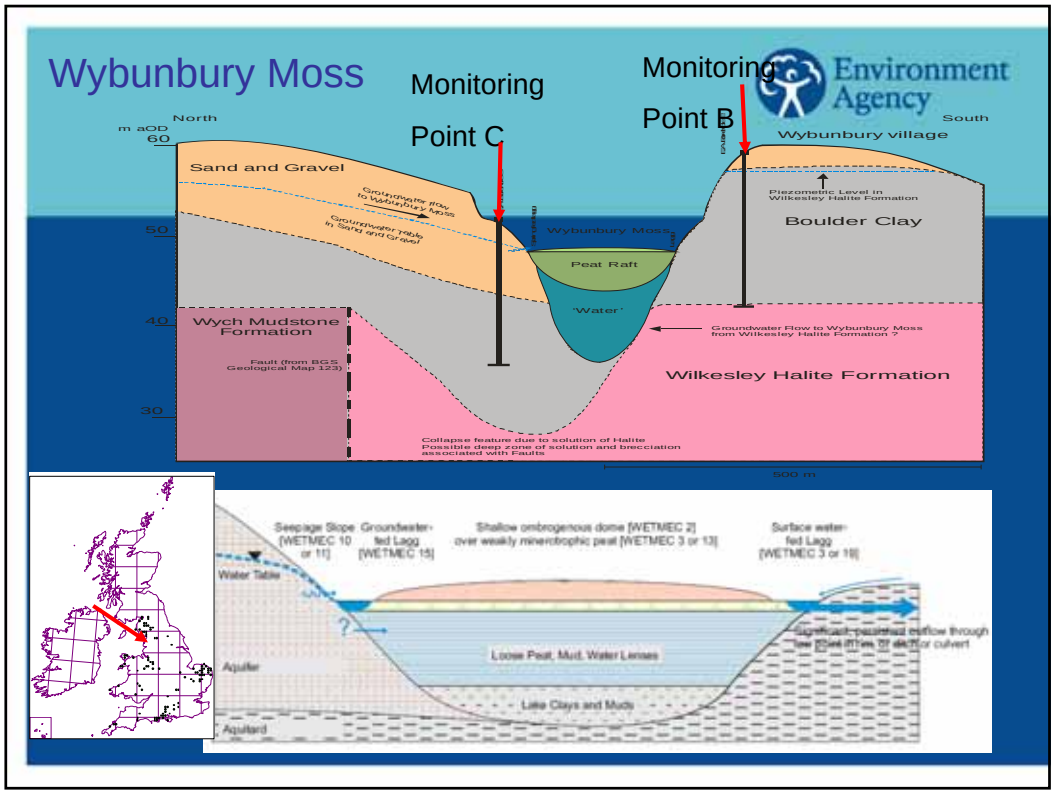

Wet Woodland

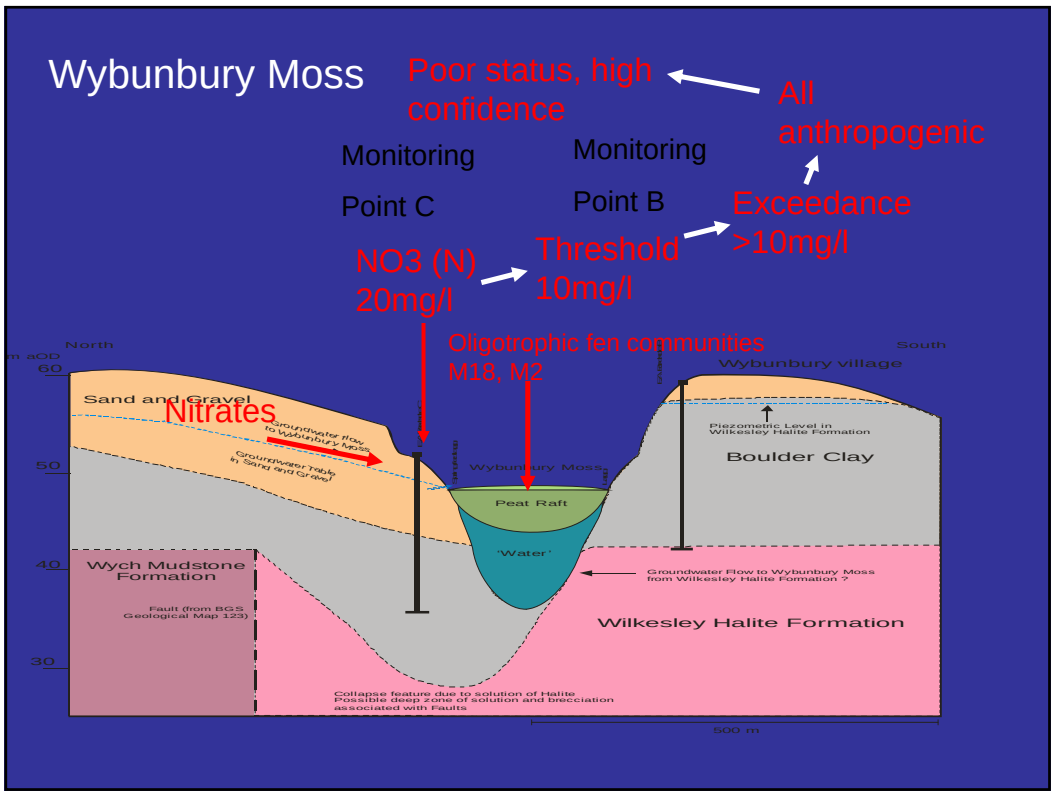

Reedbed


Wet Heath

Groundwater Classification - Wetland Test




Wybunbury Moss
Monitoring
Point C
Monitoring
Point B
Environment Agency
North
South
m aOD
60
50
40
30
Sand and Gravel
Groundwater flow to Wybunbury Moss
Groundwater table in Sand and Gravel
Wybunbury Moss
Peat Raft
'Water'
Wych Mudstone Formation
Fault (from BGS Geological Map 123)
Wybunbury village
Piezometric Level in Wilkesley Halite Formation
Boulder Clay
Groundwater Flow to Wybunbury Moss from Wilkesley Halite Formation ?
Wilkesley Halite Formation
Collapse feature due to solution of Halite
Possible deep zone of solution and brecciation associated with Faults
500 m
Seepage Slope [WETMEC 10 or 11]
Groundwater-fed Lagg [WETMEC 15]
Shallow ombrogenous dome [WETMEC 2] over weakly minerotrophic peat [WETMEC 3 or 13]
Surface water-fed Lagg [WETMEC 3 or 19]
Water Table
Aquifer
Loose Peat, Mud, Water Lenses
Lake Clays and Muds
Aquitard


Wybunbury Moss
Poor status, high confidence
All anthropogenic
Monitoring
Point C
Monitoring
Point B
Exceedance >10mg/l
NO3 (N) 20mg/l
Threshold 10mg/l
Oligotrophic fen communities M18, M2
Nitrates
North
South
m aOD
60
50
40
30
Sand and Gravel
Groundwater flow to Wybunbury Moss
Groundwater table in Sand and Gravel
Wybunbury Moss
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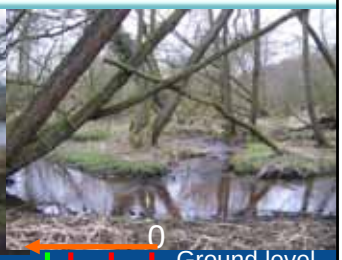
500 m

Hurcott



Wet Woodland

0

Ground level

3 m

Community Change

W5 to W6

W5/W6 Regime summer water levels between 5 and 45cm bgl

Currently water levels between 0 and -4 mbgl

Dipwells fluctuate 70cm in 2007

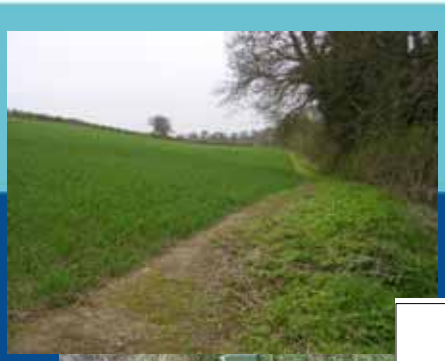
Dam lowered 1.34m

Modelled recovery 2-3m

Abstraction effects significant

Poor Status high confidence

Reference: Ecohydrological Guidelines for Wet Woodlands (Barsoum et al. 2006) English Nature Research Report 619 see www.naturalengland.org.uk



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What's Next?

-GWDTE Investigations

-Agreement with Natural England/CCW

Wybunbury Moss

Cors Bodeilio

Cors Eirdeinniog

Frome St Quentin

Newbald Becksies

Bransbury Common

Reference: Environment Agency report "Guidance on Monitoring and Investigation at Groundwater-dependent Terrestrial Ecosystems" (Andy Brooks/Simon James)

Issues (1)

- Attenuation of phosphate in the groundwater body before groundwater emerges on site
- ADAS loading data led to an over-estimation of the risk in many upland areas
- Nutrient requirements of plant communities on wetlands or of the effects of elevated nutrients on plant communities
- Condition monitoring not intended to detect reason for change
- .

Issues (2)

- Few sites with hydrological or chemical monitoring data
- Wales sites with no condition assessment data. Assigned good status may have been at poor status
- 149 sites on unproductive strata
- Impacts of local drainage on shallow wetland water levels

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Environment Agency

Thank You

Conclusions

- **Insufficient data but we can still make decisions**
- **Ecologists & hydrogeologists working together**
- **Further condition surveys/investigation required to increase confidence**

Acknowledgements

Paul Hulme, Andy Brooks, Steve Fletcher, Tim Besien, Cath Tomlin, Ann Skinner, Grant McMellin, Anna Hall, Stuart Kirk, Keith Phillipson, Graham Morgan, Peter Daldorph, Peter Jones, Johan Schutten, Julie McNish, David Johnson, Ursula Buss, Lindsay Powell, and all the participants in the local workshops.