



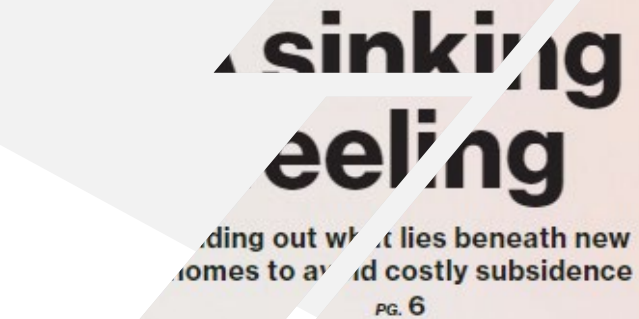
Terrafirma

Understand the Ground

Rachael Hodge, Senior Commercial Manager

Agenda

- An introduction to Terrafirma
- How does ground instability affect conveyancing?
- How Terrafirma are addressing the problem
- What does the future look like?



Is sinking feeling
Finding out what lies beneath new homes to avoid costly subsidence
PG. 6

Terrafirma

Information | Data | Consultancy

- ✓ Providing property risk screening to over 4000 transactions per day
- ✓ Undertaking 400 Property Risk Reports per day
- ✓ The first commercial company to be licenced to produce the official CON29M by the Law Society
- ✓ Second largest provider of Coal Mining Reports in England and Wales (85,000 a year)
- ✓ A database of over 10 million data points, 200 years of digitised historical maps and pioneering technologies including our innovative 'Logic Engine'.
- ✓ Worlds first commercial use of 'real time' earth observation and surface deformation satellite data

TERRA
FIRMA
CON29M

TERRA
FIRMA
GROUND

Mining



Mineral Planning



Fracking



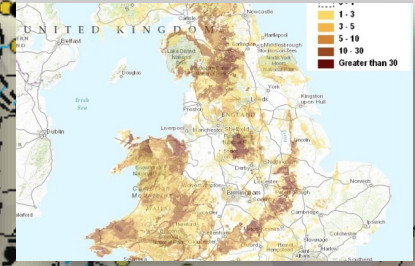
Natural Perils



Subsidence



Radon



understand the ground

How did we get here?!



understand the ground

What is ground stability?

Man made hazards (mining)



Natural Hazards






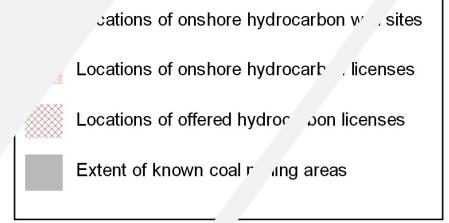
Mining in the UK

What is the first thing you think of?

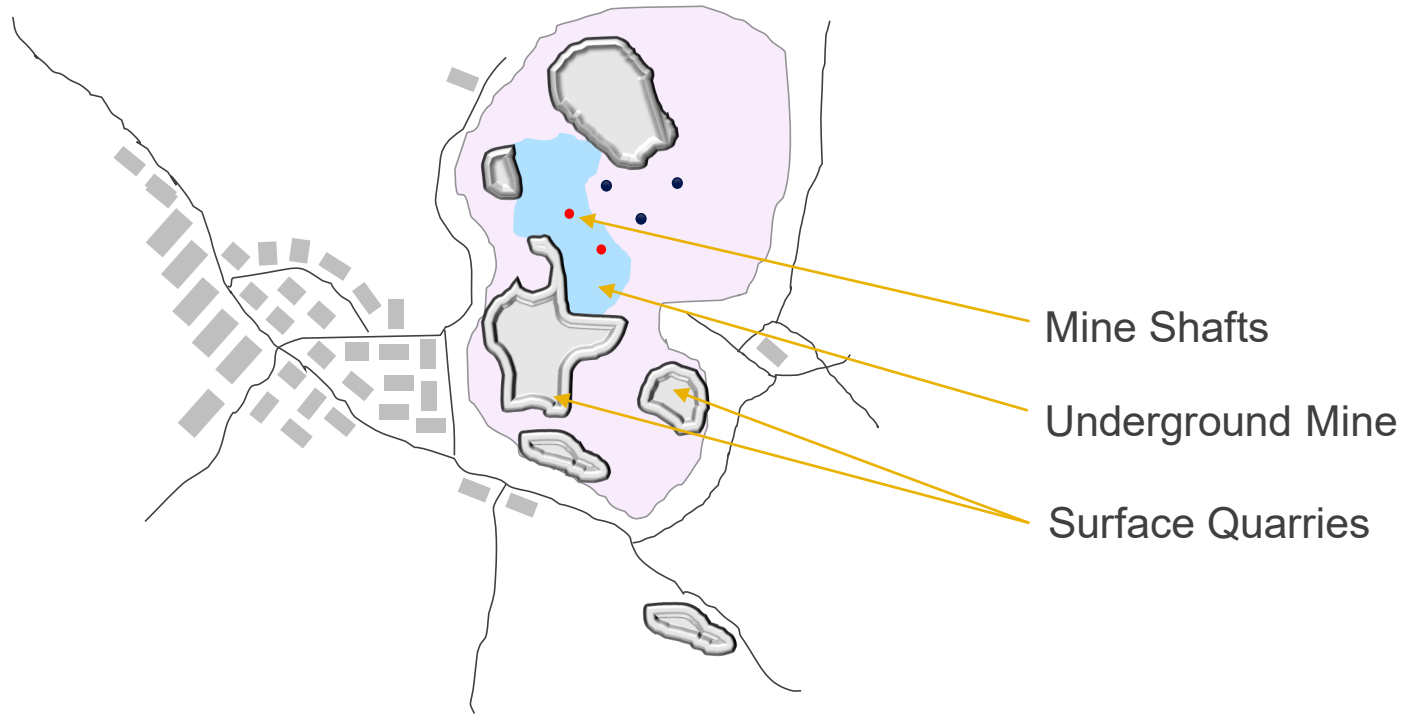


Based on the answers from providing over 500 hours of CPD across legal sector

-  Mineral extraction is one of the UK's greatest industrial legacies, with over 63 unique mineral resources extracted since the Stone Age (or 4500 years BCE).
-  Intensive extractive industry prior to 1872 (when underground mining 'began' to be documented) with vast majority of sub-surface workings poorly recorded.
-  Vast majority of 19th Century mines worked underground by less than 12 people and therefore not required by law to be surveyed upon abandonment.



1880

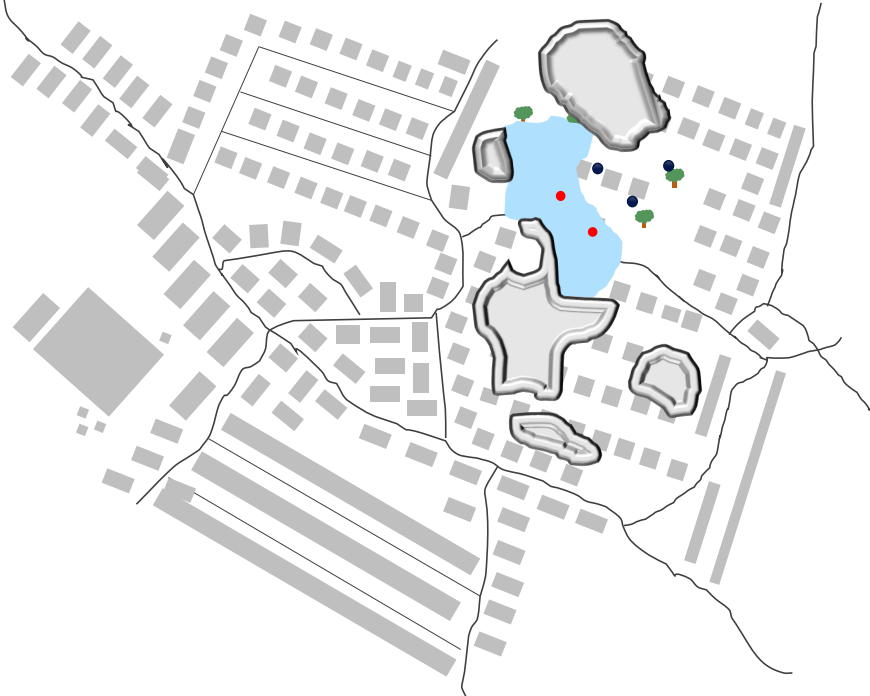


1960

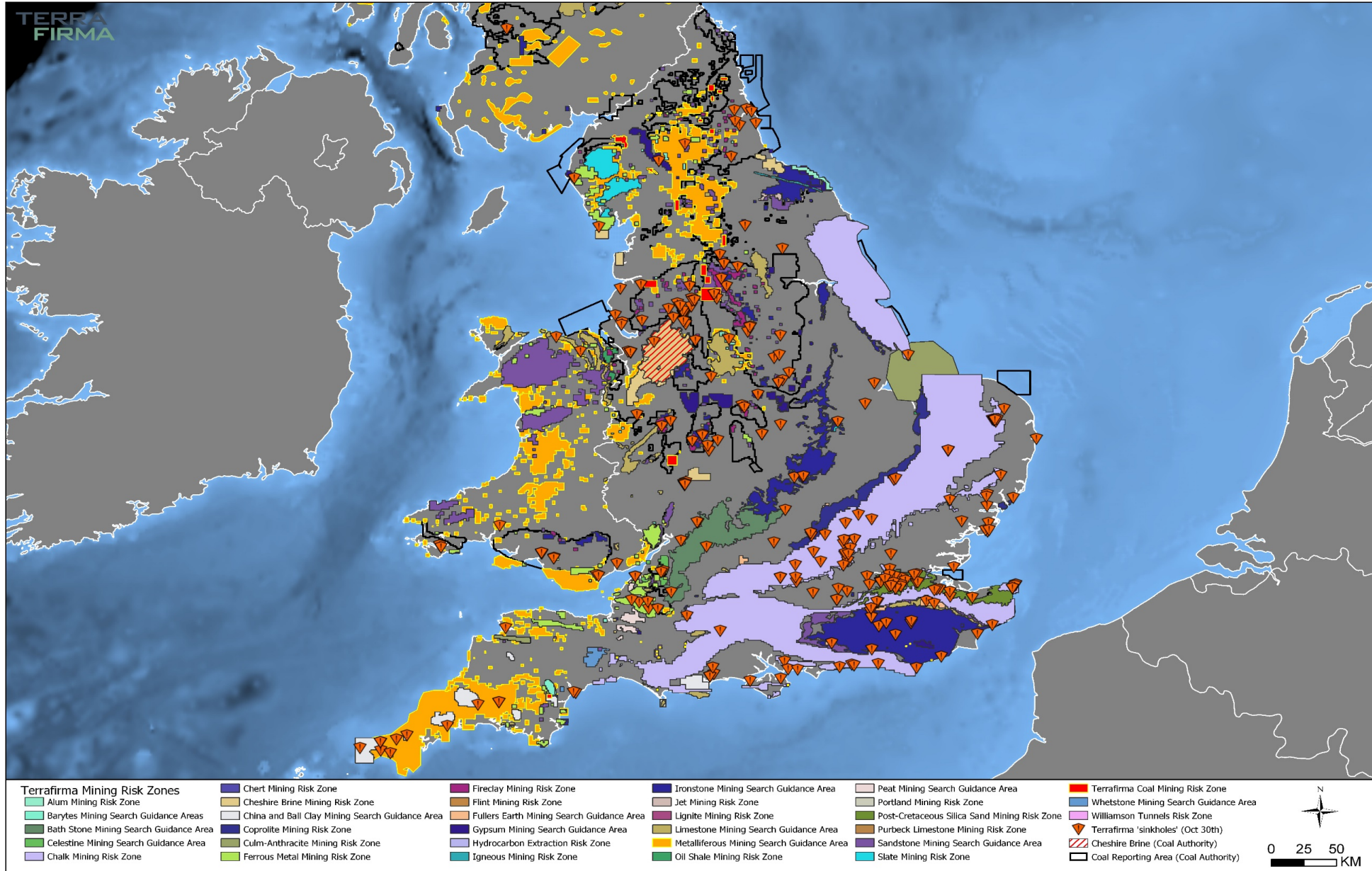


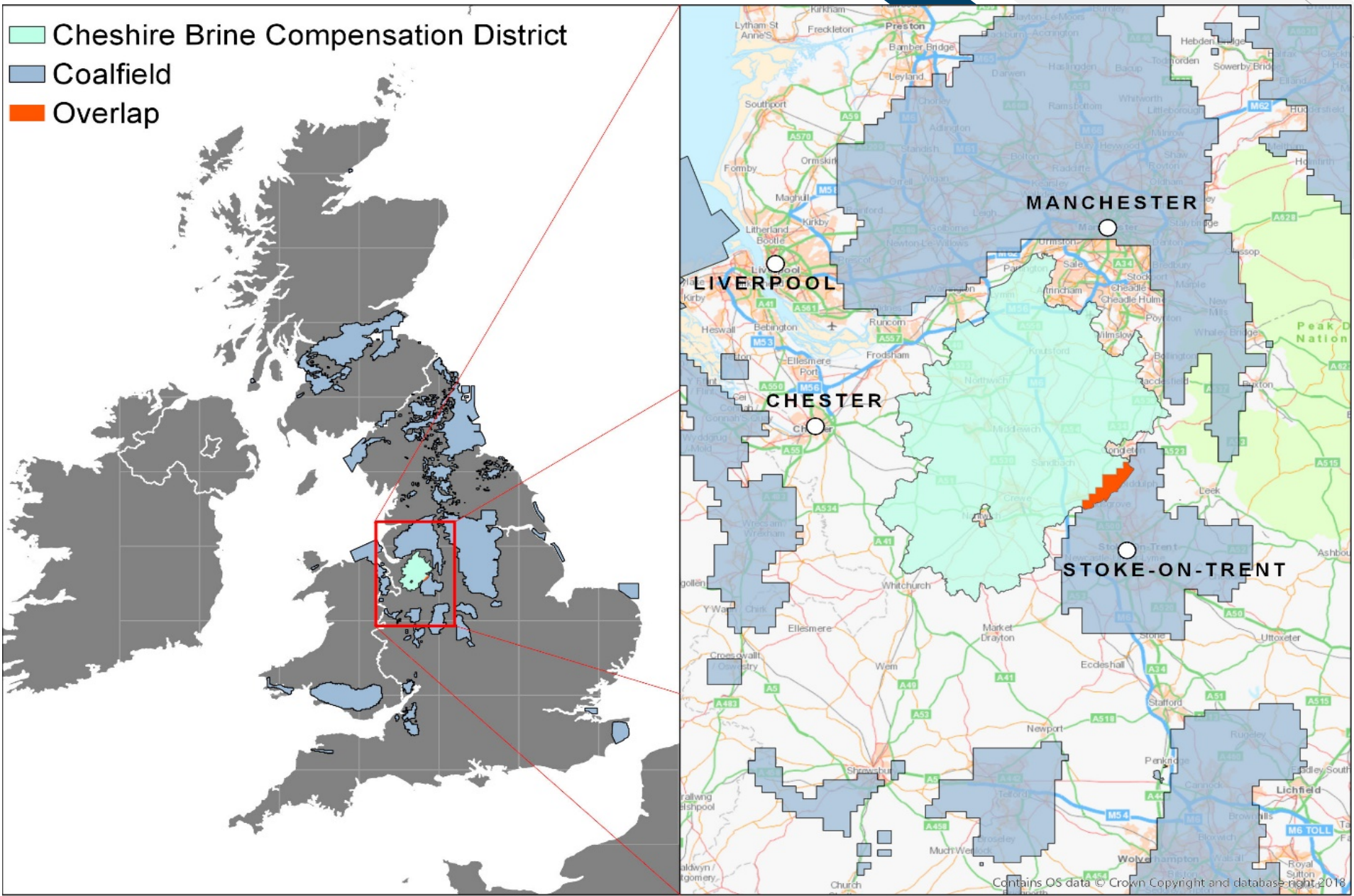
understand the ground

2019



understand the ground





understand the ground

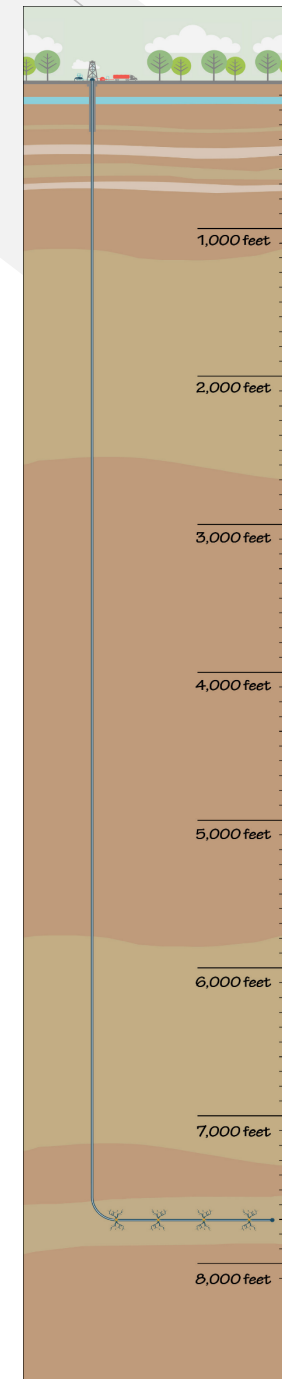
What is fracking?

Fracking could wipe tens of thousands of pounds off house prices

Estate agents fear fracking will collapse house prices and sales in Lancashire, Manchester and Sussex

What effect could Fracking have on house prices?

- Analysis in a study by academics from LSE, University of Bristol and Duke University found that **house prices fell by 2.7 to 4.1%** (pdf) in the area of Cuadrilla's fracking site in Lancashire –which caused two earthquakes in 2011.
- Research from Redshift found that estate agents in three areas of the UK affected by fracking estimated the possible **loss to house prices at 8-11%** or more.
- In 2015 the government was forced to publish a DEFRA draft report through a Freedom of Information (FOI) request that found that “there could **potentially be a range of 0 to 7% reductions in property values** within 1 mile of an extraction site.”



Natural Ground Perils



Clay Subsidence



Dissolution



Running Sands



Landslip



- ⚠️ Landslide risk assessment primitive with existing hazard mapping only considering slope angle and geology.
- ⚠️ Over 17,000 recorded landslides in the UK. Deforestation, a changing climate and increased development influencing frequency of landslide events.
- ⚠️ Major arterial routes and public transport networks most at risk but can deny access to homes to property owners for many 000
- ⚠️ Rarely occur but devastating in their impact, often with fatalities and significant diminution of land/property value.
- ⚠️ Over 25% of all 'sinkholes' in 2016-2018 have been associated
- ⚠️ Approx. 50% increase in landslide events since 2010 to 2018 with over 100 reported landslides in 2017, compared to 52 in 2010.





Guess the Ground Hazard....



Chalk Mining



understand the ground

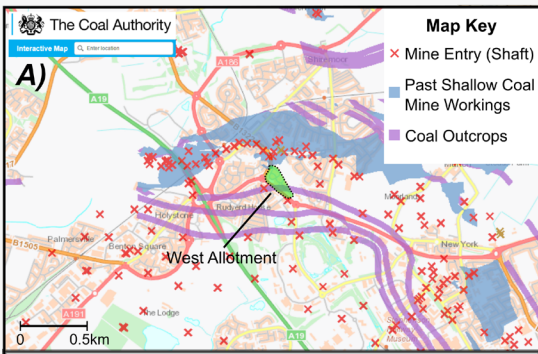


- Site developed by Bellway Homes
- Homes sold for approximately £200,000 in Late 2015
- Mid 2016 residents relocated following discovery of subsidence
- Coal Authority created a base at the Site and carried out investigations with NHBC
- December 2016 proposed that houses 12, 14, 16, 17 and 18 will be demolished, just 12 months after sale.
- On
beg
afte



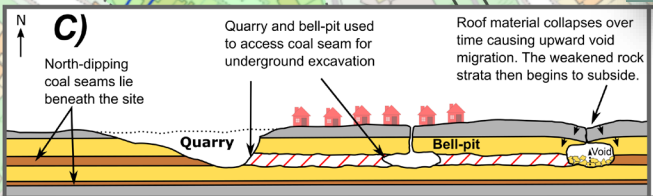
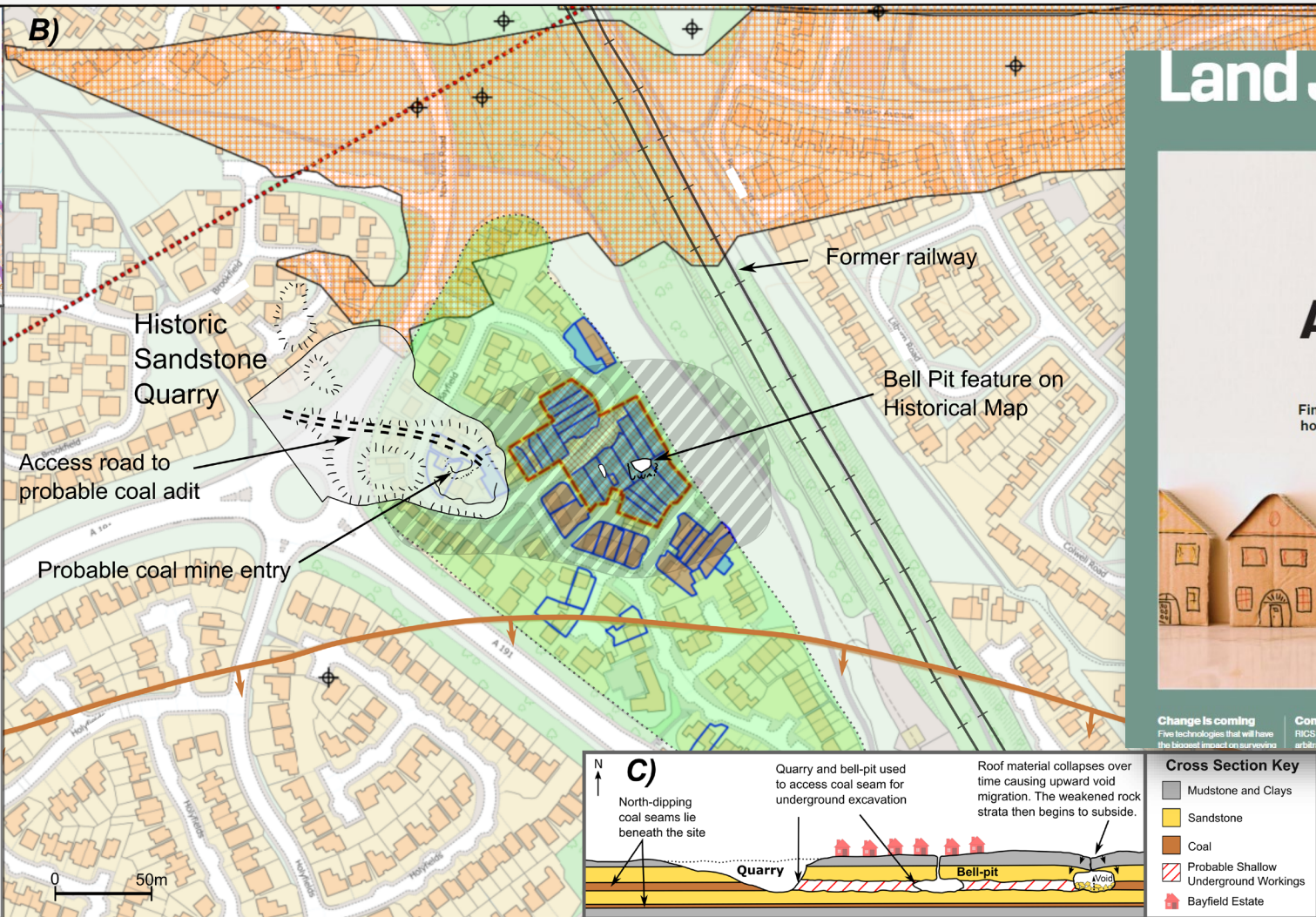
Is it just the five houses that are due to be knocked down?

No. The Coal Authority has now lodged another application with the council asking for permission to demolish 10 more homes. So far, that takes the total to 15.



- Map Key**
- ✕ Mine Entry (Shaft)
 - Past Shallow Coal Mine Workings
 - Coal Outcrops

- Map Key**
- Recorded Shallow Workings (at a depth of below 30 metres)
 - ⊕ Mine Entry (Shaft)
 - Subsidence Claims:**
 - - Rejected
 - - Awaiting Decision
 - - Accepted
 - Coal Seam and Direction of Dip
 - Demolished Properties
 - West Allotment
 - ▨ Interpreted Probable Workings Accessed From Quarry and Historical Pit/Shaft
 - ⋯ Geological Fault



- Cross Section Key**
- Mudstone and Clays
 - Sandstone
 - Coal
 - ▨ Probable Shallow Underground Workings
 - Bayfield Estate

Land Journal

A sinking feeling

Finding out what lies beneath new homes to avoid costly subsidence

pg. 6

Change is coming
Five technologies that will have the biggest impact on surveyors

Common ground
RICS guidance notes on rural arbitration explained

Neighbours at war
Mediation is the best way to settle costly disputes

November/December 2017
rics.org/journals

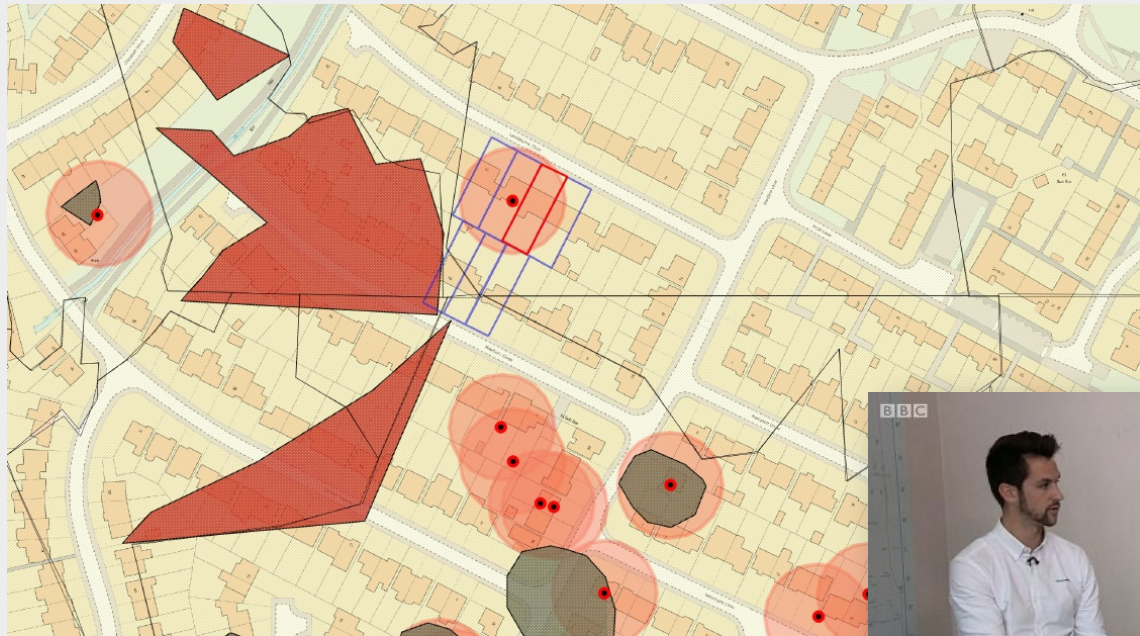


The scene at Rockliff-gardens, Plumstead, when children had narrow escapes in an extensive landslide near the playground.

understand the ground

Case Study: 9 Lambourne Close, Great Wyrley

- Mine entry within 20 metres
- Coal Authority unable to improve report
- 4 mortgage providers have refused to lend
- Valued at £250,000 in 2014, however didn't reach reserve of £160,000 at auction in 2016.



So what happened?

- Interrogating land use, ownership and mapping since 1878 as well as in context with local mining methods and history in the area, it was concluded that the shaft had been excavated out by later opencast extraction.
- Initial Terrafirma CON29M passed property for ongoing use but for BBC film, we investigated the shaft to validate the model.
- Investigations proved mine shaft did not exist and an area of backfill was identified where the opencast pit was expected.

TERRA
FIRMA



COMBINED DESKTOP AND
SITE INVESTIGATION
9 Lambourne Close, Great Wyrley
BICKLEY052018TFGSS

Professional Opinion

Within the scope of the assessment and limits of the investigation undertaken, there is no indication that the documented mine shaft poses a significant risk of instability to the property.

Next Steps

No further action required.

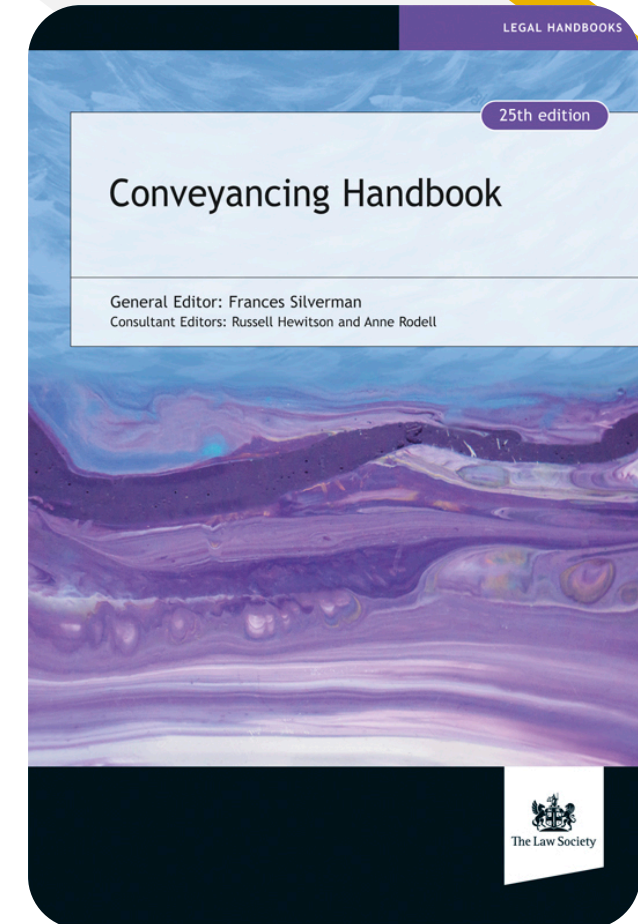
A property should be searched against all 'affected areas' to identify whether further investigation of site-specific ground instability risks is required.

In the event a property is located within an 'affected area', solicitors should carry out further investigation of the risks present. This step may include obtaining a site-specific report from a commercial search company.

An assessment should include a professional opinion of whether the property will be affected by mining or natural ground stability and whether there is likely to be any effect on the value or enjoyment of the property.

There is no need to inform the lender where the search result is clear or 'passed'.

When reporting the search results to the client, the solicitor should explain that they are not qualified to advise on the technical issues in the search and recommend that the client raises questions with the consultant who prepared the report.



How we identify and manage ground risk



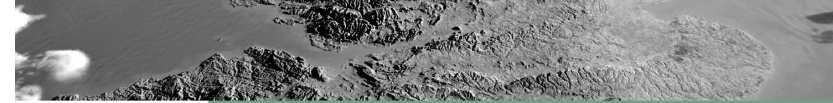
Don't be caught out by ground risks

Take advantage of our FREE audit.



understand the ground

GROUND HAZARDS RISK AUDIT



NAME OF FIRM: LAW FIRM

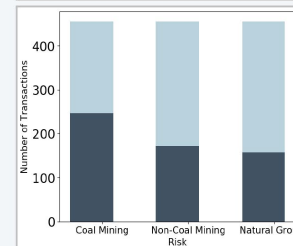
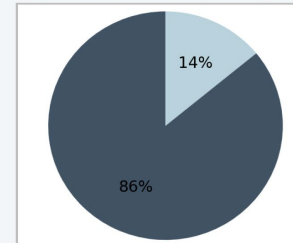
TRANSACTION PERIOD: JANUARY – SEPTEMBER 2018.

Using our records and Land Registry Data, the statistics below give you an accurate representation of the ground hazards that may affect your 430 transactions (excluding new build).

GROUND HAZARDS RISK AUDIT FOR LAW FIRM:

Registration Categorisation:	Percentage:
% OF REGISTRATIONS IN AN AREA AFFECTED BY ALL GROUND HAZARDS:	86%
% OF REGISTRATIONS IN AN AREA AFFECTED BY COAL MINING HAZARDS:	56.1%
% OF REGISTRATIONS IN AN AREA AFFECTED BY NON-COAL MINING HAZARDS:	37.6%
% OF REGISTRATIONS IN AN AREA AFFECTED BY NATURAL GROUND HAZARDS:	34.5%

TRANSACTIONS AT RISK OF GROUND HAZARDS:



MINING:

Name of past mining hazard:	Percentage:
Coal:	56.1%
Rare Minerals:	0.9%
Metalliferous (Inc. Tin):	3.1%
Clay (Inc. China and Ball Clay):	7.0%
Stone (Inc. Limestone and Chalk):	29.9%
Evaporites (Inc. Cheshire brine):	2.2%

NATURAL GROUND:

Name of natural ground hazard:	Percentage:
Running Sands:	7.9%
Soluble Rock:	3.5%
Collapsible Deposits:	1.3%
Compressible Ground:	7.9%
Clay Subsidence:	16.0%
Landslides:	8.8%

CHART KEY: Hazard (dark blue), No Hazard (light blue)

DATA:

This data is sourced from the Coal Authority, the British Geological Survey, and our own records (amongst others). This report is designed to show you which ground hazards affect the properties you have transacted on for informative purposes and is not covered by our terms and conditions or professional indemnity insurance. These hazards are highlighted as those transactions that would have required further interpretation or reporting by TerraFirma. These hazards do not necessarily mean that any individual properties are specifically affected by ground hazards that may have a financial or legal liability to the site.



For any mining or ground related issues please contact the experts at TerraFirma

Call us on: 0330 900 7500
Email our team: info@terrafirmasearch.co.uk

Let's not beat around the bush..

Potential Risk

Moderate Risk

Low Risk








**TERRA
FIRMA**
CON29M

**TERRA
FIRMA**

**Introducing
the new Enhanced
CON29M**



What do we actually want to know about coal mining hazards?

Will coal mining activity impact the value of the property?	UNLIKELY TO IMPACT VALUE	
Are there adverse mining features that should be brought to the lender's attention?	NO NEED TO NOTIFY LENDER	
Are there mining hazards that should be brought to the purchaser's attention?	HAZARDS IDENTIFIED (See Next Steps on Page 2)	

How do you currently decide what is reported to the lender and your client?

User Key

Lender Further Action

Conveyancer Further Action

Purchaser Advisory

Passed – No Further Action

These colour signatures are used throughout the report. For the full key, please see the back of the report.

Do you know when shallow mining is a risk to the security of the site?

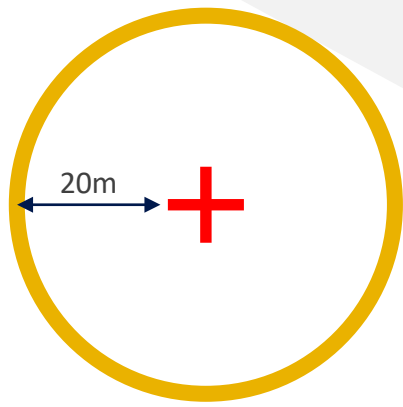
Do you feel confident to judge on what constitutes a coal mining hazard?

Are you able to give your clients comprehensive guidance on how to manage the risk and find out more information?

You shouldn't have to.

Terrafirma mining
intelligence around
the property is
included in the
new **CON29M**

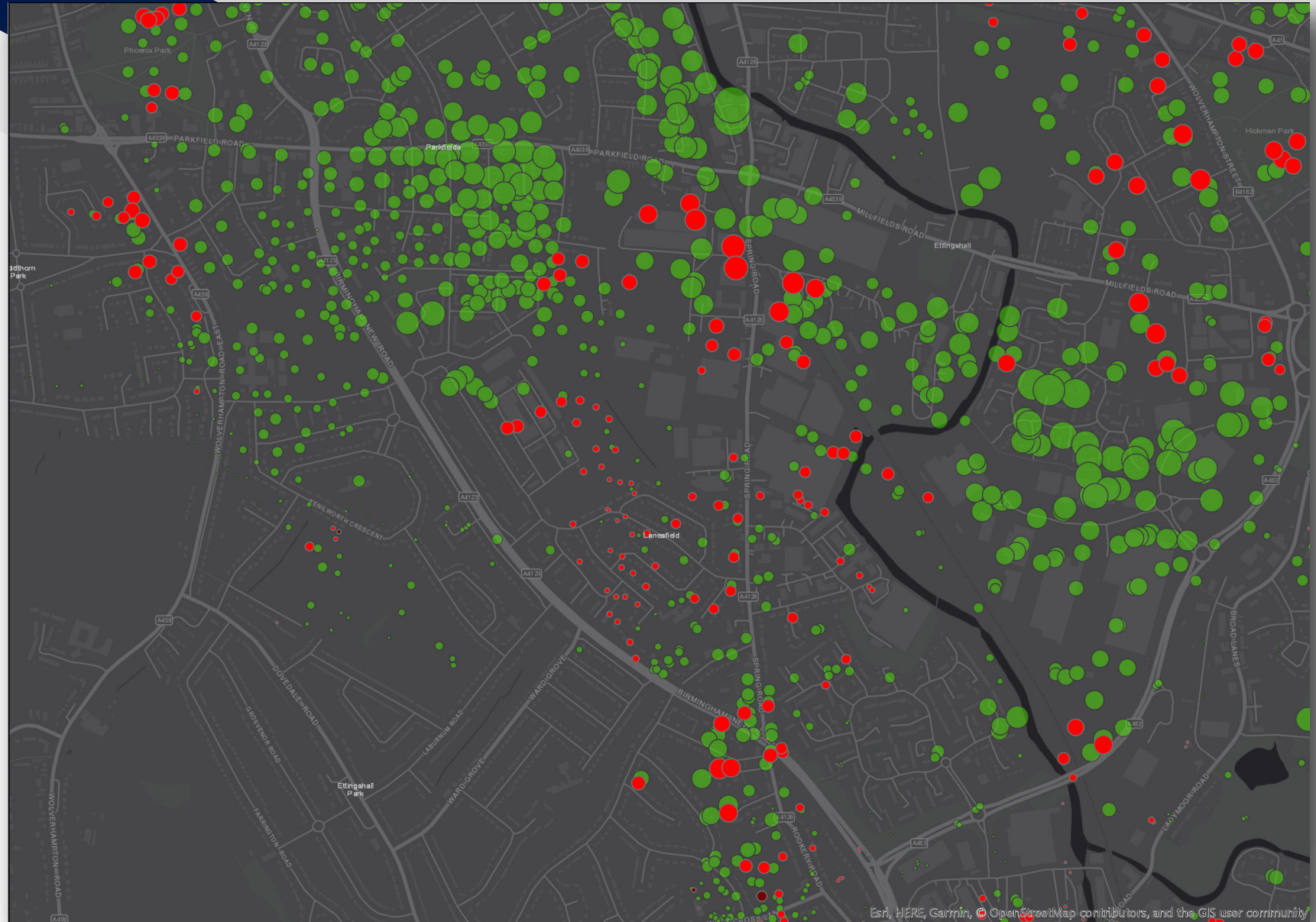




Time to lose the 20 metre buffer!

And instead analyse:

- Context
- Geology
- Soil and Surface Topology
- Depth of the Mine Entry
- Age of the Mine Entry
- Treatment Details
- Ownership details
- Historical Land use
- Satellite Data Monitoring
- And so much more





Overall Result:

PASSED

Expert Opinion:

Within the scope of this assessment, the Site is not considered to be susceptible to coal mining-related ground instability. Any identified coal mining features are considered unlikely to impact the value or security of the Site for normal lending purposes and there is no reason for them to impact upon the completion of this transaction.

Will coal mining activity impact the value of the property? UNLIKELY TO IMPACT VALUE

Are there adverse mining features that should be brought to the lender's attention? NO NEED TO NOTIFY LENDER

Are there mining hazards that should be brought to the purchaser's attention? NO HAZARDS IDENTIFIED

It is important to be fully informed of all coal mining risks associated with a property before completing your purchase. Please read the next steps on page 2 carefully.

Within Coal Authority Mining Reporting Area YES Report Address:

CON29M Questions Assessment SAMPLE

CON29M Questions	Assessment	Report Address:
1. Past underground coal mining	NO PASSED	SAMPLE
2. Present underground coal mining	NO PASSED	
3. Future underground coal mining	NO PASSED	
4. Shaft and adits (mine entries)	NO PASSED	
5. Coal mining geology	NO PASSED	
6. Past opencast coal mining	NO PASSED	
7. Present opencast coal mining	NO PASSED	
8. Future opencast coal mining	NO PASSED	
9. Subsidence claims (incl. Subsidence Claims Buffer Report)	NO PASSED	
10. Mine gas emissions	NO PASSED	
11. Emergency call out incidents	NO PASSED	

Report Details:

TF Reference: Sample
Client Reference: Sample
Date: 01/05/2019

User Key

- Lender Further Action
- Conveyancer Further Action
- Purchaser Advisory
- Passed – No Further Action

These colour signatures are used throughout the report. For the full key, please see the back of the report.

Official Coal Authority Licensed Data: V1_125_20190520_F | 24.05.2019

April 2019 – Update to CON29M

- Re-design to support ease of use.
- Addition of unique **UserKey**, which debuted successfully in the Ground Report. Containing Lender Alert, where adverse mining features have been identified.
- Addition of 'At a Glance' Professional Opinion that answers the key questions for all parties in the transaction.
- Increase of Loss of Value Insurance from £50k to £100k.
- Increase in pass rate (where no additional reports are required) to 99% with the upfront inclusion of the Mine Entry Interpretive Report.



Mine Entry Interpretive Report

This report has been prepared using data licensed to TerraFirma by the Coal Authority at the time produced.

● Mine Entry Information

If you live in a mining area, there is a small risk that your home may be affected by ground movement associated with mine entries.

To identify if your property is within an area of possible ground movement, TerraFirma expertly model the actual or plotted position of the mine entry, its known or assumed diameter, the local geological conditions (including depth to rockhead, rock and soil properties and hydrogeological factors), historical land use and key attributes of the mine entry such as its age and depth. Using official Coal Authority and British Geological Survey data, TerraFirma have calculated a Zone of Influence (ZOI) for each individual mine entry to provide an accurate representation of the risk to your property. More information on how TerraFirma model the risk from mine entries can be found at the back of this report.

In the unlikely event of your property being damaged by coal mining subsidence, you can, under the provisions of the Coal Mining Subsidence Act 1991, make a claim against the mine owner. The mine owner will treat the mine entry and arrange for repairs to the property to be carried out to reasonable satisfaction of the property owner. The mine owner may also be liable to pay compensation for damage to moveable property such as furniture.

Please note – The Coal Mining Subsidence Act 1991 does not cover damage caused by extraction of minerals other than coal. It is recommended that a professional opinion that considers the risk of ground movement associated with non-coal mining and other ground perils is obtained prior to property purchase. For more information, visit: www.understandtheground.co.uk.

Professional Opinion:



The mine entry does not pose a significant risk of ground instability.



The mine entry ZOI does not extend beneath the building footprint.



The mine entry ZOI does not extend beneath the property boundary.

Any insurance given with previous mining reports is applicable to this Mine Entry Interpretive Report.



For any mining or ground related issues please contact the experts at TerraFirma

Call us on: 0330 900 7500
Email our team: info@terrafirmasearch.co.uk



The following mine entry has been identified within 20 metres of the Site:

Mine Entry Reference:

Entry type	Shaft
Mineral extracted	Coal
Source of entry	Coal Authority
Mine entry name	NA
Date abandoned	NA
Depth of shaft (m)	12.3
Diameter of shaft (m)	2
Treatment details	Treated by grouting.
Treatment date	2016
Conveyance	Not sold

This mine entry is shown on the Mining Hazard Map on Page 5.

●● Risk of Instability:

The mine entry is recorded to have been treated in 2016. As the mine entry has been treated recently, it is unlikely that it would cause ground stability issues for the Site in future. In the unlikely event of instability associated with the mine entry, its 'Zone of Influence' has been calculated. This calculation is based on the depth and composition of superficial deposits, and the mine entry diameter. According to the calculation, if in its documented position the potential influence area of the mine entry, should it collapse, could affect the ground stability of the Site grounds/gardens, however, the ground stability beneath the footprint of the existing building* should not be affected.

*location of buildings/structures within Site boundary based on current OS mapping.

●● Next Steps:

The identified mining features are unlikely to impact the value or security of the site for normal lending purposes; however, it is recommended that the prudent purchaser undertakes further assurances to safeguard their investment regarding the stability of the site.

Given the shallow depth of recorded workings beneath the site, it is considered possible that movement in the ground has already occurred. TerraFirma consider it prudent that an appropriate RICS Survey Level-Three Building Survey is acquired for the property in question to assess, amongst other important considerations, the current condition of the property. This report will highlight any subsidence-related defects, which may relate to ground instability associated with shallow coal mining, while also noting any serious or dangerous issues that may require attention. This survey will also include advice on any defects, repairs or maintenance decisions. For further information about

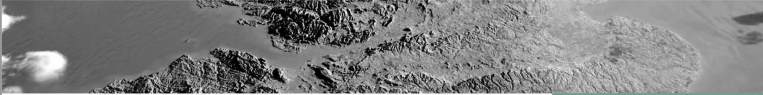


For any mining or ground related issues please contact the experts at TerraFirma

Call us on: 0330 900 7500
Email our team: info@terrafirmasearch.co.uk

Ground Report

TERRA FIRMA



OVERALL RESULT There are no further actions that may hinder the completion of this transaction.

Passed



CON29M COAL MINING

Passed

No further action is required.

Assessment on page 3



ALL OTHER MINING

Passed

No further action is required.

Assessment on Page 6



NATURAL GROUND PERILS

Passed

No further action is required.

Assessment on Page 8



GROUND MOVEMENT

See page 10

Not Identified



RADON

See page 12

Not Identified



OIL AND GAS ACTIVITY

See page 13

Identified



MINERAL PLANNING

See page 14

Not Identified

Address:

Sample Address

Your ref:

Sample ref

TF ref:

Sample ref

Date:

13/08/2018



KEY

Lender – attention required

Conveyancer – further action

Purchaser – prudent advice

No further action

These colour signatures are used throughout the report. For the full key, please see page 16.

It is important to be fully informed of all mining and ground risks associated with a property before completing a purchase. Please read the recommendations on the following pages carefully.



understand the ground



understand the ground



MINERAL PLANNING

See page 14

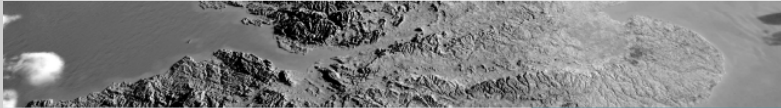
Not Identified



OIL AND GAS ACTIVITY

See page 13

Identified



Ground stability hazards are not known or suspected to have occurred within 250 metres of the Site (property and land). None of the ground hazards outlined below have been identified.

Not identified

No further action is required

Date: XX/XX/2018

Property

<PROPERTY, ADDRESS>

Your Search Reference:

<REFERENCE NUMBER>

TerraFirma Reference:

<TERRAFIRMA REFERENCE>

Past underground mining hazard results

Coal	Not identified
Rare minerals	Not identified
Metalliferous Inc. Tin	Not identified
Clay Inc. China and Ball	Not identified
Building stone Inc. Limestone	Not identified
Evaporates Inc. Cheshire Brine	Not identified

Natural ground hazards results

Running sands	Not identified
Dissolvable rock	Not identified
Collapsible ground	Not identified
Compressible ground	Not identified
Clay shrink/swell subsidence	Not identified
Landslides and slope stability	Not identified

Professional Opinion

Within the scope of this assessment, the Site is not considered to be susceptible to ground instability from natural ground hazards or past underground mining activity. Such hazards are considered unlikely to impact the value or security of the Site for normal lending purposes and there is no reason for them to impact upon the completion of this transaction.

TerraSearch® Assure is provided under the TerraFirma terms and conditions (a copy of which is available on our website). These terms and conditions provide a limit of liability per report of £10 million, backed by Professional Indemnity Insurance.



understand the ground





What does the future look like?

Emerging Risks – What does the future look like?



Coastal Erosion and Flooding



Radioactive gas is slowly killing people in Devon and Cornwall

Radon is responsible for more deaths every year than drink drivers and workplace accidents combined





SHARE      30 SHARES  6 COMMENTS By Max Channon
19 OCT, 18 OCT 2018 | UPDATED 17:03, 18 OCT 2018 NEWS

Enter your postcode for local news and info Enter your postcode 



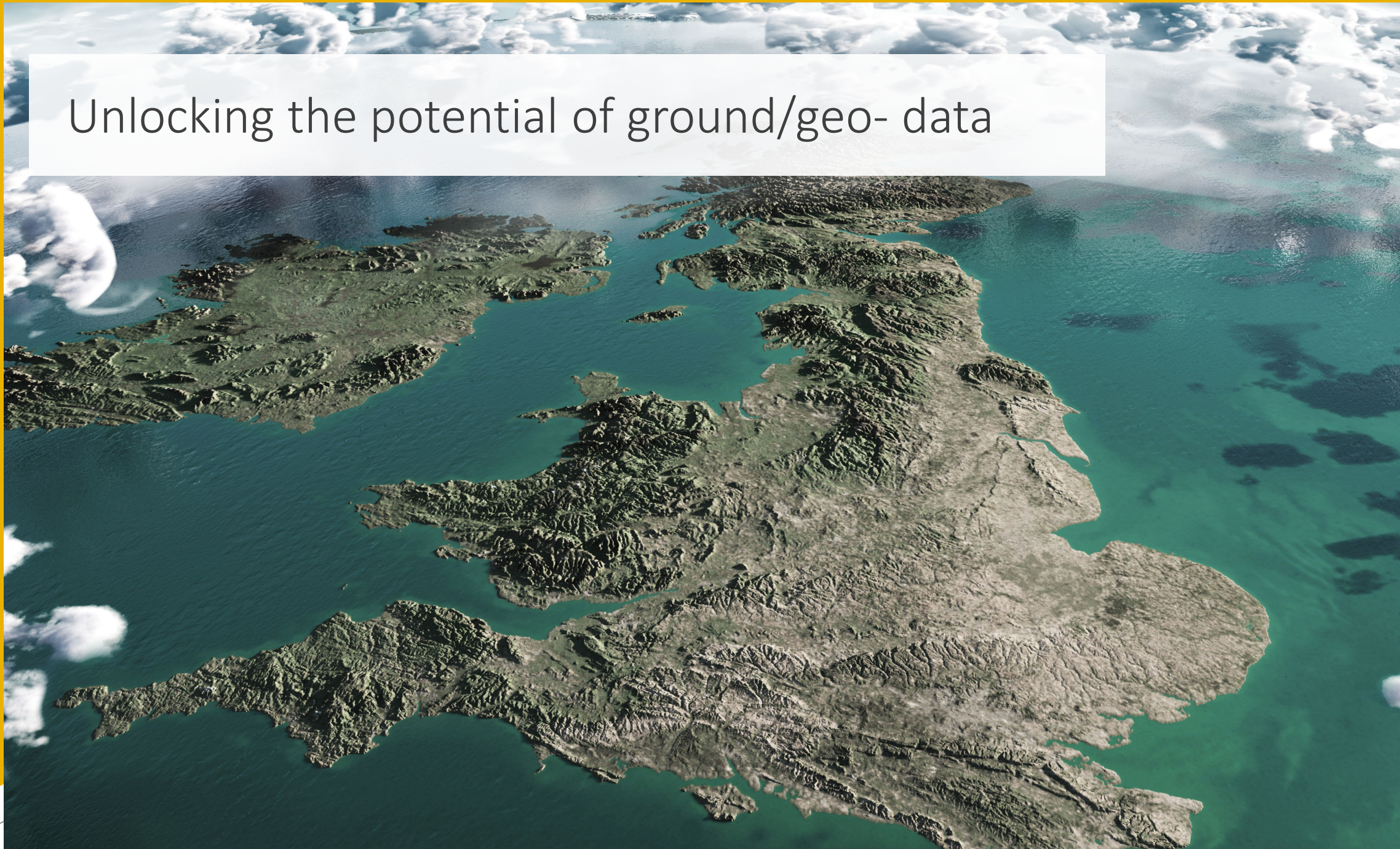
Get Daily updates directly to your inbox

RECOMMENDED

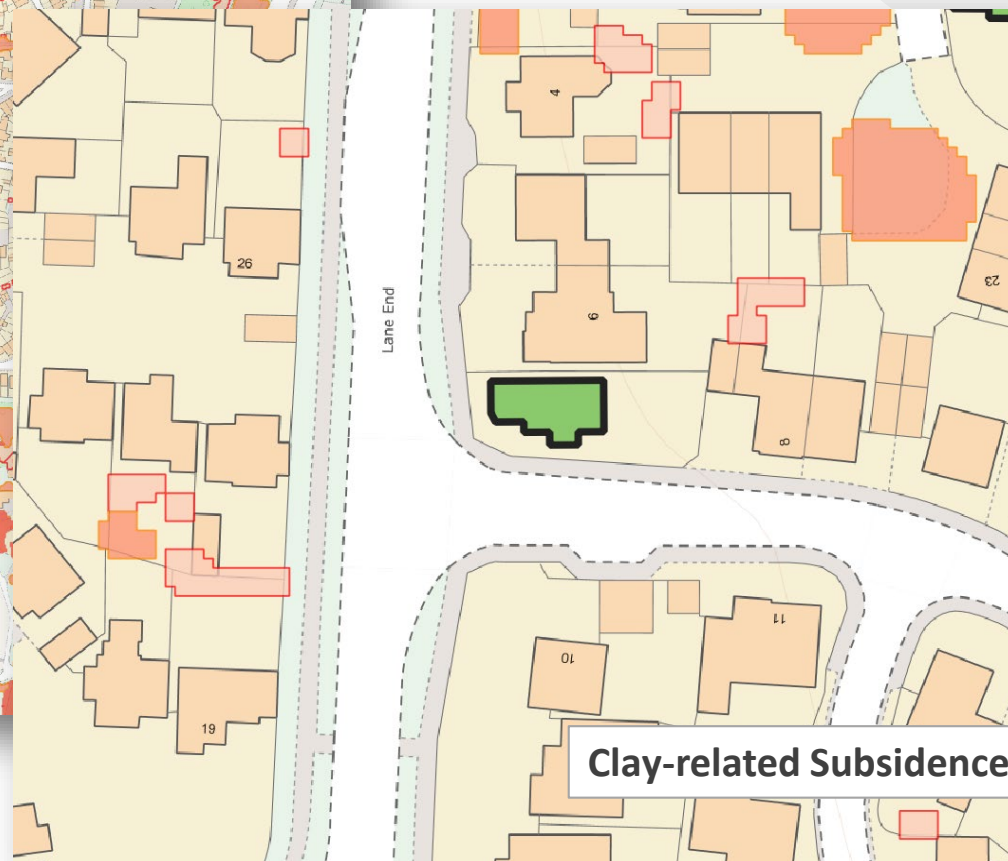
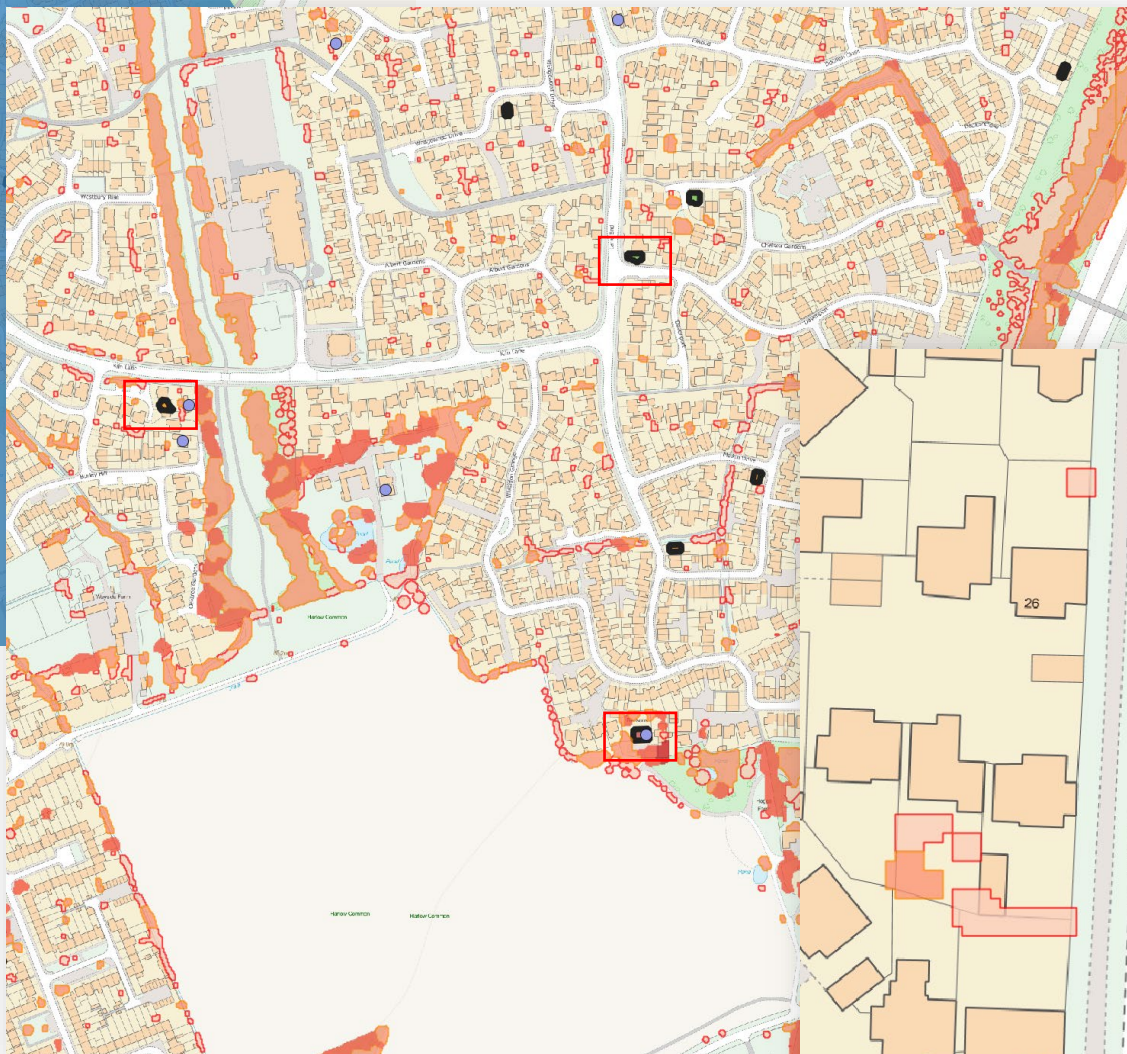
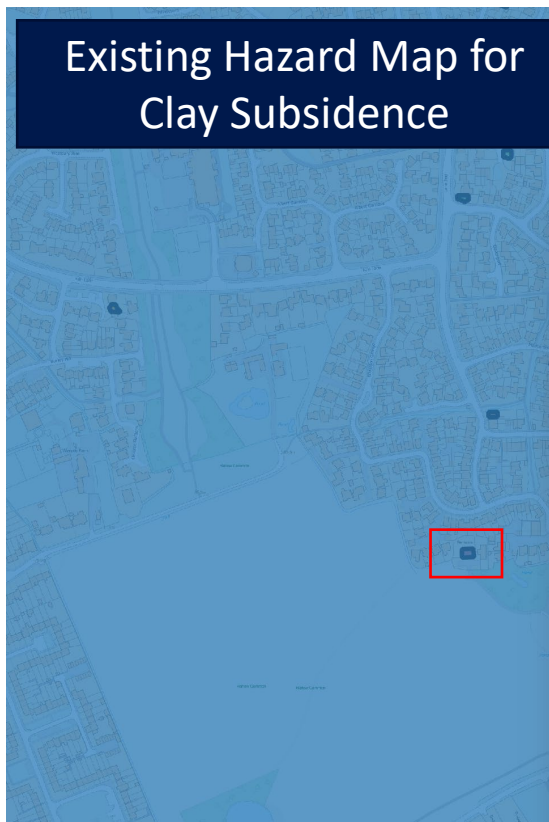
-  Queen's brutal reaction to Charles dating Camilla revealed
-  A30 closed because of police incident at Okehampton
-  McDonalds and Burger King ads banned
-  Concerns raised at Cornwall hospitals after CQC inspection



Unlocking the potential of ground/geo- data



Existing Hazard Map for Clay Subsidence

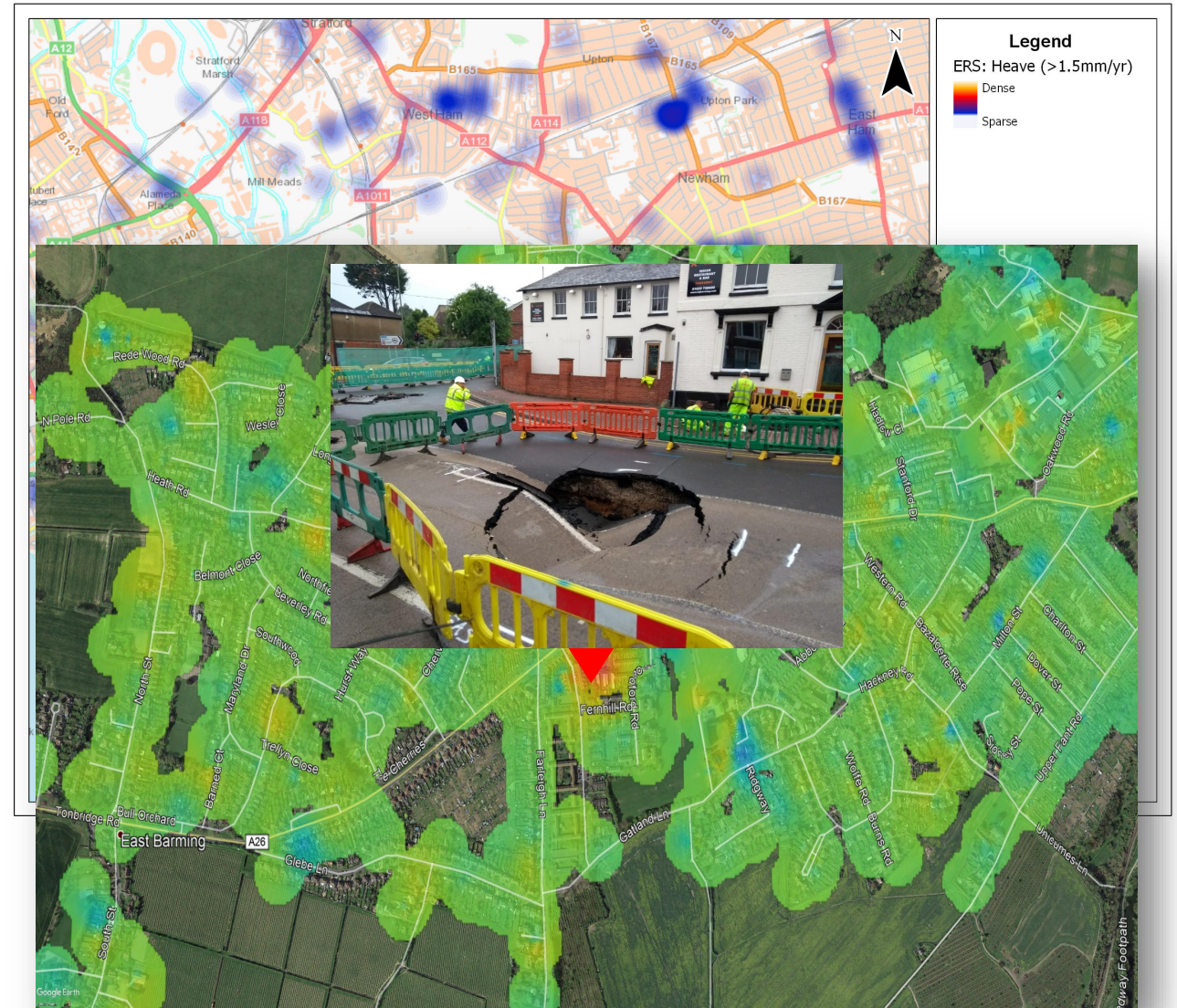
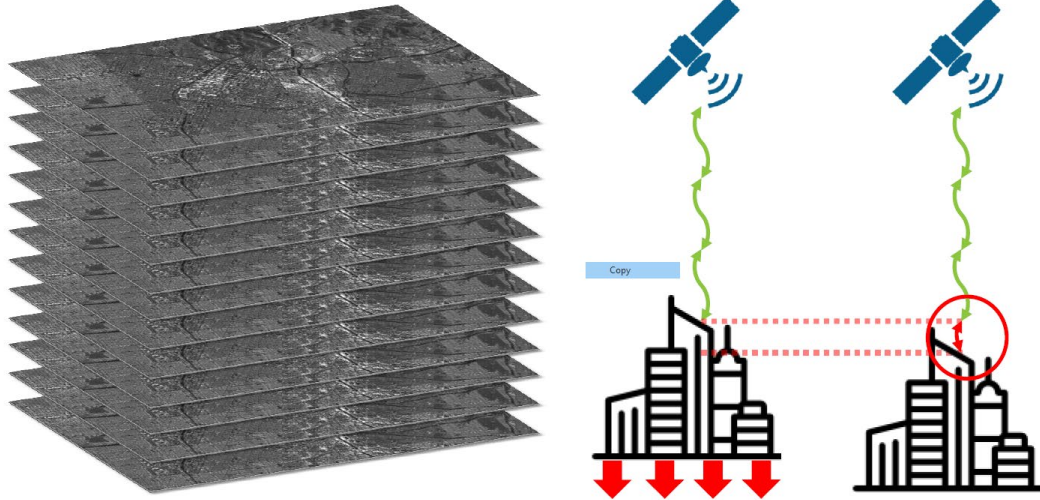


Clay-related Subsidence

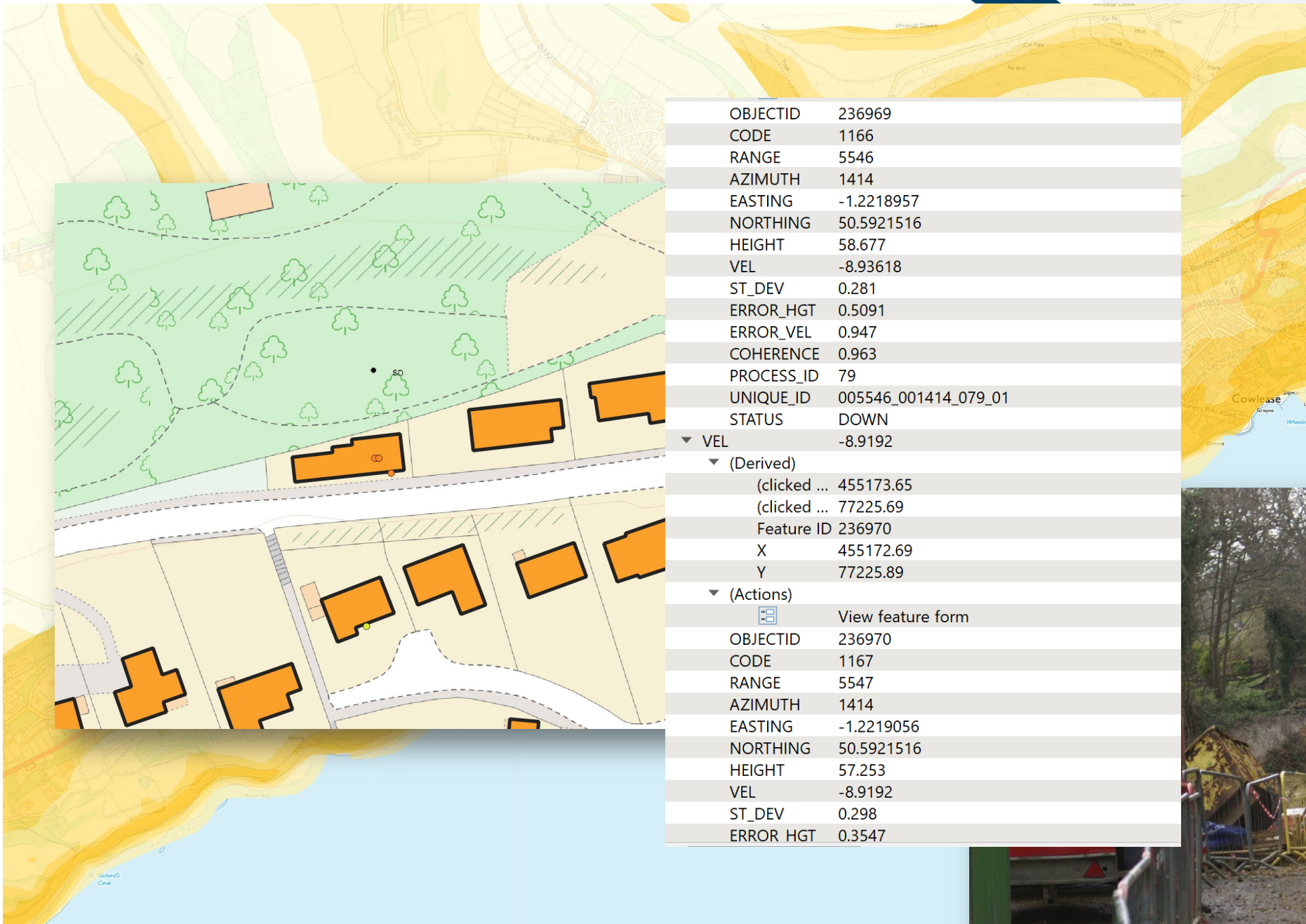
understand the ground

Monitoring the Ground from Space:

- 🌐 'Real time' earth observation and surface deformation satellite data now available from Sentinel-1.
- 🌐 Over 10 million point cloud data points processed and interpreted for the first time in a commercial risk model
- 🌐 Combined with advanced subsidence models from Cranfield and TerraFirma, as well as mining and ground data.
- 🌐 Limitless academic and commercial potential



understand the ground



Isle of Wight Slope Stability

understand the ground



www.terrafirmasearch.co.uk

0330 900 7500

Any Questions?

Terrafirma

Understand the Ground