The Clay Research Group

RESEARCH AREAS

Climate Change ◆ Data Analysis ◆ Electrical Resistivity Tomography
Time Domain Reflectometry ◆ BioSciences ◆ Ground Movement
Soil Testing Techniques ◆ Telemetry ◆ Numerical Modelling
Ground Remediation Techniques ◆ Risk Analysis
Mapping ◆ Software Analysis Tools

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Climate : Telemetry : Clay Soil : BioSciences : GIS & Mapping
Risk Analysis : Ground Remediation : Moisture Change
Data Analysis : Numeric Modelling & Simulations : Software

February 2014

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Issue 105, February 2014

Weather Update

The wettest January since records began according to the Met Office. Inland and coastal flooding with more rainfall predicted.

This has little bearing on subsidence numbers in the summer unfortunately. One might anticipate that with the ground fully saturated, the likelihood of surge diminishes, but this isn't so.

There has been a marked increase in landslip claims, particularly around the coast, and at least one sink hole incident.

On page 7 we see why August is the most dangerous of months for root induced clay shrinkage claims using Met Office anomaly maps.

Future View

This month we take a look at some new technology and link it to available software to see what the future holds.

Will homeowners be carrying out their own detailed surveys using a 'patent applied for' iPhone device using laser technology? Are we all going to be replaced by a clever computer? If so, when?

Google's purchase of DeepMind to bring Artificial Intelligence to the masses must be sending shudders down the spines of subsidence practitioners.

Dates for the Diary

6th February, 2014 – Subsidence Forum Customer Focus Group. Derry Baxter from the FOS will be attending. Agenda will focus around the FCA, Treating Customers fairly and the current thinking of the FOS. We understand the meeting is on despite the planned tube strike

26th June, 2014 – Aston Subsidence Conference. Updates on the EKO soil treatment research, Berent and others matters relating to domestic subsidence.

21st October, 2014 – Subsidence Training Day

Hortlink II Update

A project meeting was held in London last week and progress is being made toards agreeing a project plan. Neil Curling has agreed to provide an update next month.

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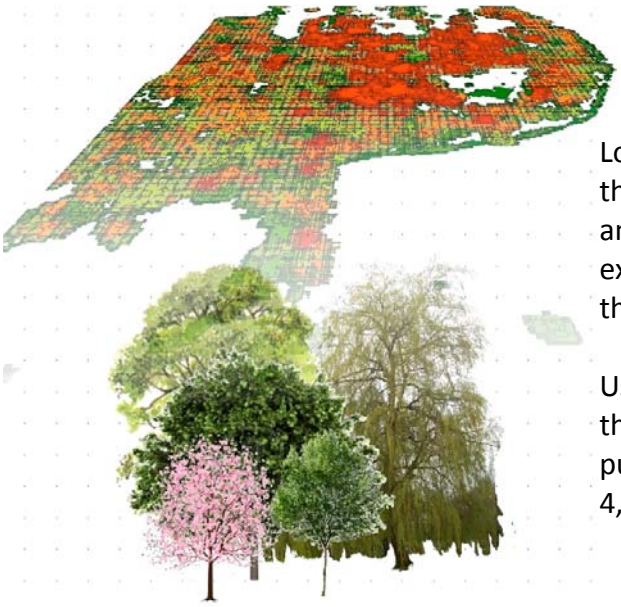


LiDaR Revisited

Islington Tree Canopy

London Government are seeking to increase the area of tree canopy across the Boroughs, and using LiDaR data we have carried out an exercise to estimate coverage in 2005, when the data was gathered.

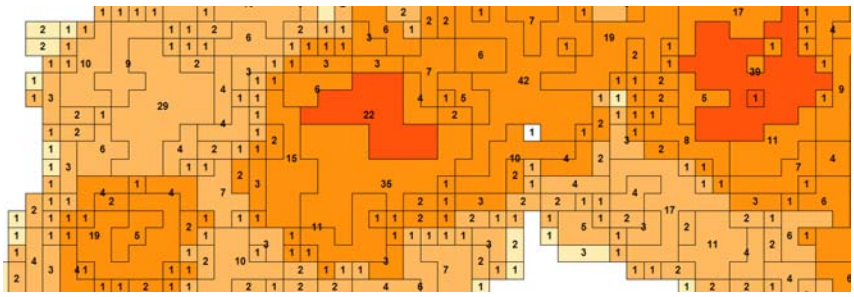
Using Islington as an example, it is estimated that the canopy (including both private and public trees) at that time was just under 4,500,000 sq mtrs.

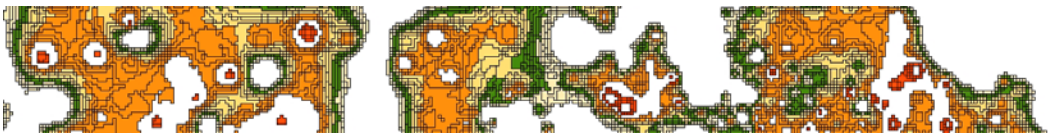
Islington has an area of around 14.8 sq km, suggesting the tree canopy in 2005 covered just under 30% of the Borough.

The exercise is fraught with problems. First, not all vegetation has been included in the survey. Trees less than 4mtrs high and large shrubs were not measured. The mapped canopy only includes the perimeter trees of large groups in parkland and the 1m grid that was used for the exercise leads to small but cumulative errors.

Left, the LiDaR 1m grid superimposed onto aerial imagery to check accuracy. Below, an illustration of the grid with the areas shown, and the heights mapped thematically.

We would be happy to assist any London Boroughs with small scale trials if this exercise adds value to their studies.





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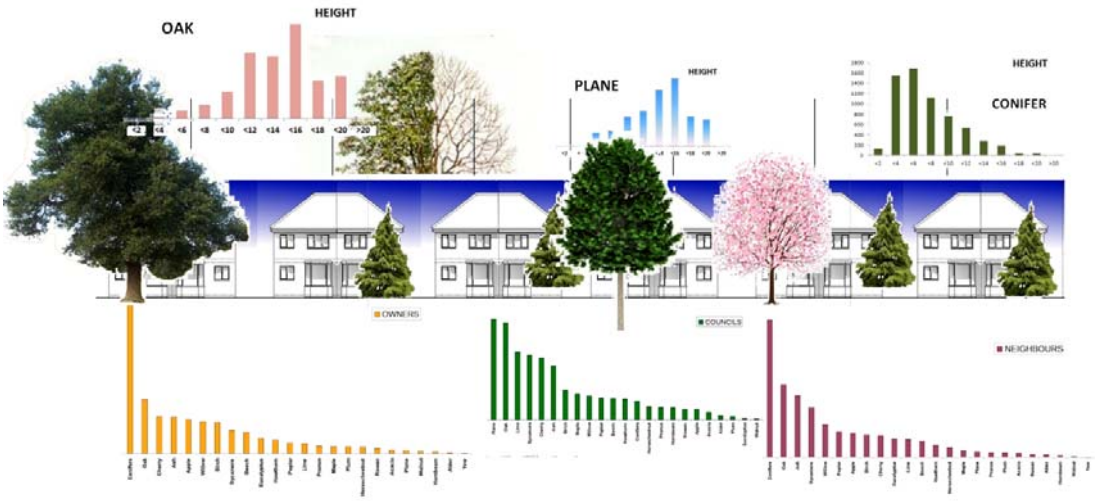
The Average Street Scene



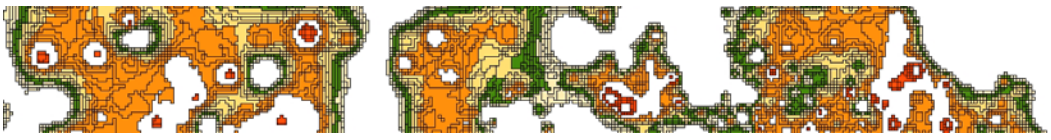
10.48 houses to every street tree and 1.42 houses for every private tree delivers an average street scene as pictured above.

Developing our understanding of risk using tree metrics and species, analytics reveal that the conifer is more dangerous than the silver birch and more importantly, by how much. The graphs surrounding the average scene illustrate the detail. All have appeared in earlier editions.

The data provide a good idea about the risk by height and distance and by ownership, and as important, by season, location and year. We know that risk is a function of the soil Plasticity Index. The higher the shrink/swell potential, the riskier the sector. More important still, we know the relative standing. Conifers are 'x' riskier than the Silver Birch, and we can multiply by 'y' and 'z' to take account of the soil and climate.

The end product is aimed at improving customer service by being better informed. Improved triage, claims handling and risk modelling.

Next month we add other factors. Which parts of the house suffer most, and how this changes (if it does) by peril. Does the location differ if the damage is caused by say drains, rather than trees? Does the age of construction change this? Are side walls riskier than say rear walls, and again, by how much and how does this compare with porches and garages?



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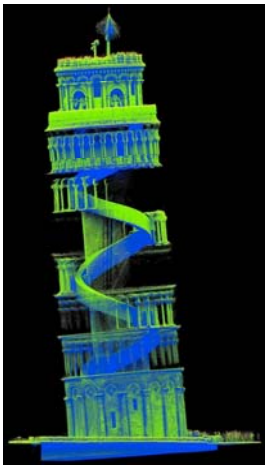
LiDaR Surveys

Zebedee is a handheld 3D mapping system developed by CSIRO, Australia's national science agency, that can scan a building as an operator walks through it.

The system produces a 3D map of the structure as well as an accurate record of the path followed. The sensing technology utilises LiDaR (**Li**ght **D**etection **a**nd **R**anging), in which an infrared laser measures distances to surfaces.



The Leaning Tower of Pisa was surveyed accurately in 20 minutes using the hand held device illustrated.

The scanner sways on a spring to capture millions of detailed measurements as the operator walks through the building. Specialised software then converts the system's laser data into a detailed 3D map.

The survey team took just 20 minutes to complete an entire scan of the Leaning Tower of Pisa's interior using Zebedee. This allowed them to "create a uniquely comprehensive and accurate 3D map of the tower's structure and composition, including small details in the stairs and stonework".

The distinguishing feature of Zebedee's design is that the laser scanner is mounted on a spring, which provides a lightweight solution for ensuring a wide scanning field of view. The spring converts the natural motions of the operator into a suitable sweeping motion of the scanner.

A low-cost inertial sensor provides rough measurements of the spring's rotations. Specially designed software is able to convert the raw range and inertial measurements into a 3D map in less time than it take to collect the data. The 3D maps are represented as point clouds, which consist of millions of points expressed in a common co-ordinate frame. It's easy to see the advantages this would offer when handling domestic subsidence claims. Fast, accurate surveys and even more detailed

How the surveyor might look in five years time. Maybe. Wobbly camera mounted on the obligatory hard hat, rushing through someone's home taking notes as the policyholder tries to keep up.

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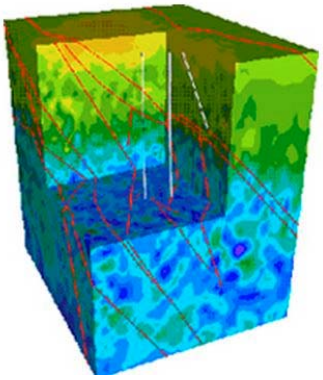
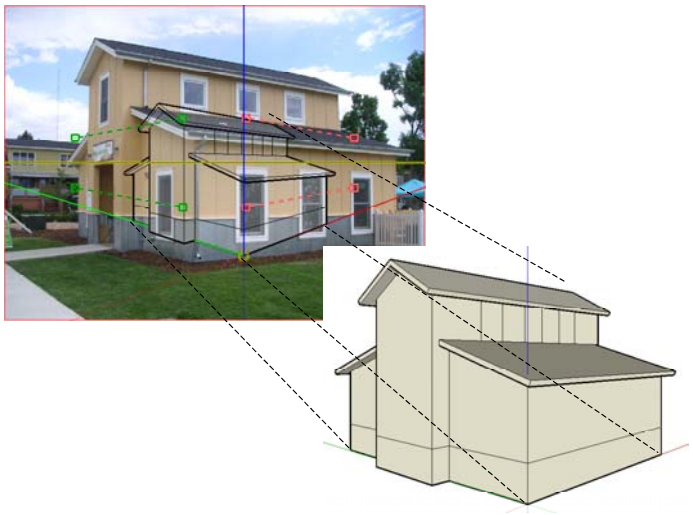
After uploading the survey into the computer, then obtaining the geographic co-ordinates from the smartphone device (see later) the software will associate the building with the underlying geology. A 3D geological dataset is already available from the BGS.



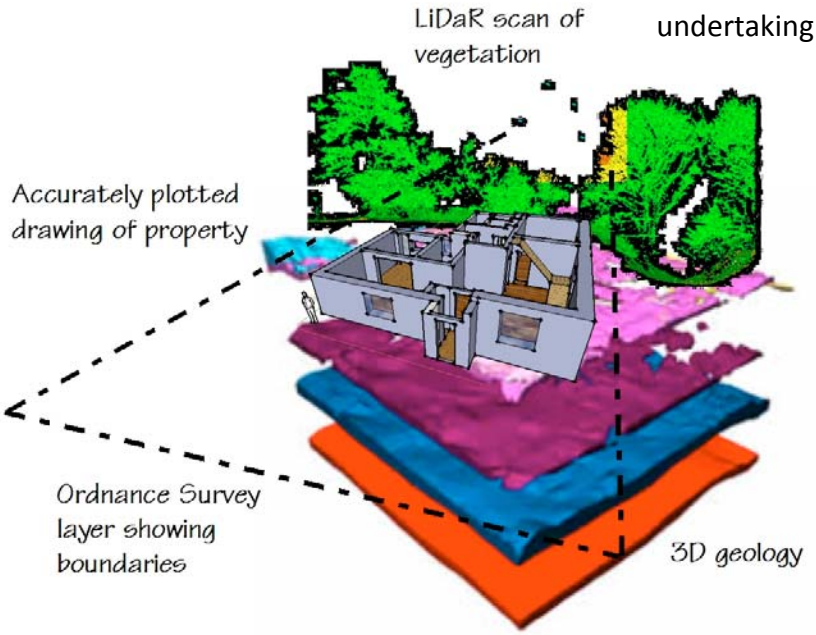
The BGS 'mathematical geology' is already available – see BGS web site for further details.

Sketchup can make 3D models by matching the Google Street View image of the house with the measured survey. Assembling them and adding the surrounding vegetation from the walk-by survey means we have far more detail than we ever thought possible.

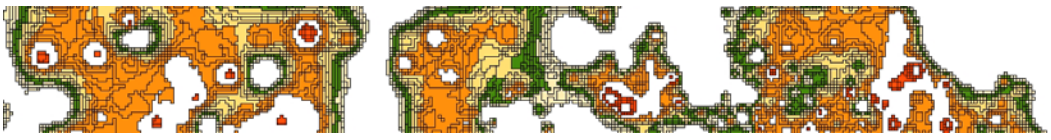


Combining Street View, Sketchup and the LiDaR survey data – sitting them onto the recorded geology and a boundary map from the OS – provides a more comprehensive and accurate picture than we could imagine a few years ago.

Too expensive, or perhaps too high-tech? Browsing the web we see that Apple have a patent application pending for a LiDaR camera to be built in (or added) to the iPhone. A 'must have' for every surveyor. Homeowners will be undertaking their own surveys shortly - perhaps.



Accurate surveys using the iPhone, automatically linked to geographic co-ordinates and a detailed model assembled (left) using Google and Sketchup.



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Soft Ground Cavity

Homes in Upper Street, Leeds near Maidstone in Kent were under threat due to the appearance of a sink hole that appeared in November 2013. The hole was estimated to have a capacity of around 50 cu mtrs.

The cause was thought to be a leaking water main. The four homes affected were evacuated while they are underpinned to prevent any damage. Apparently, soft ground was discovered 16 metres below ground which led to extensive exploratory work being needed.

Extract from 1:625,000 scale British Geological Survey map showing Greensand.

The hole was back-filled with road stone. John Burr, director of highways and transportation at KCC said: "The ground conditions around Leeds are known to exhibit deep localised crevices known as fissures. The ground above is generally quite stable however external factors can trigger a collapse."

Neil Crawford of Crawford & Company is handling the claims for three of the properties and thanks to his colleague, Jeremy Aitchison for the alert.

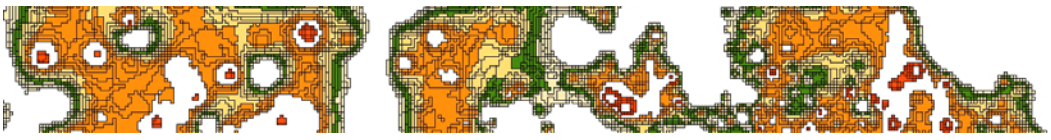
ASTON UNIVERSITY
BIRMINGHAM

26th June, 2014

Speakers this year will be talking on a range of topics. Tom Clinton from Birmingham University will bring us up to date with his work on EKO treatment of clay soils to reduce their shrink/swell properties with the aim of retaining trees.

Anna Madichie from Plexus Law will update us regarding the practical implication of the Robbins decision and Dr. Jon Heuch looks at the methods he uses to determine which tree has caused what damage when there are several nearby.

Richard Rollit challenges our view of the industry and asks "Does Subsidence need Loss Adjusters?". Other speakers to be confirmed.



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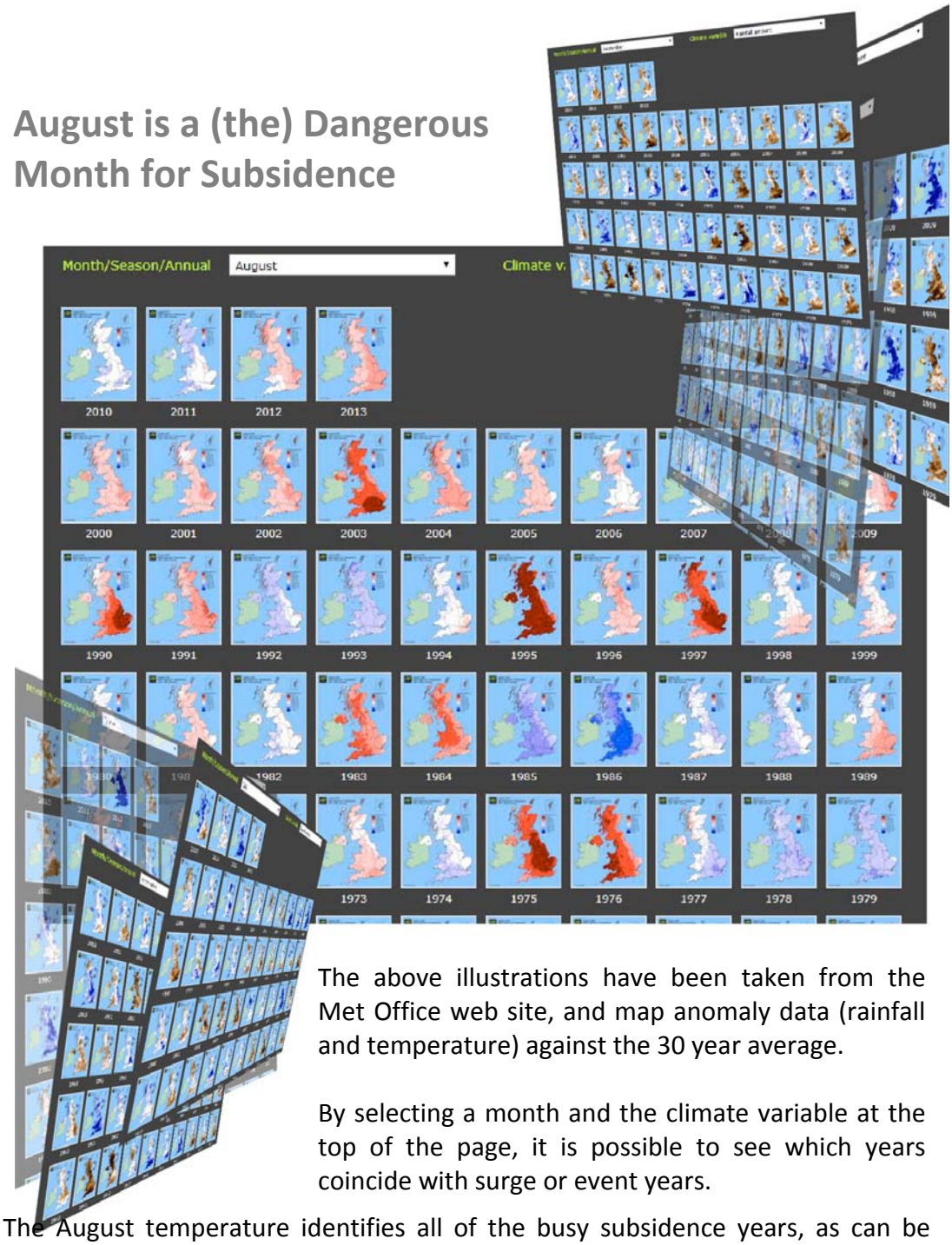
August is a (the) Dangerous Month for Subsidence

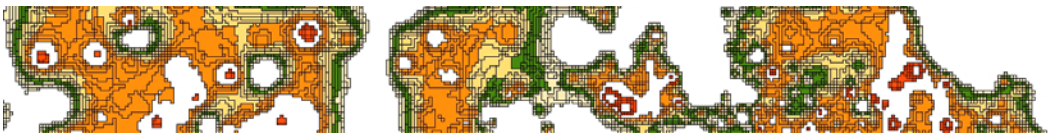


The above illustrations have been taken from the Met Office web site, and map anomaly data (rainfall and temperature) against the 30 year average.

By selecting a month and the climate variable at the top of the page, it is possible to see which years coincide with surge or event years.

The August temperature identifies all of the busy subsidence years, as can be seen above. This won't be a surprise to anyone, but the ease of access and the method of presentation is excellent. The only drawback is the fact that it isn't predictive.

http://www.metoffice.gov.uk/public/weather/climate-anomalies/#?tab=climateAnomalies



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Sink Hole Alert

A 10m deep sink hole, 5 mtrs across, opened up in Walters Ash, Buckinghamshire earlier in the week.

The problem lies in old excavations for clay and chalk - the BGS geology shows clay with flints overlying chalk. The collapse has almost certainly been exacerbated by the recent record rainfall.

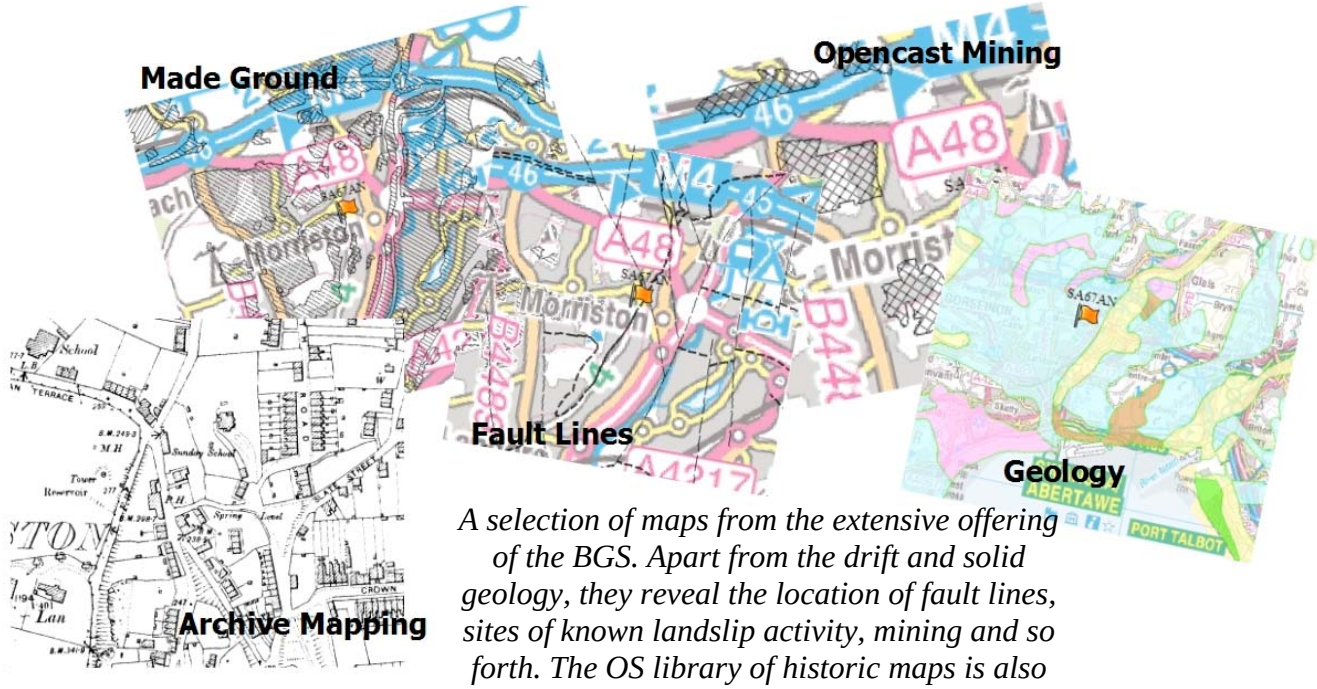
We understand there is no damage to the bungalow at the moment (although the FOS have pointed out that 'damage = loss of value'), but its foundations have been exposed within the hole as can be seen left.

Apparently the hole consumed a car.

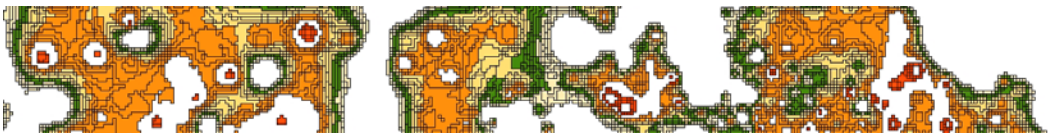
In a recent episode of Horizon on BBC2, Prof. Iain Stewart informed viewers that there were, on average, 6,700 reported sink holes in Florida every year.

The program described how sink holes are formed and the geological imperative of a mixture of sand and clay overlying chalk, with acidic water acting as a catalyst.

BGS maps have been useful on other wet-weather claims that we have seen recently, combined with historic OS mapping.



A selection of maps from the extensive offering of the BGS. Apart from the drift and solid geology, they reveal the location of fault lines, sites of known landslip activity, mining and so forth. The OS library of historic maps is also invaluable.



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Sink Hole Geology

A large scale extract from the BGS map of the geology in the location of the sink hole (green dot) referred to on the previous page, showing clay with flints overlying chalk.

In the Press

A homeowner in Peterborough took it on himself to arrange for the horse chestnut tree in front of his house to be pruned to allow a better view. It was the subject of a TPO. The homeowner was fined £1,000.

Older Trees Are Growing Faster, Storing More Carbon as They Age

N. L. Stephenson *et al.,*
"Rate of tree carbon accumulation increases continuously with tree size."
Nature, 2014

Contrary to current thinking, teams of researchers have provided evidence to suggest that older trees grow faster and sequester more carbon than their younger counterparts.

In a letter published in the journal Nature, an international research group reports that 97 percent of 403 tropical and temperate species grow more quickly the older they get.

The researchers reviewed records from studies on six continents. Their conclusions are based on repeated measurements of 673,046 individual trees, some going back more than 80 years.

Extraordinary growth of some species, such as Australian mountain ash - also known as eucalyptus - (Eucalyptus regnans), and the coast redwood (Sequoia sempervirens) is not limited to a few species, the researchers said.

"Rather, rapid growth in giant trees is the global norm and can exceed 600 kg (1,300 pounds) per year in the largest individuals," they wrote.

"In human terms, it is as if our growth just keeps accelerating after adolescence, instead of slowing down," said Stephenson. "By that measure, humans could weigh half a ton by middle age, and well over a ton at retirement."