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

Hydrogeology Meets Hydroecology
Geological Society  22nd May 2008

Mark Whiteman¹, Paul Hulme², Felicity Miller², Sarah Evers², Natalie Phillips², Andrew Brooks³, Anna Cohen³

¹Technical Adviser Hydrogeology, Environment Agency Head Office
²Environment Agency Science Group
³Entec UK Ltd.

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

Aim: assess every GDE for risk of significant ecological damage caused by groundwater pressures

Wet Heath

Wet Dune Slacks

List of 1,386 sites

Initial risk assessment (national GIS data)

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.wfd.uk.org/

Stage 1

Quantitative pressure
• Whole body pumping
• Near wetland pumping

Chemical pressure
• Whole body PO4 (only)
• Sensitivity to nutrients
• Natural background PO4

Source

Pathway

Receptor

Thanks to Steve Fletcher
Thanks to Steve Fletcher

Stage 1

Source

Quantitative pressure
- Whole body pumping
- Near wetland pumping

Pathway

Chemical pressure
- Whole body PO4 (only)
- Sensitivity to nutrients
- Natural background PO4

Hydraulic connection
- Drift thickness
- Drift permeability

Receptor

Degree of dependence of ecology on groundwater
- Rating for each National Vegetation Classification (NVC) community

Stage 2

Overview of approach

List of 1,386 sites

Initial risk assessment (national GIS data)

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)
Piezometric Level in Wilkesley Halite Formation

Boulder Clay

Sand and Gravel

Groundwater Table

Groundwater flow to Wybunbury Moss

Groundwater Flow to Wybunbury Moss from Wilkesley Halite Formation

Wilkesley Halite Formation

Peat Raft

'Water'

Wybunbury Moss

E.A. Borehole C

E.A. Borehole B

Collapse feature due to solution of Halite

Possible deep zone of solution and brecciation associated with Faults

Wybunbury village

North South

m aOD

60

50

40

30

500 m

Fault (from BGS Geological Map 123)

Wych Mudstone Formation

Lagg

Spring-fed lagg

Monitoring Point C

Monitoring Point B

Monitoring

Nitrates

Oligotrophic fen communities

M18, M2

NO3 (N)

20mg/l

Threshold 10mg/l

Exceedance >10mg/l

All anthropogenic

Poor status, high confidence

Wybunbury Moss
Hurcott

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


What’s Next?
-GWDTE Investigations
-Agreement with Natural England/CCW

Cors Bodeilio
Cors Eirdeinniog
Frome St Quentin
Wybunbury Moss
Newbald Becksies
Bransbury Common

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
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.