COMMUNICATING THE RISKS ARISING FROM GEOHAZARDS

Martin Culshaw

Kingsley Dunham Centre
Keyworth
Nottingham NG12 5GG
Tel 0115 936 3100

© NERC All rights reserved

NATURAL ENVIRONMENT RESEARCH COUNCIL

Rosenbaum and Culshaw 2003

"The public understanding of science is important, but more so is the scientists' understanding of the public"

© NERC All rights reserved

SOME OF THE ISSUES

- Before we try to communicate …..
- What is the audience?
- Characteristics of the audience
- Matching the message to the audience
- Some examples

© NERC All rights reserved

BEFORE WE COMMUNICATE

- Audience – what is it?
- Engagement – how do we get them to look/listen?
- Knowledge transfer and empowerment – what is the form and content of the message?
- Continuation – consistency of the message, coordination between message providers – no mixed messages

© NERC All rights reserved

WITH WHOM ARE WE TRYING TO COMMUNICATE?

- Professional geoscientists and geo-engineers
- Professional non-geoscientists
- The general public
- Victims of geohazard occurrences

© NERC All rights reserved

USERS OF GEOHAZARD ADVICE AND INFORMATION

Geo-professionals

Non-geological professionals

- developers
- financiers
- planners
- building control officers
- architects
- civil and structural engineers
- utility and transportation providers
- surveyors
- builders
- insurers
- lawyers
- conservationists

The public

- victims
- non-victims

© NERC All rights reserved

CHARACTERISTICS OF THE AUDIENCE

Identify the characteristics of the target audience (particularly the public)

- What is their state of knowledge?
- Do they understand science?
- Are they literate?
- What language do they speak?
- What are their cultural values?
- What are their domestic constraints?

© NERC All rights reserved

WHAT ARE WE TRYING TO COMMUNICATE?

- Our science to scientists – look what we've done – aren't we clever - what do you think?
- Our science to other professionals – this might be of interest – did you know about this? – it might affect how you do your job
- Our science to the public – this is exciting – it might affect you – this is what you should do
- Our science to victims – could we have warned you? – this is what should happen next time

© NERC All rights reserved

WHAT ARE WE TRYING TO COMMUNICATE?

- Hazard – what sorts are there?
- Hazard – where are they?
- Hazard – what you should do about them
- Vulnerability – does the hazard actually matter that much? I'm more interested in how I might be affected
- Risk – this is what the hazard will 'cost'
- The difference between hazard and risk (most people don't know!)

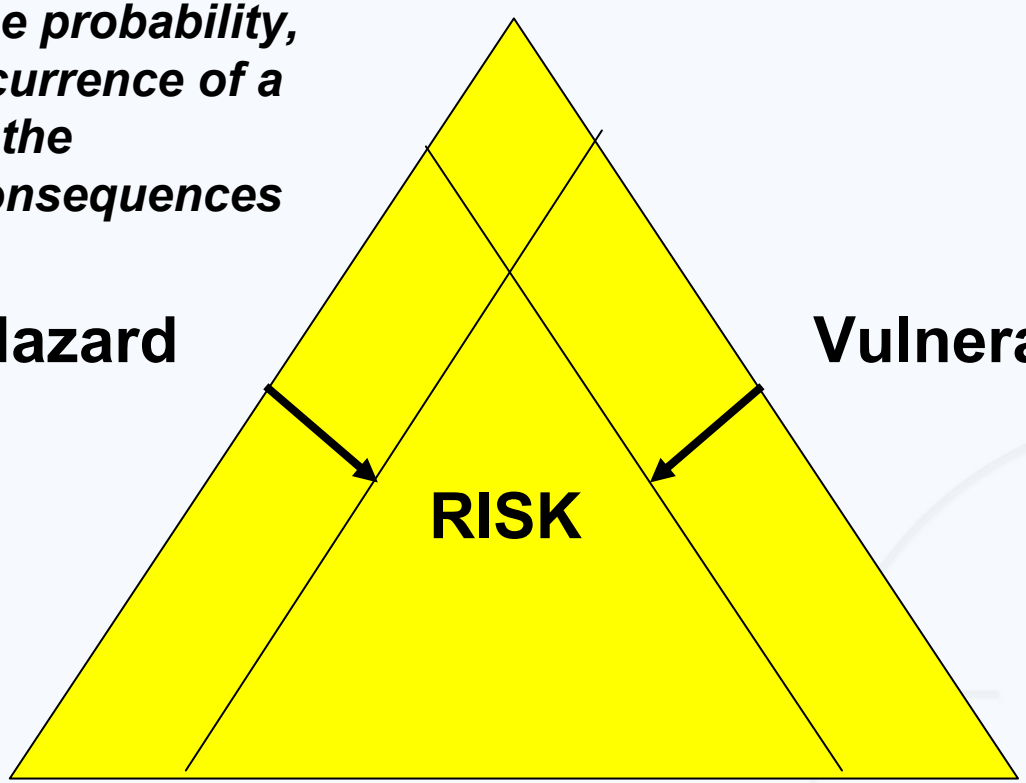
© NERC All rights reserved

THE RISK TRIANGLE

Risk = Hazard x Elements at Risk x Vulnerability

A combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of occurrence

But what does this definition mean?



© NERC All rights reserved

VULNERABILITY – PUTTING THE SCIENCE IN ITS PLACE!

Heijmans (2001)

CAUSE	SOLUTION
• *Natural hazards*: vulnerability results from the size of the hazard and the proximity of people to it	• mitigation through prediction (geological approach); relocation (planning approach); better building design, construction and building codes (engineering approach)
• *Cost*; mitigation is too costly, so not applied	• insurance, government disaster funds and subsidised personal savings
• *socio-economic and political situation*; poorer people find it more difficult to respond to, cope with and recover from hazard events	• alleviating poverty by changing social and political structures

© NERC All rights reserved

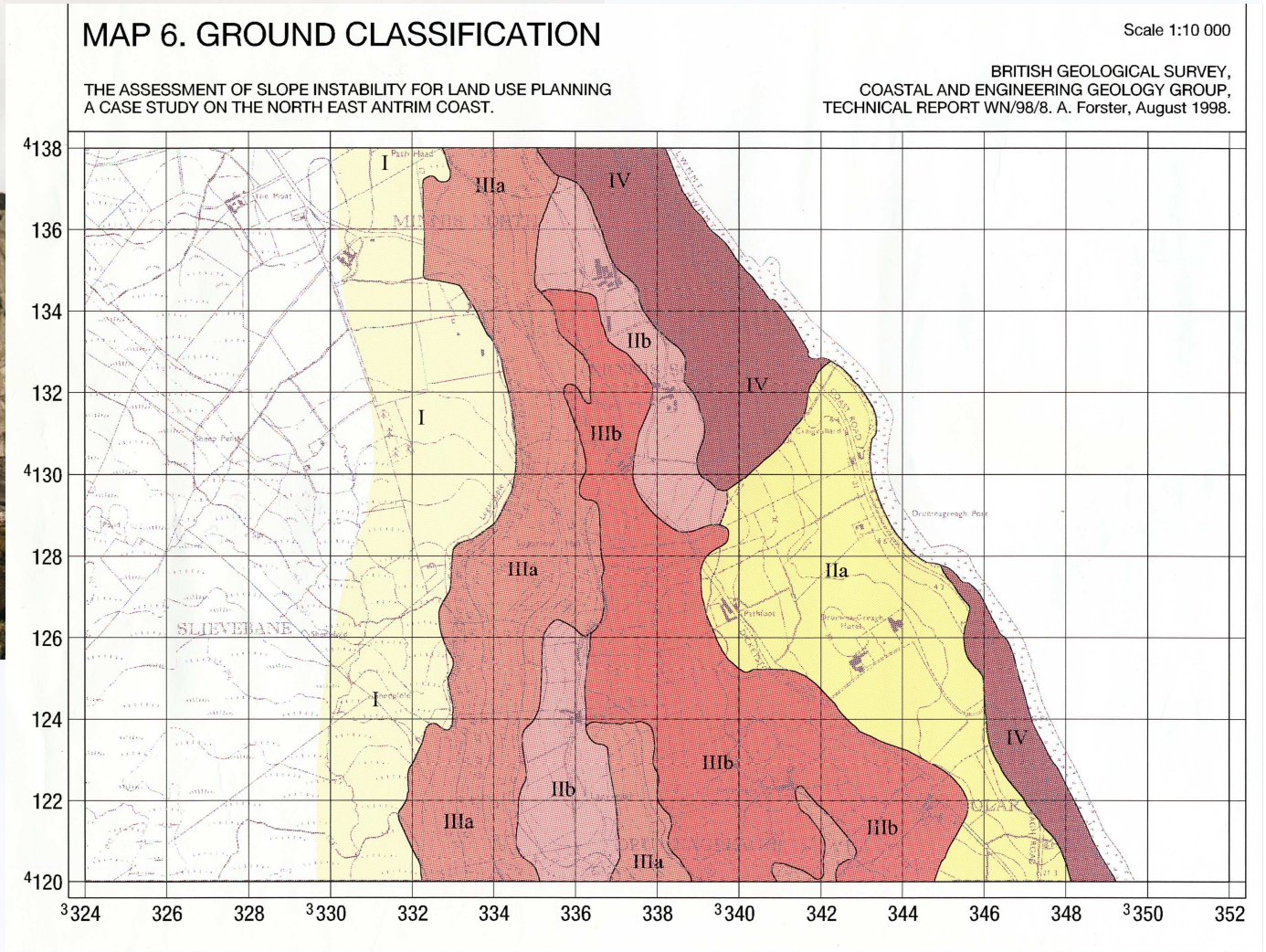
SOME EXAMPLES:
PLANNING AND DEVELOPMENT

© NERC All rights reserved

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

www.bgs.ac.uk

LANDSLIDE HAZARD – ANTRIM COAST



© NERC All rights reserved

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

www.bgs.ac.uk

LANDSLIDE HAZARD ASSESSMENT – ANTRIM FOR PLANNING AND DEVELOPMENT

MAP 6 Key: CONSTRAINTS ON DEVELOPMENT OF THE ANTRIM COAST DUE TO SLOPE INSTABILITY

Instability constraint on development	Morphology	Slope range in degrees	Dominant Geology	Current activity	Past activity	Hazards constraining development	Implications for decision on planning permission
Low I	Plateau	0-10	Basalt	None	None	Rockfall from plateau edge. Instigation of instability down slope.	A desk study and walk over survey report necessary. Further investigation may be required. Care required with disposal of surface water, undercutting or loading of ground. May be possible to define a safe building line some distance from the plateau's edge
Medium IIa	Coast lowland	0-15	Chalk Superficial deposits	None	Flows	Potential for mudflows, slides and minor slumping	A desk study and walk over survey report necessary. Policy needed for safe disposal of surface water and sewage. Water supply may need flexible couplings. Possible restriction on irrigation, watering, ponds, swimming pools etc. Further ground investigation to determine stability usually required
Medium IIb	Within landslide complex	0-35	Basalt, Chalk	None	Scarps	Potential for reactivation of block slides	A desk study and walk over survey report necessary. Policy needed for safe disposal of surface water and sewage. Water supply may need flexible couplings. Possible restriction on irrigation, watering, ponds, swimming pools etc. Further ground investigation to determine stability usually required
High IIIa	Rock slumps	15-35+	Basalt, Chalk	Rockfall	Rockfall Rock slumps	Rockfall or reactivation of slumping. Instability may affect surrounding ground and/or the site may be affected by adjacent instability.	Permission for development highly unlikely on grounds of instability. Should development be considered the suitability of the ground for the purpose would need to be proved by detailed ground investigation and stability analysis of site and its surroundings. Excavation or earth works subject to prior stability analysis
High IIIb	Foot slopes	5-15	Lias, Greensand Superficial deposits	None	Flows and scarps	Reactivation of mudflows and slides	Permission for development highly unlikely on grounds of instability. Should development be considered the suitability of the ground for the purpose would need to be proved by detailed ground investigation and stability analysis of site and its surroundings. Policy needed for safe disposal of surface water and sewage. Possible restriction on irrigation, watering, ponds, swimming pools etc.
Very high IV	Sea cliff (south) Coast slope (north)	0-35 15-35	Lias, Greensand, Superficial deposits Chalk, Lias, Greensand, Mercia Mudstone	Slumps Mudflows Mudslides	Slumps Mudflows Mudslides	Slopes at or close to maximum stable angle, water levels high in places. Significant areas of current activity. Undercutting or increasing porewater pressure would start new, or reactivate dormant, instability. Instability may damage surrounding areas. Coastal stability may be impaired by failure.	Permission for development highly unlikely on grounds of instability. Stabilisation and remediation works will be an essential part of a programme of site investigation and stability analysis needed to prove the safety of any development in this area

IMPLICATIONS FOR PLANNING DECISIONS

Zone I. A desk study and walk-over survey report necessary. Further investigation may be required. Care required with disposal of surface water, undercutting or loading of ground. May be possible to define a safe building line some distance from the plateau edge.

Zone IIA …..

Zone IIB …..

Zone IIIA …..

Zone IIIB …..

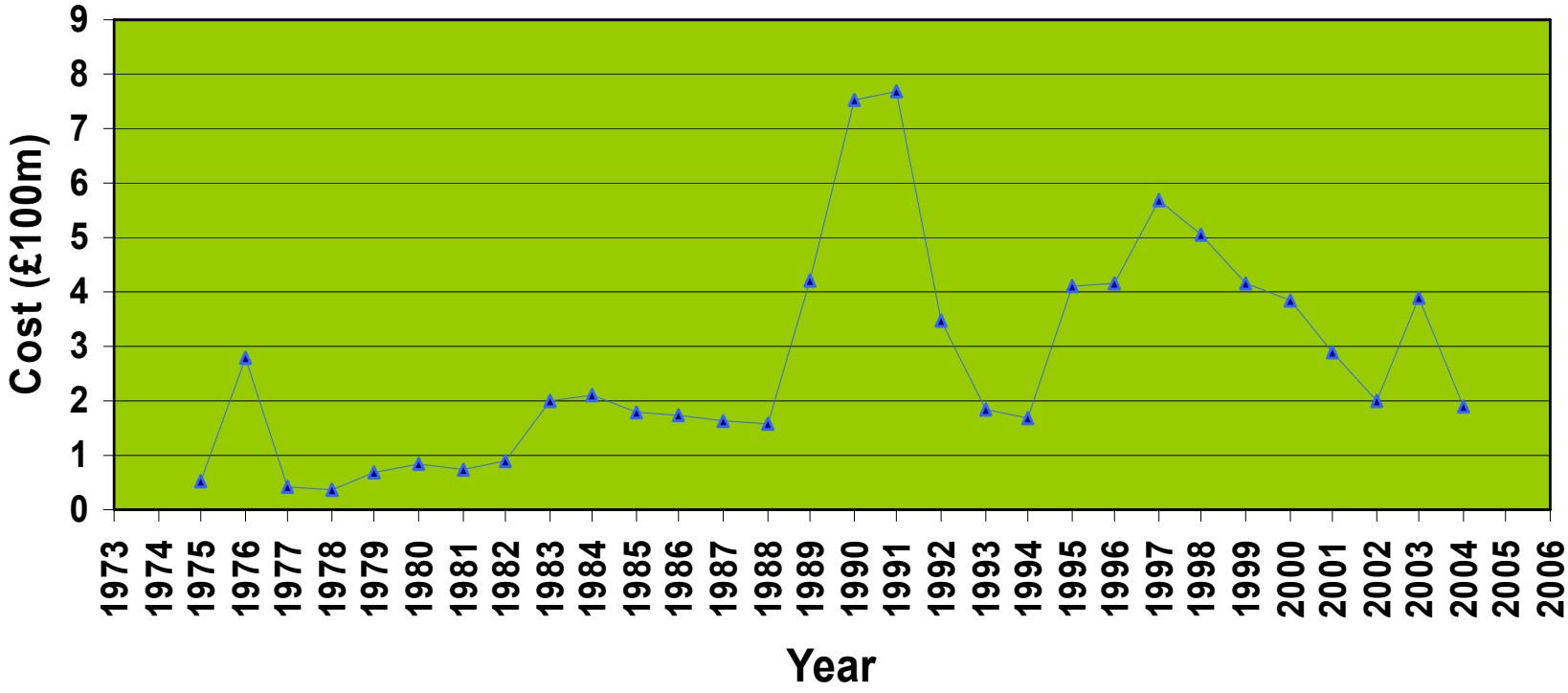
Zone IV. Permission for development highly unlikely on grounds of instability. Stabilisation and remediation works will be essential following a programme of site investigation and stability analysis needed to prove the safety of any development in this zone.

© NERC All rights reserved

SOME EXAMPLES: INSURANCE

© NERC All rights reserved

Subsidence claims 1975 to 2004 adjusted for inflation (RPI)



Total claims 1975 to 2004 = £8.23 billion (adjusted for RPI)

73% of the cost has been in the last 15 years (average £400m per year)

© NERC All rights reserved

GHASP - VARIOUS GEOHAZARDS FOR THE GUILDFORD AREA OF SE ENGLAND

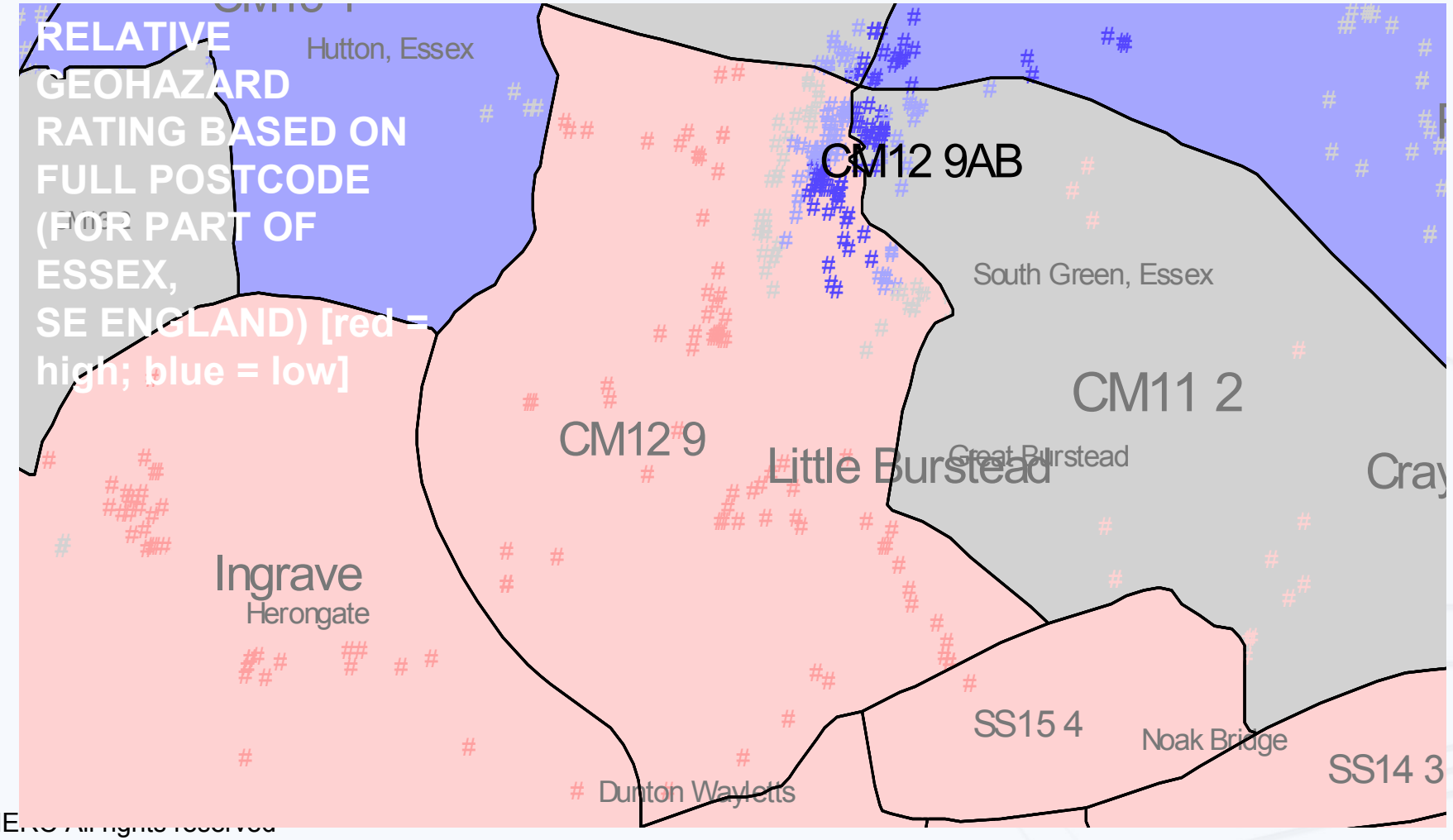
© NERC All

GHASP POSTCODE SECTOR FACTOR

Hazard	Area (%) (within postcode sector)	National Hazard Factor	Local Weighting Factor	Area Hazard Factor
Swell/shrink clays		1.0		(multiply columns to left)
Landslides		0.5		
Soluble rocks		0.5		
Gulls and cambering		0.3		
Shallow mining		0.7		
Compressible soils		0.7		
Postcode Sector Factor				(Add rows above)

© NERC All rights reserved

GHASP OUTPUT

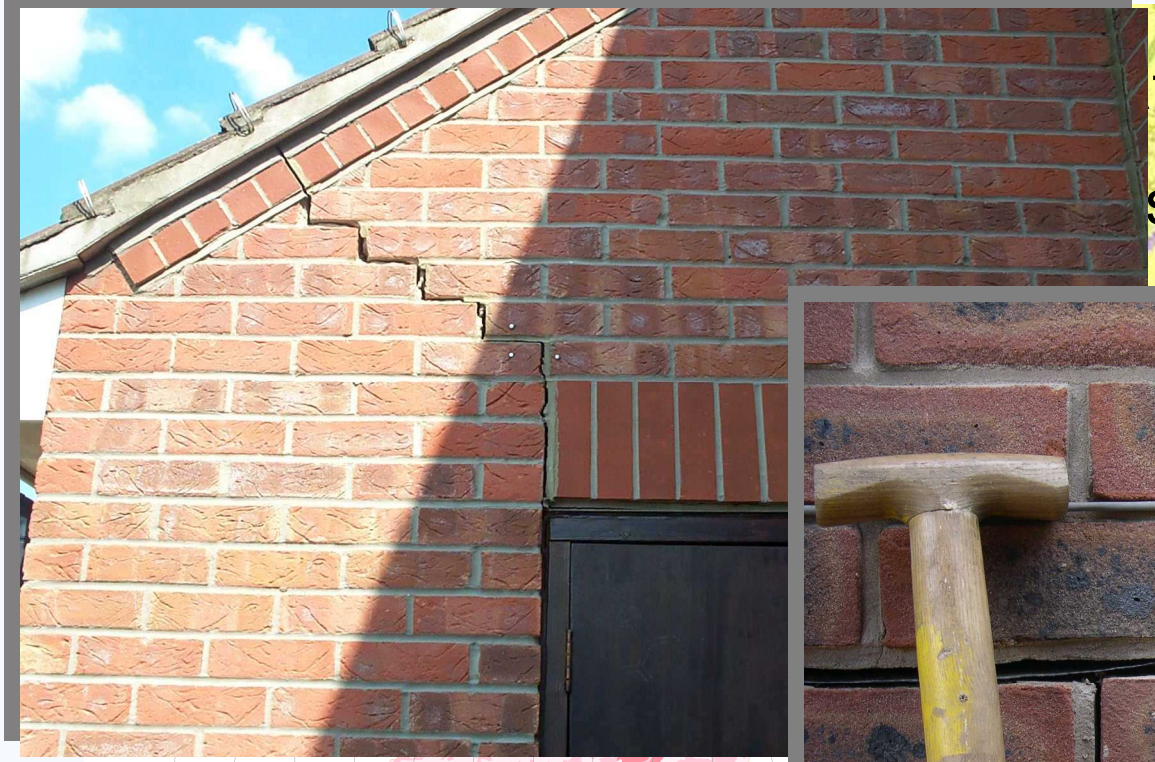


© NERC All rights reserved

SOME EXAMPLES:
HOME INFORMATION PACKS

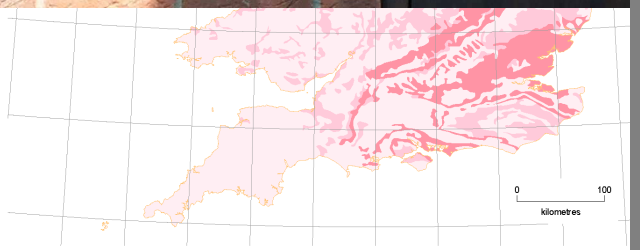
© NERC All rights reserved

Swelling and shrinking clays



ter

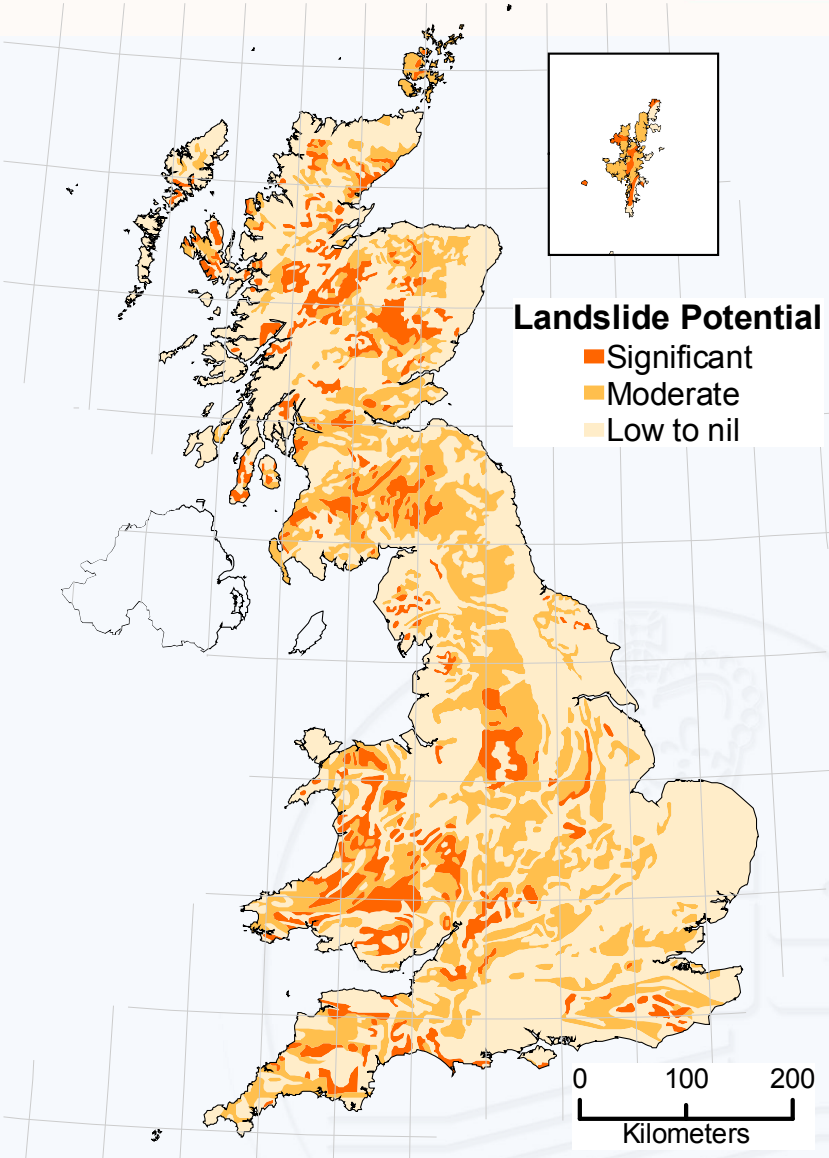
sture content



© NERC All rights reserved

Photographs courtesy of NHBC

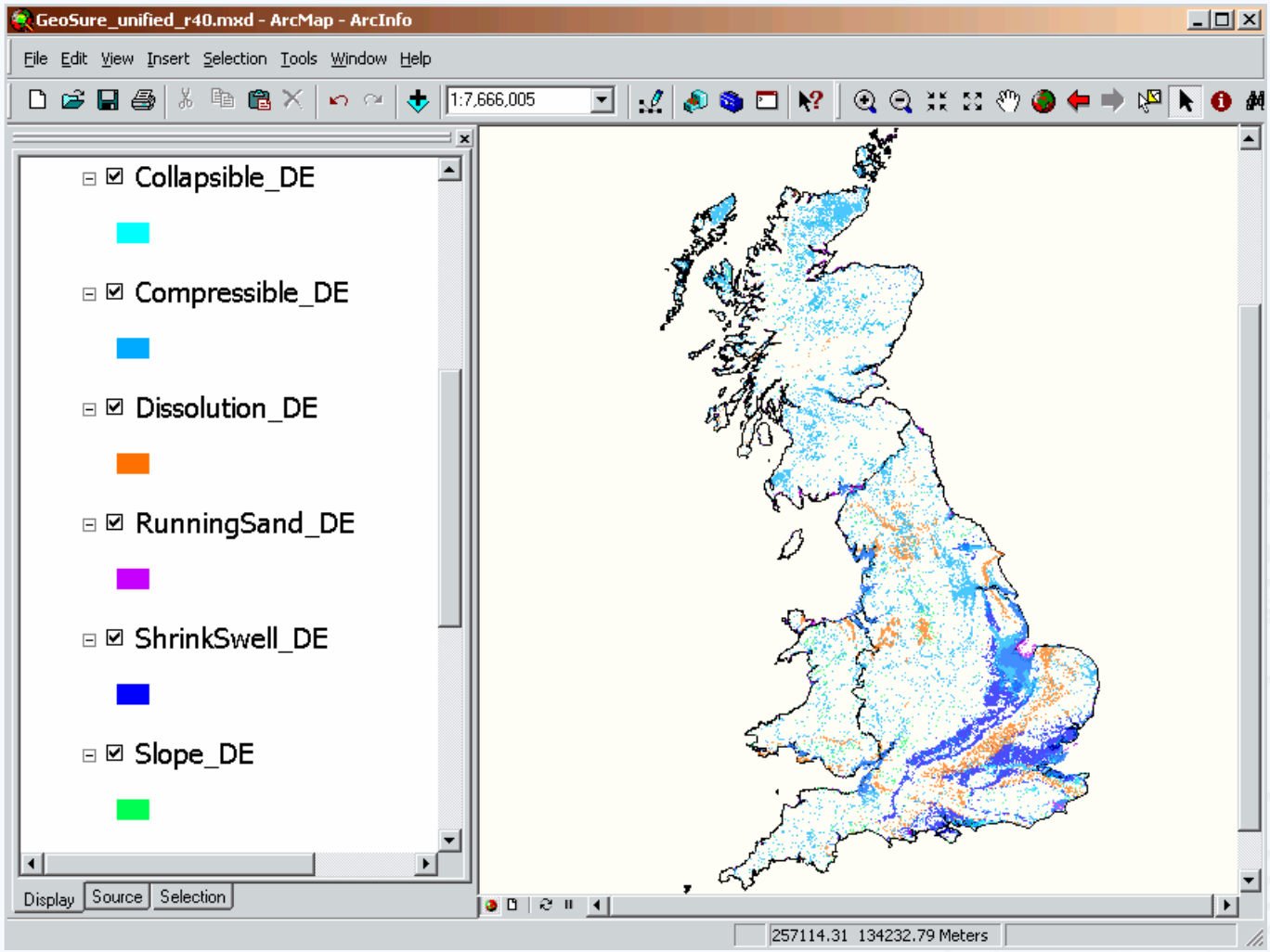
Slope Instability



365,000 (1%) of homes within “significant potential” zone

© NERC All rights reserved

SIX HAZARD VISUALISATION LAYERS



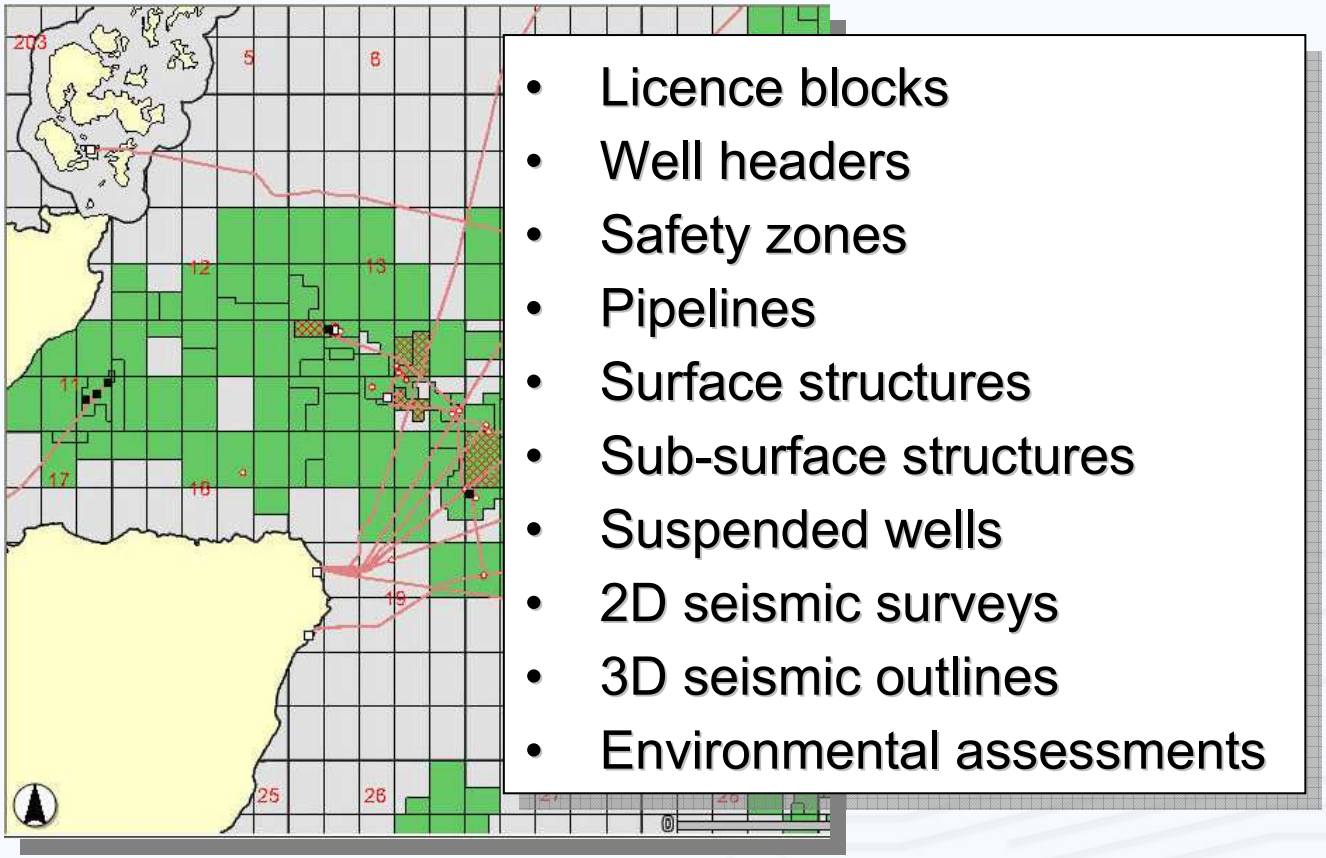
© NERC All rights reserved

SOME EXAMPLES: INFORMATION PORTALS

© NERC All rights reserved

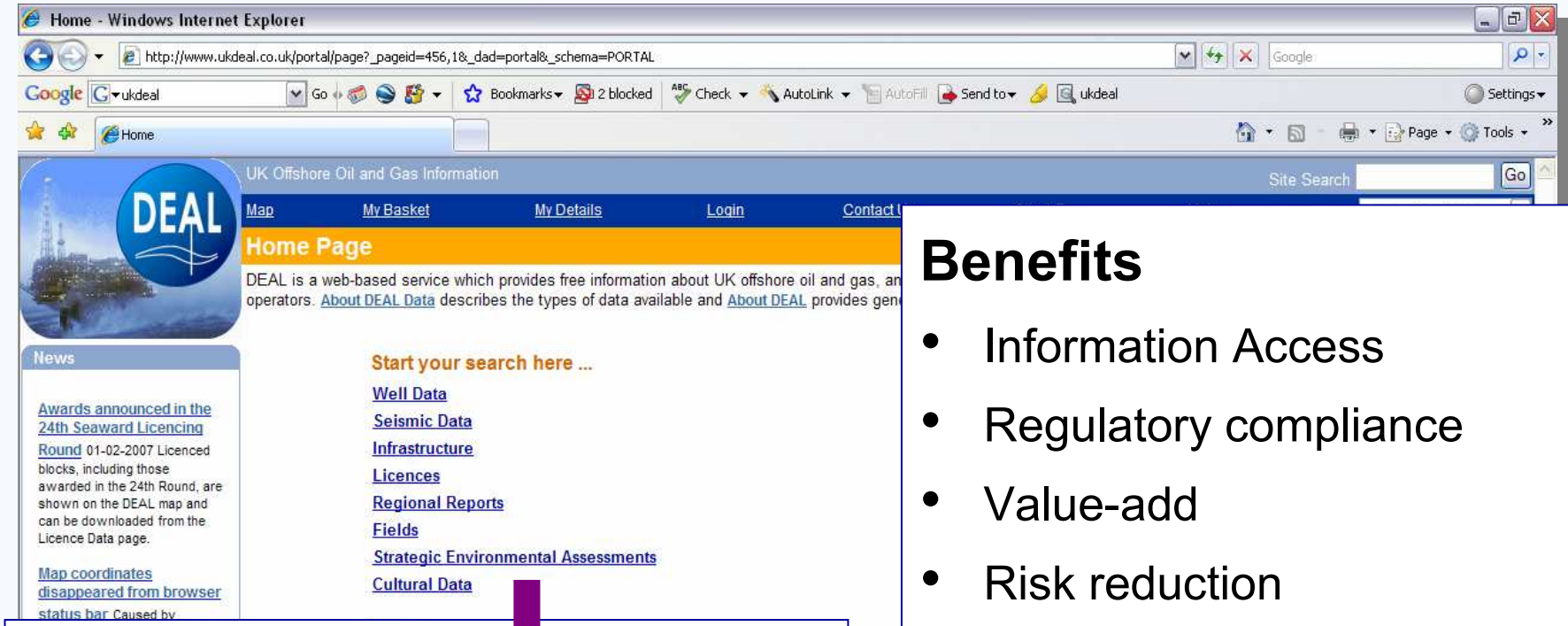
DEAL Information Portal

Award-winning web-based GIS



- Licence blocks
- Well headers
- Safety zones
- Pipelines
- Surface structures
- Sub-surface structures
- Suspended wells
- 2D seismic surveys
- 3D seismic outlines
- Environmental assessments

© NERC All rights reserved



- Oil companies
- Data vendors
- Regulators
- De-commissioning, fishing, other
- Academia

Benefits

- Information Access
- Regulatory compliance
- Value-add
- Risk reduction
- Work processes
- Time savings
- Cost reductions
- Data quality

© NERC All rights reserved

IN CONCLUSION

As geoscientists we:

- Collect the data
- Provide the information
- Increase the sum of knowledge

However, if we do not adequately and appropriately communicate what we have found *to those who need to use it,* we might as well not have bothered

© NERC All rights reserved