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

August 2014
Edition 111

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Issue 111, August 2014

Funding Required

Replacement Weather Station

The weather station donated by Marishal Thompson has expired and funding is required to replace it with a new one that can hopefully deliver data using telemetry or some form of text messaging.

The data is an important part of Tom Clinton's PhD work on the EKO project, but is also central to much of our work in reporting on weather patterns.

We have a detailed quotation from Tempcon. If anyone feels able to help please contact us as the E-mail address below.

Aldenham Update

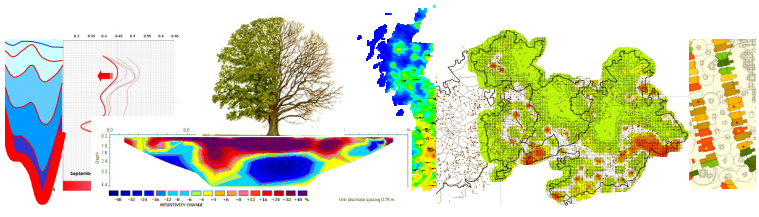
Aldenham School have generously agreed to allow field trials of the EKO technique to be undertaken at their 100 acre site in North London.

They have hosted various projects since 2006 and these have included long-term monitoring of the willow and oak using a variety of techniques. Subsidence Management Solutions (formerly InFront Innovation) are the primary sponsors, funding the work of the CRG and contributing towards the PhD costs of Glenda Jones' (Keele University) work on Electrical Resistivity Tomography (ERT). Ground movement has been measured over the duration of the project, sponsored by Crawford & Company.

Southampton University funded their own research measuring moisture change over time using the neutron probe. This was linked to the ground movement measurements obtained using precise levels.

In addition, site investigations and soil testing were undertaken using a variety of techniques, and funded by MatLab Limited. We now have data linking moisture change to ground movement, and comparisons with a range of site investigation methods and sampling techniques.

The next phase will be the field trials of the electrokinesis osmosis (EKO) research outlined at Aston over the last few years. Tom Clinton, the PhD student from Birmingham University, is arranging field trials involving dummy foundations and load frames within influencing distance of the willow tree prior to treating the ground and measuring the outcome. This work is part funded by Foundation Piling Limited.



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Aston Conference Feedback

One colleague took issue with Richard Rollit's suggestion that insurers paying for tree removal was a good thing, pointing out that mitigation was for the homeowner.

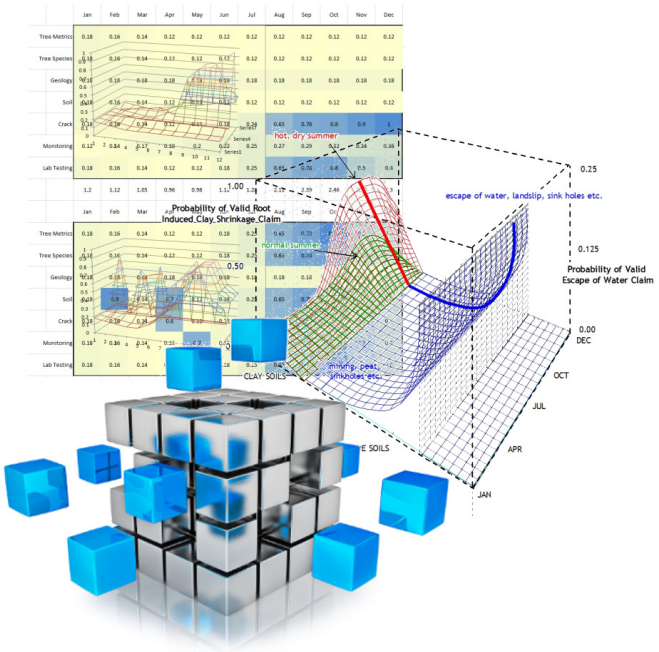
The enquirer pointed out that on burst pipe claims the policy is clear and implementation agreed across the industry. Insurers do not pay to repair the pipe. The policy covers the cost of making good the damage that was caused by the leak. Extending the tree argument, is it the case that the FOS would support a move towards this cost being covered as well?

Our colleague thought that the ABI took the view that the cost of tree surgery fell squarely in the homeowner's lap, whereas the FOS supported the idea that meeting the cost could be cheaper than the alternative of underpinning and could speed claim settlement.

In response, Richard explained that an informal survey of insurers that handle around 60% of subsidence claims suggested that nearly all pay for tree removal where the tree was the cause of damage. They didn't pay for maintenance or preventative work. Some also paid for drainage repairs.

Some good news. Tony Boobier has provided access to the IBM OLAP cube – a system similar to our own probability cube, but with greater scope for analysis. We look forward to exploring its potential over the coming months. OLAP stands for **O**n**L**ine **A**nalytic **P**rocessing.

Both cubes (IBM and CRG) take account of spatial as well as periodic data. This means that they can account for borehole depths for example, as well as monitoring data gathered over time.

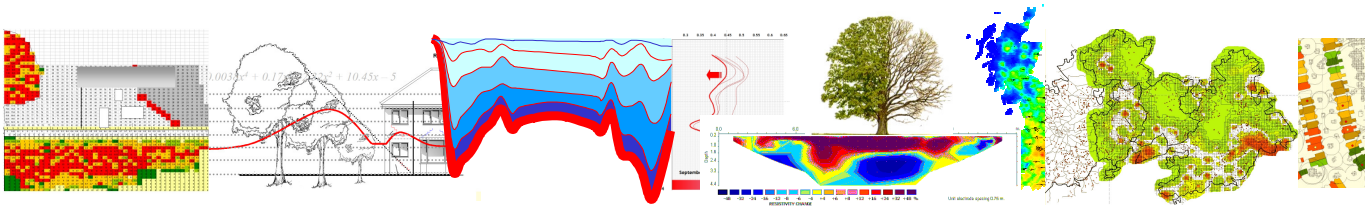


The image above traces the development of the models. Top left, the 'flat' Excel file uses correlation techniques to match profiles using individual applications.

Centre right, the CRG model as it stands today, showing profiles for all claims (clay shrinkage, escape of water, landslip etc.) by location and by month.

Bottom left a diagrammatic view of the advanced and more sophisticated OLAP cube.

More on this in coming months hopefully but it fits very well with the theme on the following page.



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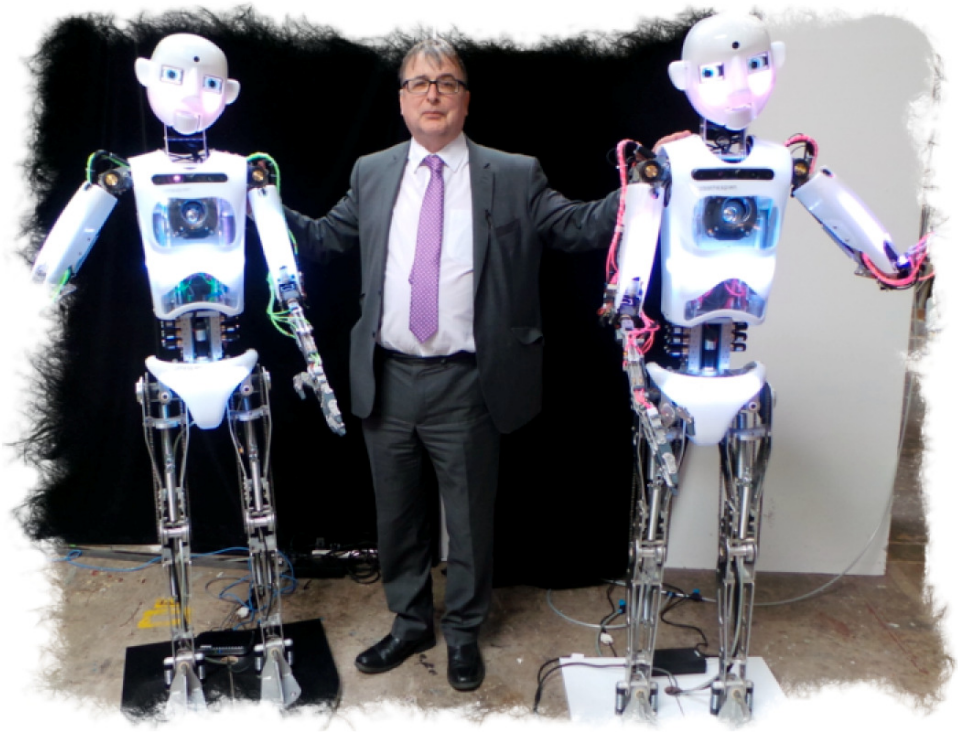
Aston Conference Feedback - 2

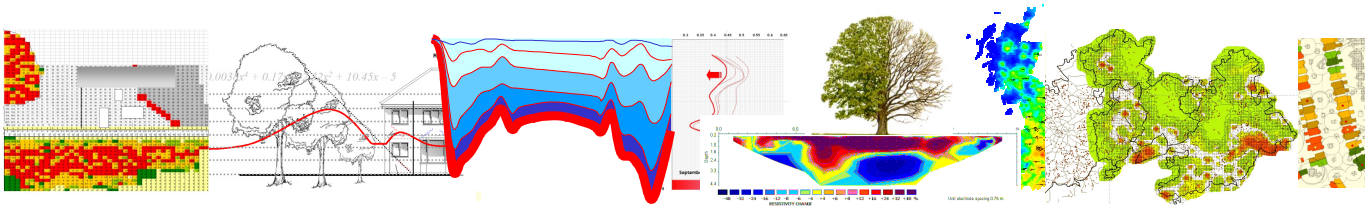
Much of the conference this year was directed towards business changes and developments rather than the operational and practical issues of how we test soils, diagnose subsidence or monitor buildings.

Tony Boobier from IBM provided clear guidance. We have to measure more, understand the output and take appropriate action. The future lies in cognitive developments. Refining systems and developing skills to anticipate and learn from what has gone before.



Paul Stanley has spent many years anticipating change and outlining what the future might look like. Unfortunately his two assistants who we believe are named Boris and Doris (they are actually robots but it would be impolite to point this out – Boris is on the right by the way) were unable to make the conference.

No, Paul does not propose deploying them to handle claims. He sees a unique opportunity that looks at another aspect of the business. Recognising a changing market, the robots may turn up in the most unexpected of places. More to come no doubt.



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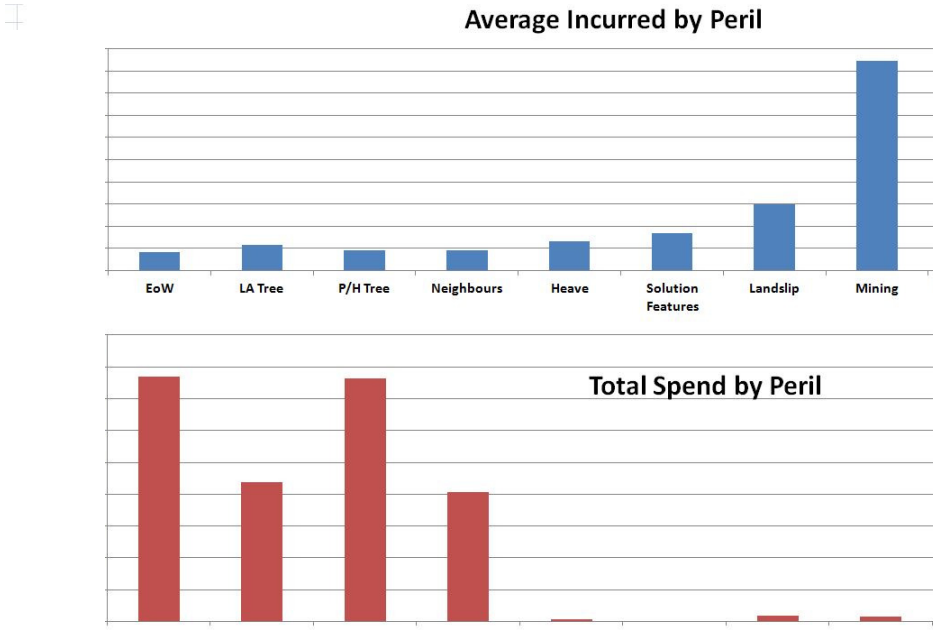
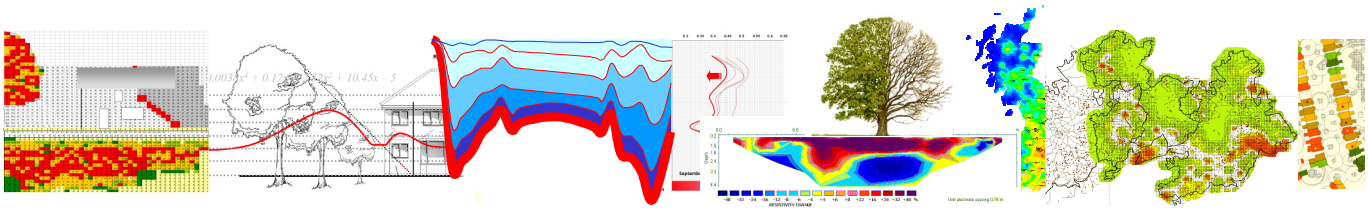
Spend by Peril – Average and Gross Figures

An overview of where the money goes, by peril. Top, the average claim cost by cause, including escape of water (EoW), trees (by owner), heave, solution features, landslip and mining. Not surprising perhaps to see landslip and mining at the top of the league, although recoveries would hopefully reduce the eventual cost of mining claims.



Graph of 'spend by peril' showing average incurred cost of individual claims (top)and the gross cost of the portfolio. Sample size around 30,000 claims. Values omitted for commercial reasons. The exercise is to determine relative standing.

The total spend by peril puts the various causes into perspective. If the root induced clay shrinkage claims are combined, ignoring ownership their predominance is overwhelming. Whilst individually mining claims are expensive, in the scheme of things they are of far less consequence than the routine cases of leaking drains and clay shrinkage.



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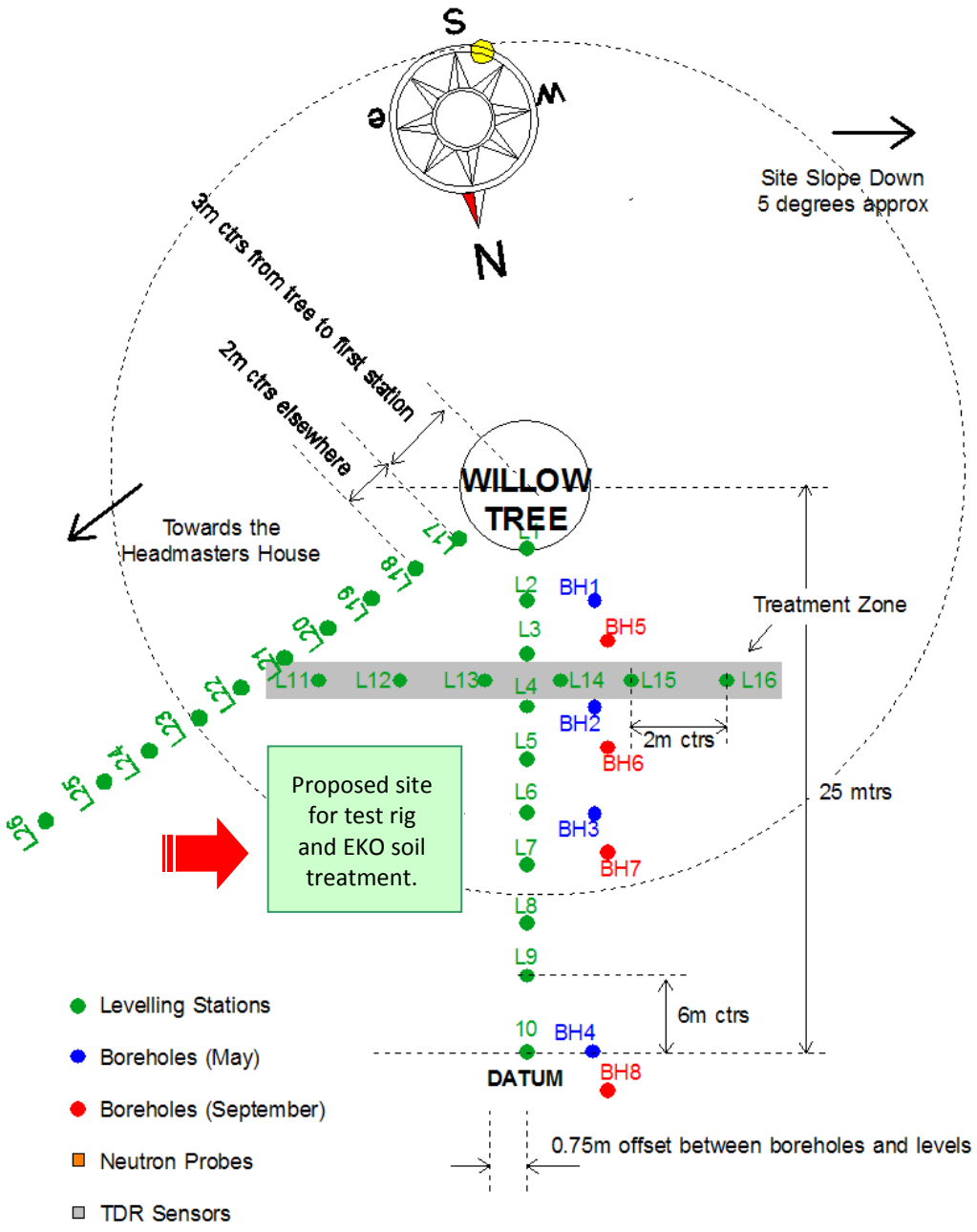
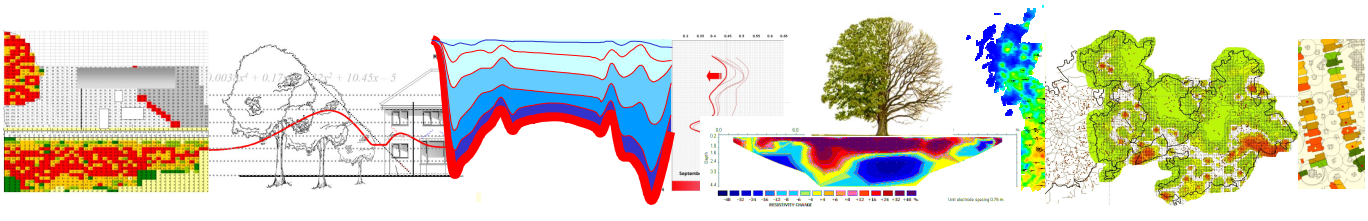
Test Site for EKO Treatment – Aldenham Willow



A load frame is to be installed on site at the above location (indicated by a red arrow), between the two levelling arrays. See following pages for details.



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EKO Field Trials - Introduction

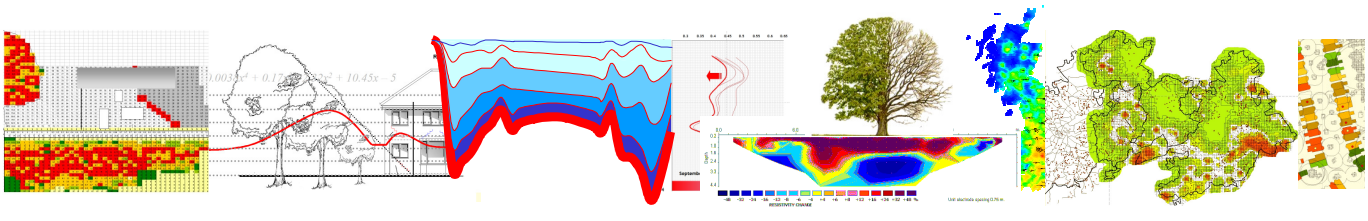
Although the treatment of soils by passing an electrical charge between two electrodes isn't new, it has been predominantly used as a device to de-water and increase the shear strength of a weak soil. However, both run counter to the situation we meet when investigating claims for root induced clay shrinkage.

In such cases, the shear strength is almost inevitably adequate to begin with and has been increased further as a result of root activity. Also, more water is needed, not less. An earlier study undertaken at Birmingham University reported "The electrokinetic processes reportedly cause a decrease in the water content and an acceleration of consolidation of the clay, an increase in the plastic limit, an increase in the shear strength of the clay and formation of insoluble salts in the clay."

Recent meeting at Aldenham to discuss the project and agree procedures. A further meeting is to be held shortly when the apparatus is in place, and we welcome hearing from anyone who would like to attend.

The ideal outcome of the present study would be the opposite – to resolve root induced clay subsidence the treatment needs (a) to rehydrate the soil to raise the building back to its original position and then (b) 'fix' the soil by reducing the shrink/swell properties.

Tom proposes an initial trial period of 6 months, possibly extended depending on the results.



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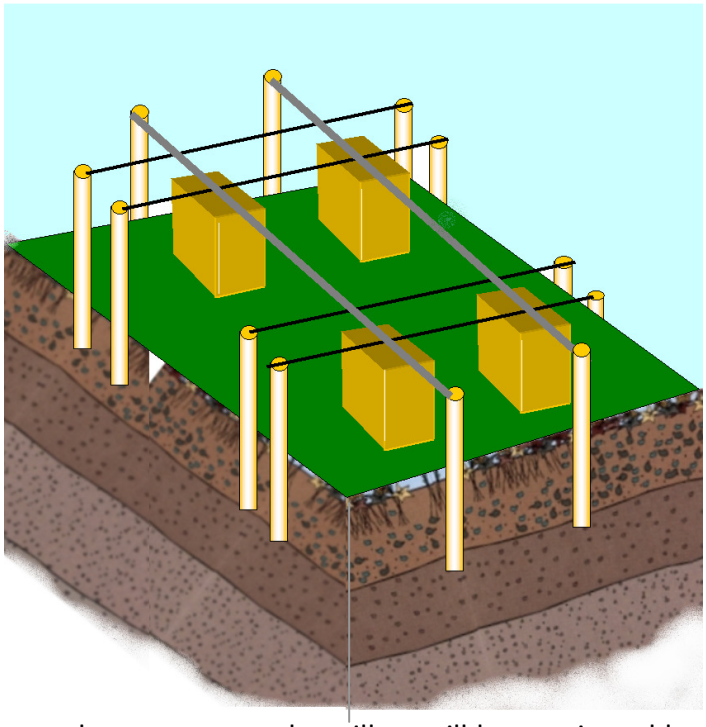
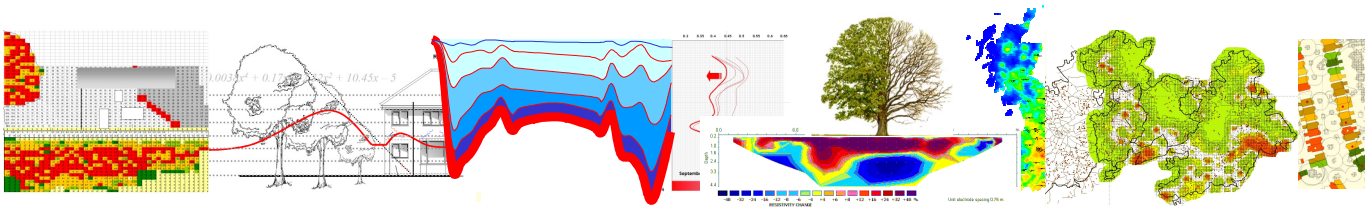
The work at the Aldenham site will involve the construction of a load frame and dummy foundations as outlined below. Four concrete strip footings (600 x 600 x 1500mm long) will be placed on the ground and a load frame constructed as shown below.

Tom Clinton describes the work as follows. “The load will be provided by hydraulic jacks mounted on a loading frame that is anchored into the ground with mini friction piles. A reference frame will be positioned over the ends of the concrete beams to hold displacement gauges to assess any movement of the beams during the process.” The imposed load from the jacks will replicate a typical house loading (40kN/m).

In addition to precise levels and displacement gauges, the effects of the treatment process on the ground moisture content will be monitored at regular intervals by Dr. Nigel Cassidy of Keele University, using the existing resistivity arrays already in place and the addition of temporary arrays around each experiment.



Effects of the ground treatment on the willow will be monitored by Dr. Jon Heuch of Duramen Consulting. Tree stress will be measured before, during and after treatment via visual examination and chlorophyll fluorescence techniques. See following page.



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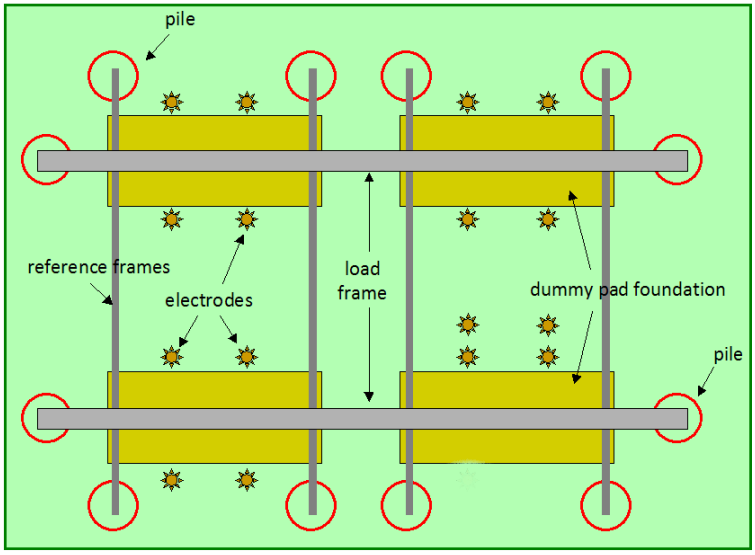
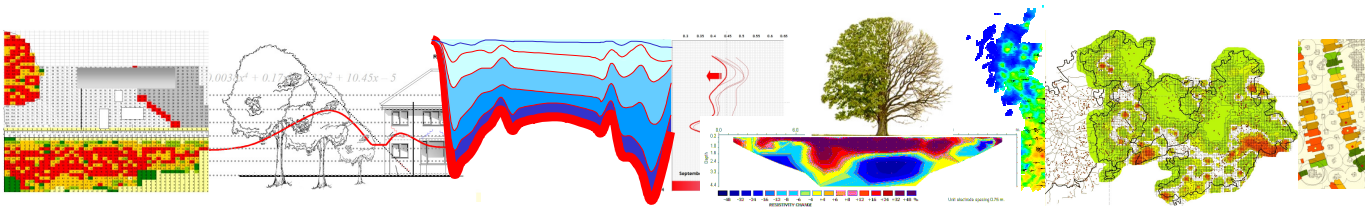
A view looking up into the crown of the willow (left) showing lots of dead wood tangled in the branches. Right, Jon, Richard and Allan discussing the procedure to assess the tree's response to ground treatment.

Treatment will consist of the introduction of electrodes either side of the dummy concrete foundations. This experiment will take two forms. First, electrodes will be placed vertically either side of the concrete pads and second, both will be inserted from the same side (replicating the introduction from outside a domestic property), one vertical and the other at an angle, following the laboratory trials illustrated in the previous edition.



A preliminary and diagrammatic illustration of the proposed apparatus. Four concrete pads will rest onto the shrinkable clay soil, within influencing distance of the Aldenham willow. The ground beneath the pads will be treated and movement monitored using levels and pressure devices.



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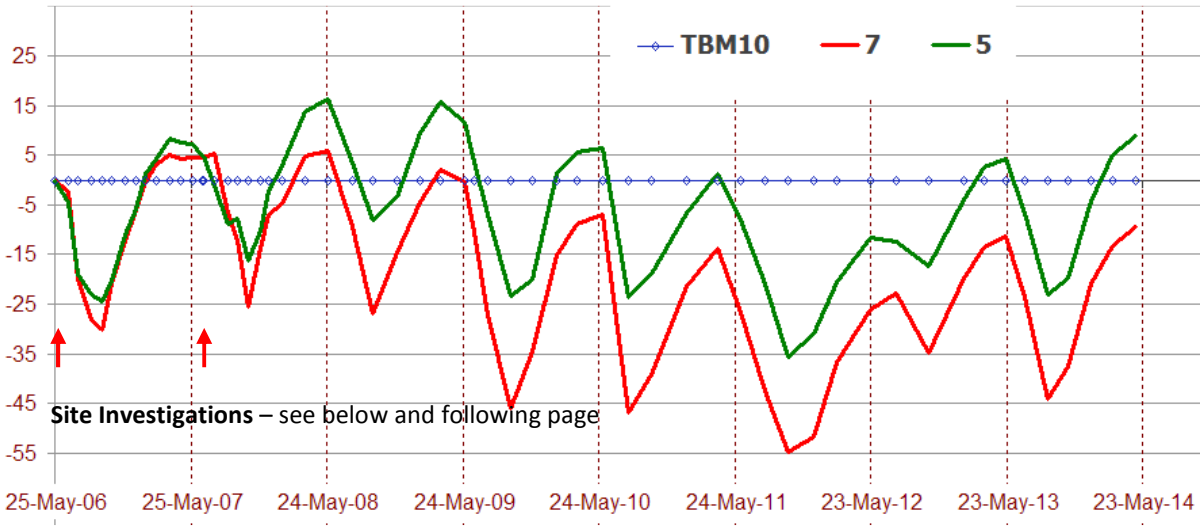
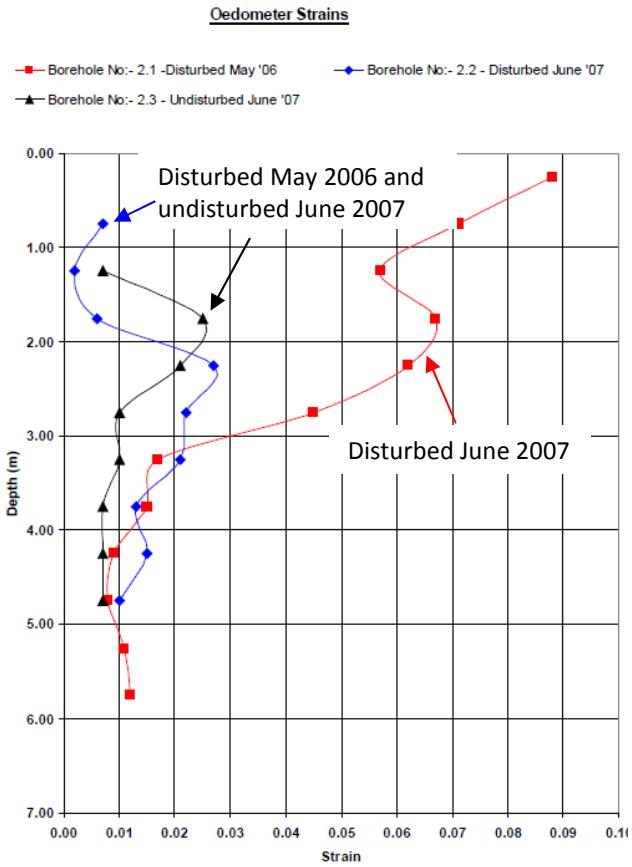
Precise Levels near to EKO Treatment Zone



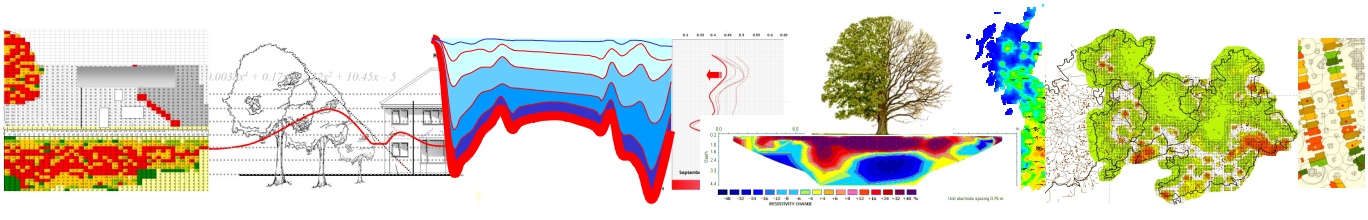


Strains and Levels

Above, precise levelling data from the vicinity of the proposed EKO test zone showing seasonal movement in relation to the dates of site investigations undertaken in May 2006 and June 2007.

Left, oedometer test results from boreholes sunk between 8 - 10mtrs from the willow.

Desiccation extended to a depth of around 3 – 3.5mtrs bGL. Estimates of heave varied depending on the date of the investigations, sample disturbance and test method. See following page.



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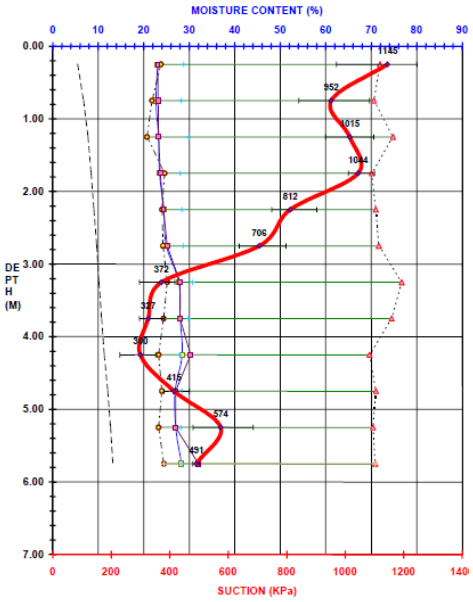
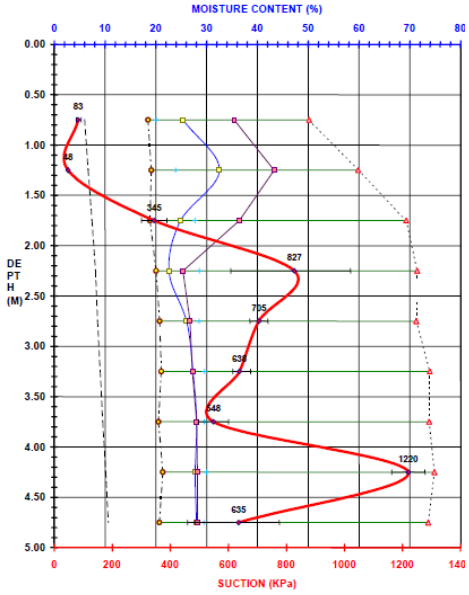
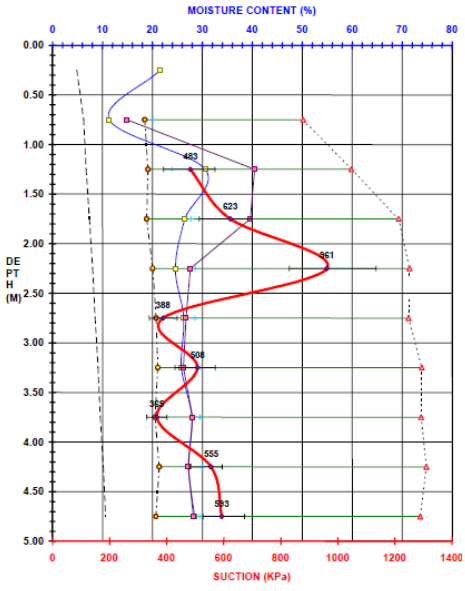
Investigations, Soil Testing and Estimates of Heave Undertaken on the dates indicated and in the vicinity of EKO Treatment Zone



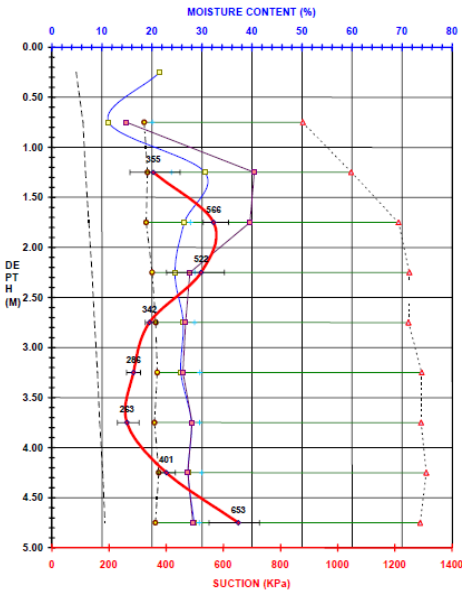
Disturbed May 2006
Estimated Swell = 89mm



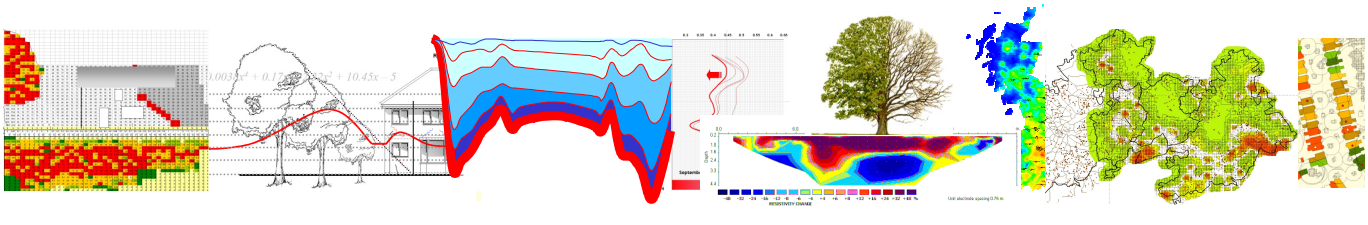
Disturbed June 2007
Estimated Swell = 57mm



Undisturbed June 2007
Estimated Swell = 63mm
New Filter Batch



Undisturbed June 2007
Estimated Swell = 48mm



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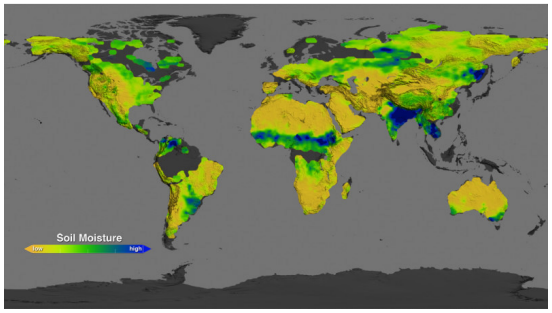
Global Soil Moisture Map

Based on materials provided by NASA/Goddard Space Flight Center as reported in Daily Science, July 2014

The Aquarius satellite is mapping soil moisture content using microwave radiometery. Soils naturally radiate microwaves and the Aquarius sensor can detect the microwave signal from the top 50 millimetres of the land.

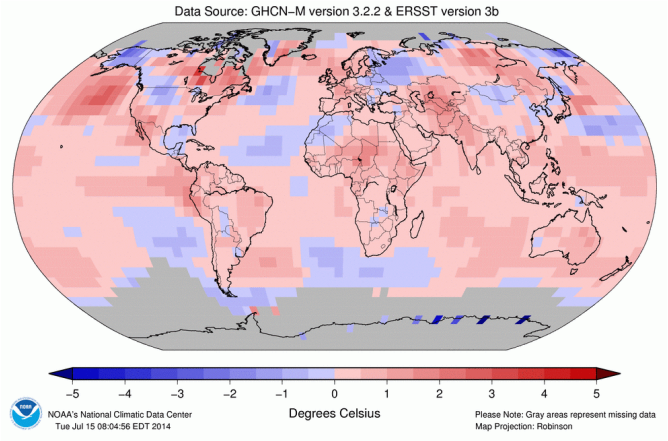


It doesn't have the resolution of the forthcoming NASA Soil Moisture Active Passive (SMAP) mission, but is of use to crop growers around the world. The planned SMAP data has a spatial resolution 10 times that offered by Aquarius.

NOAA Update

Taken from the National Oceanic and Atmospheric Administration web site. www.ncdc.noaa.gov

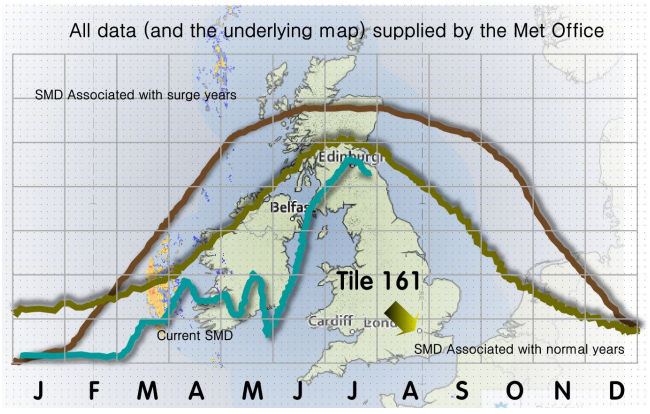
NOAA report that "the June temperature for the United Kingdom tied with 2010 as the ninth warmest June since records began in 1910, at 1.2°C (2.2°F) above the 1981–2010 average."



Temperature change for June 2014 in relation to the 30 year average. Taken from NOAA web site.

The UK Met Office report June as having below average rainfall – across the UK, the rainfall was 76% of the average for this time of year. In contrast, they report an increase in hours of sunshine – 109% of the national average.

These figures are reflected in the steep incline of the SMD for tile 161 as we see below.



It may have peaked a little early to deliver large claim numbers. 2006 was 134mm deficit and the current reading has fallen to 95mm.