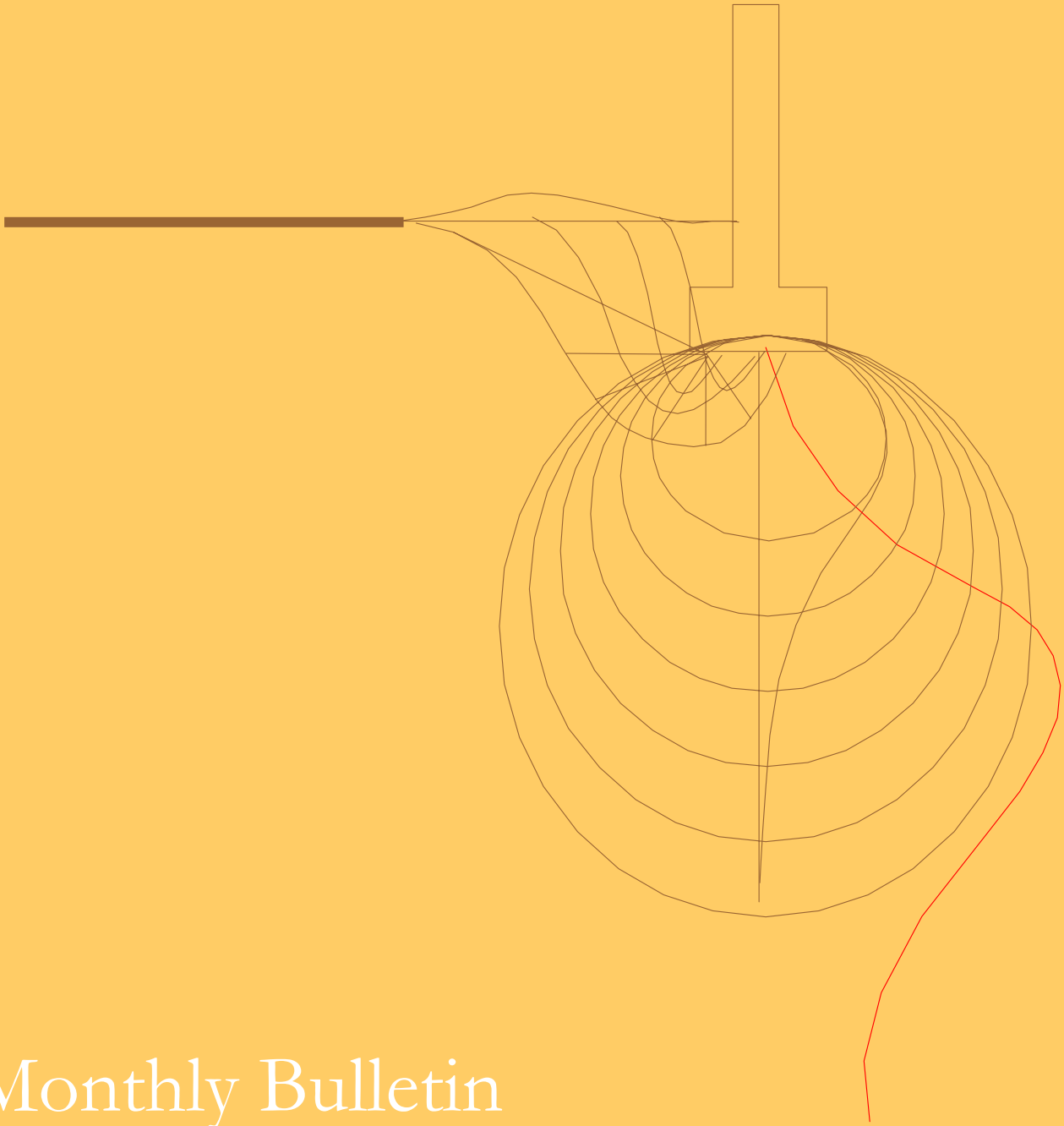
The Clay Research Group



Monthly Bulletin

Modelling – taking account of the site

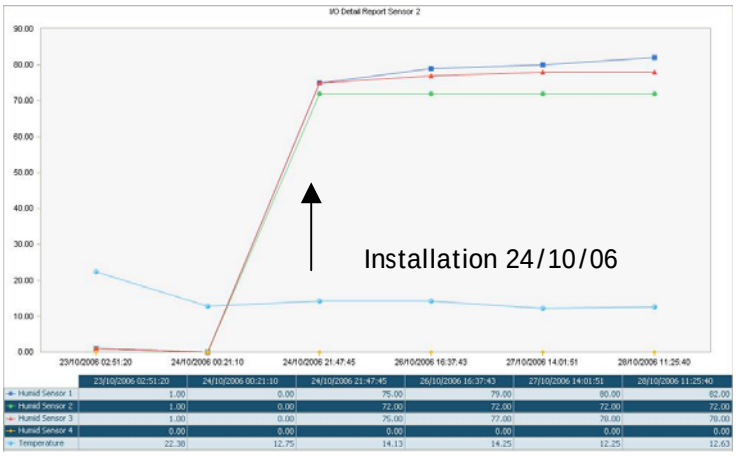
October 2006.

CONTENTS

TDR Sensors

The TDR sensors were installed on the 24th October 2006.

The installation comprises 3 moisture and 1 temperature sensor. The latter is incorporated within the datalogger, and records the ground temperature. The final location was determined by the need to avoid the football pitches.

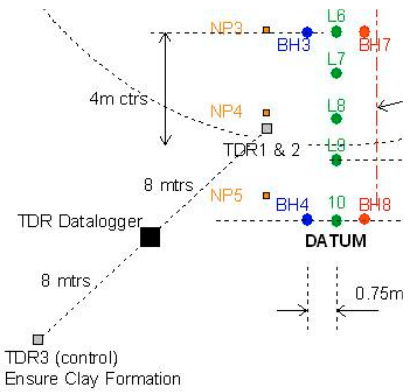


	23/10/2006 02:51:20	24/10/2006 00:21:10	24/10/2006 21:47:45	26/10/2006 16:37:43	27/10/2006 14:01:51	28/10/2006 11:25:40
Humid Sensor 1	1.00	0.00	75.00	79.00	80.00	82.00
Humid Sensor 2	1.00	0.00	72.00	72.00	72.00	72.00
Humid Sensor 3	1.00	0.00	75.00	77.00	78.00	78.00
Humid Sensor 4	0.00	0.00	0.00	0.00	0.00	0.00
Temperature	22.38	12.75	14.13	14.25	12.25	12.63

Bentonite was used to seal around the probes. They were installed at an angle of around 20 degrees. Cable lengths restricted the distances from the datalogger to the various sensors to around 6mtrs, not 8mtrs as shown.

TDR1 – Code ML2 183/029 – 700mm bGL
TDR2 – Code ML2 183/028 – 1.1m bGL
TDR3 – Code ML2 183/024 - 700mm bGL - **control**

Below we see the logger about to be buried and above is the graphical output from the web. We are using this technology to record movement (both building and moisture change) over time.



Modelling

Model Audit – Progress Report

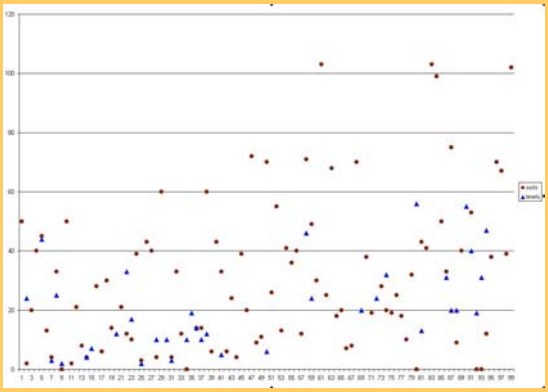
The audit involves plotting our modelled prediction against soils data and precise levelling results, where we have them.

Precise levels provide the bench mark because they record actual foundation movement.

Our findings suggest that soils results tend to over-estimate swell by as much as 1.5 – 2.

The modelled output is 5 times more accurate than the soils data.

The model is strong in the middle range, and weaker at the upper boundary conditions (i.e. where we have a very large tree, in an event year on highly plastic soils) where an adjustment needs to be made to retrospectively fit the data.

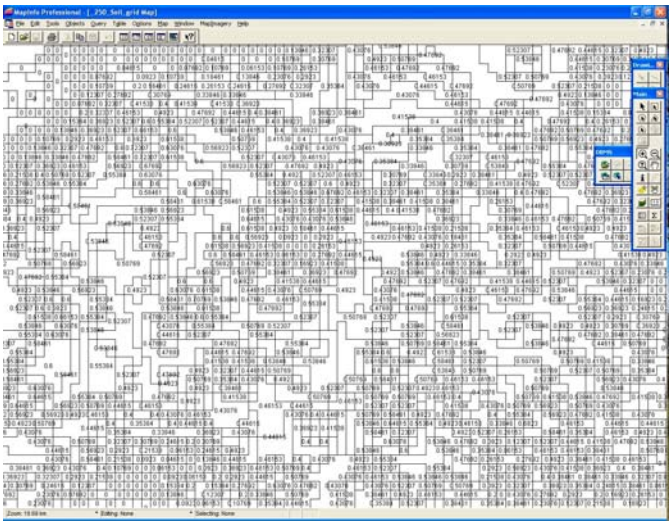


These iterations ensure the model fits the actual conditions and the work continues. The difficulty is having sufficient level data to allow comparisons to be made.

Obtaining good data isn't as easy as one might think, but many thanks to our co-operating partners for their ongoing support.

Digital Geology

Another view of the digital geology map, set out on a 250m tiled grid and using normalised values and viewed within a GIS application.



Weather Station Update

Turning it on would be helpful! After a few months of head scratching and checking the web for data, we thought it might be useful to press the little button that said 'ON'.

In fact, it didn't make any difference. We have a small problem with the datalogger and the manufacturers – Tempcon - have been very helpful indeed. They have taken it away to see what can be done to repair it.

ABA Receptor Located

A team of Chinese researchers have published their findings in a paper entitled "The Mg-chelatase H subunit is an abscisic acid receptor", *Yuan-Yue Shen* Nature, Vol 443, 19th October 2006.

They describe ABA as having "a vital function in plant adaptation to stressful environments by regulating the stomatal aperture and the expression of stress-responsive genes".

They go on to list the genes involved and challenge the view that the ABA receptor is limited to the green tissues. Their work suggests it is found throughout the plant and answers the question of how ABA could be involved with several processes from stomatal closure to seed dormancy.

At some date in the not too distant future, there will be a means of regulating evapotranspiration. It could lead to a situation whereby Local Authorities install small drips containing ABA feeding directly into the xylem for example. Something that would work now if there was a ready supply of the hormone and a will to try it.

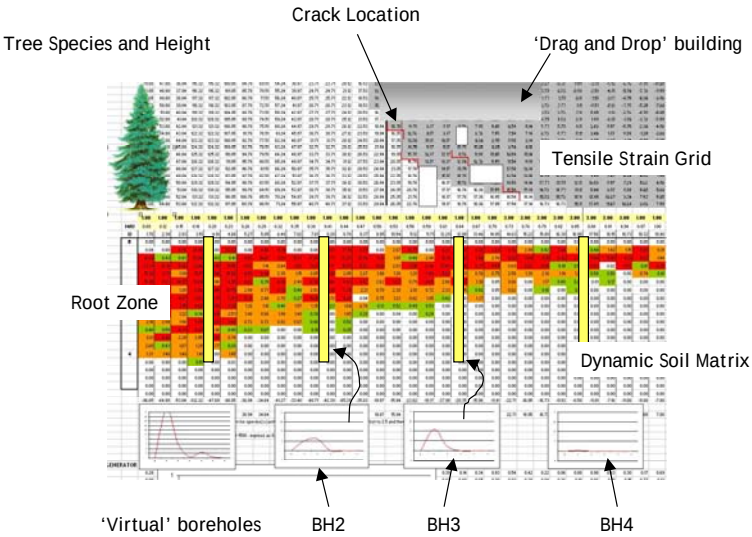
In the meantime, our work is directed towards triggering the genetic expression of the gene, and we are using laboratory work and then field trials.

Gary Visits Site

Gary Strong from GAB Robins called along to see how things were progressing, and had a conducted tour led by Cyril Nazareth, the project co-ordinator. Most of the instrumentation is buried, but Gary did manage to see Keele take the ERT readings.

Modelling the Root Zone - II

Last month we saw how we model the tree root zone and predicted the location of crack propagation in masonry. Below is an image of how the model handles trees of differing species. Here we show a conifer root zone, with the house superimposed.



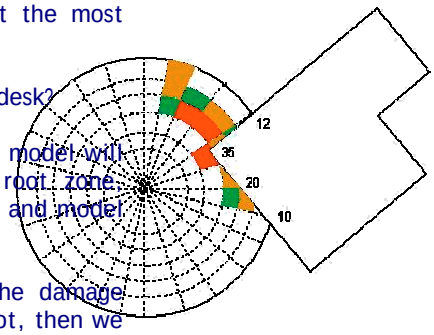
The model plots the likely suctions (see graphs along the baseline) relating to any amount of boreholes (yellow) and produces an estimate of ground movement. The estimate is then transposed onto a grid above ground level to produce a series of values and any exceeding the limiting tensile stresses produces a pattern of likely crack patterns.

We can model what might happen in a drier year, with soils that have higher shrink/swell potential. What happens if the tree grows and there is a long hot summer? What would happen if the tree was felled?

We can sink virtual boreholes along the length of the root zone and by rapidly cycling the data through tens of iterations, we arrive at a likely failure pattern.

The model could be used to resolve ABI Neighbouring Tree Root claims ''on the spot'' if modelling was adopted for all but the most complex of claims.

Why not press a button – from your desk?



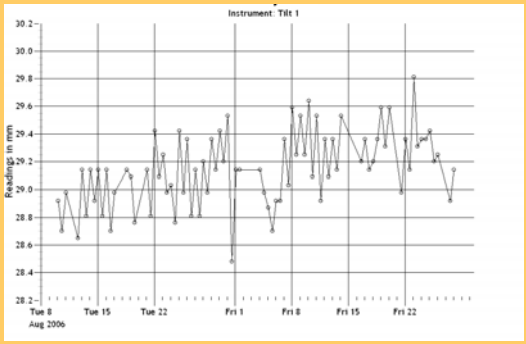
Left is a representation of how the model will look. Sit the property onto the root zone, 'drag and drop' trees and drainage and model the distortion in the masonry.

If the distortions coincide with the damage then an agreement is reached. If not, then we agree a level of proof.

Telemetry & ERT

Telemetry

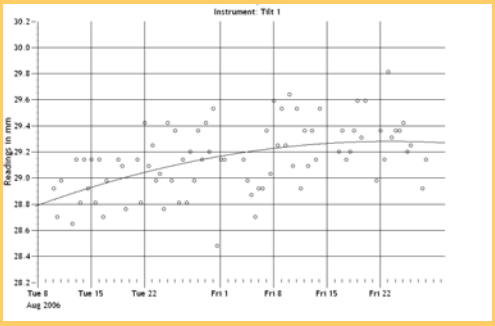
The data from our test site – the claim where we have electrolevels installed – has provided useful information.



First, we can see the damage is more likely to be due to root induced clay shrinkage, than embankment failure because we have recovery, but the amount of recovery will be a determining factor.

Second, we have been able to monitor the site daily over the web using telemetry.

Finally, we can see the weather pattern and detect change very quickly. This year we saw 'the end of summer' – at least as far as tree root activity and ground movement in the Midlands was concerned, around the 1st September. As we can see from the plot below, the damaged wall is now rotating in the opposite direction, confirming rehydration.

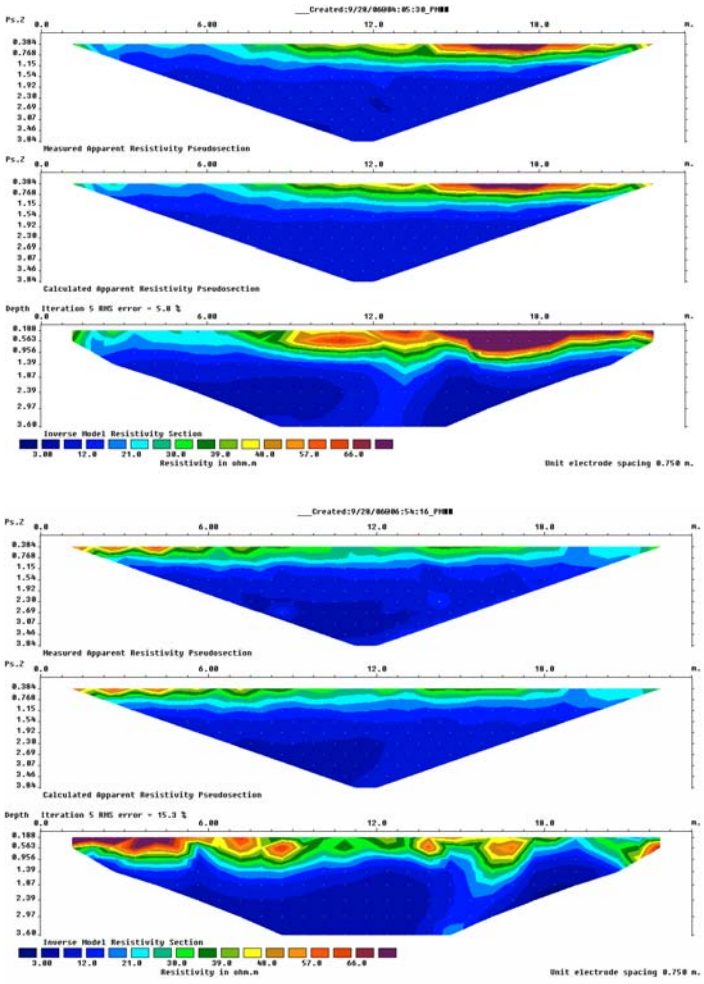


The resolution of this claim will involve some 'fine tuning' of the trees at the top of the embankment, and given the nature of the Mercia Mudstone on this site, we will continue to take readings after the building has been repaired to be assured we have arrived at the correct solution. It is the cheapest form of monitoring available.

September 2006 ERT

Here are the preliminary readings for September. Glenda is working on sub-sets and data extracts to refine the output and is considering removing the interference at ground level before drawing any firm conclusions.

More news as it breaks, but Keele will be reviewing in the New Year



Left we see the ER kit, with readings being taken from a laptop computer between probes cycling through various permutations of spacing to provide values at depth. Thanks to Gary Strong for the snap.

Precise Levelling

Electrokinesis

John Peterson is the MD of Foundation Piling and he has been working alongside Prof. Chris Rogers of Birmingham University, developing an electrokinetic solution for firming up non-cohesive soils, and attempting to reduce the P.I. of clay soils. The main application so far has been attempting to stabilise shallow landslips.

He will be joining the team at Aldenham to see if electro-osmosis and phoresis can help us trigger some positive response in the tree by taking advantage of the ionic gradient that takes place both in the soil and the tree root.

Our earlier editions show the methodology and adding John's practical experience will be of great benefit.

The instrumentation we have in place will help us to monitor any changes either side of the treatment zone, and the precise levels will record change resulting from our work.

Electrolevel Installation

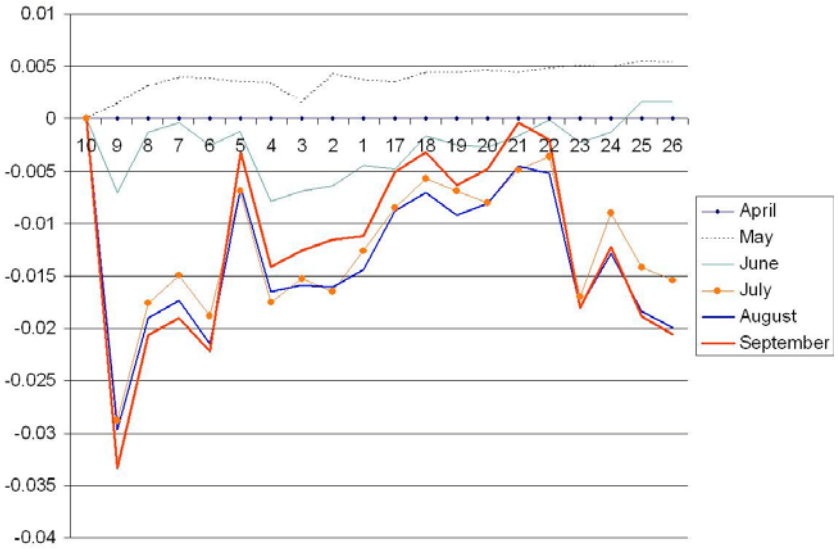
It is important to ensure the sensors are installed in a location, and at an orientation, to capture any movement that takes place.

At the test site the sensor was secured to an angle bracket to ensure we were measuring movement in the plane of rotation.

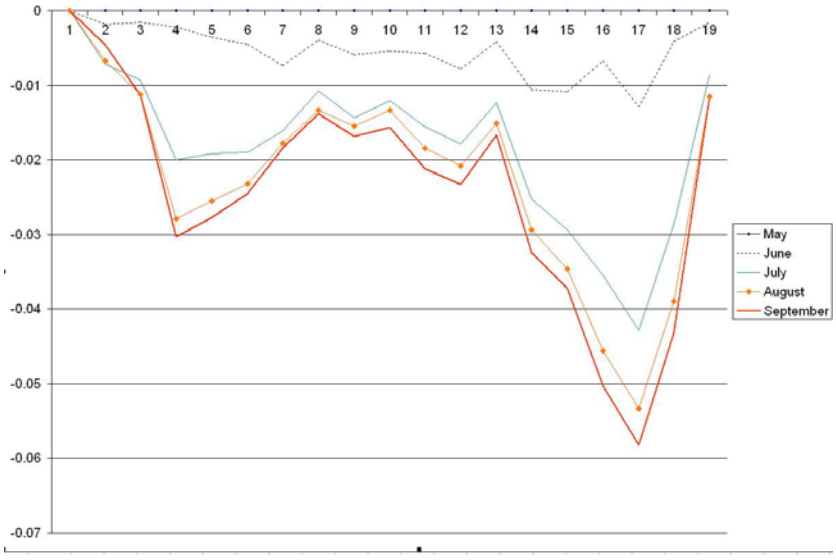
This sensor is recording the movement we see plotted on Page 4. Had it simply been fixed to the wall without the bracket, it is unlikely we would have recorded any movement at all.

Precise Levelling Data September 2006

We are recording some initial recovery (around 5mm) immediately beneath the Oak tree (top) but with some very minor continued downward movement (3mm) at the periphery of the root zone, which may be initially surprising given the presence of a persistent moisture deficit. We anticipated recovery immediately beneath the tree might take place later given the cover afforded by the canopy.



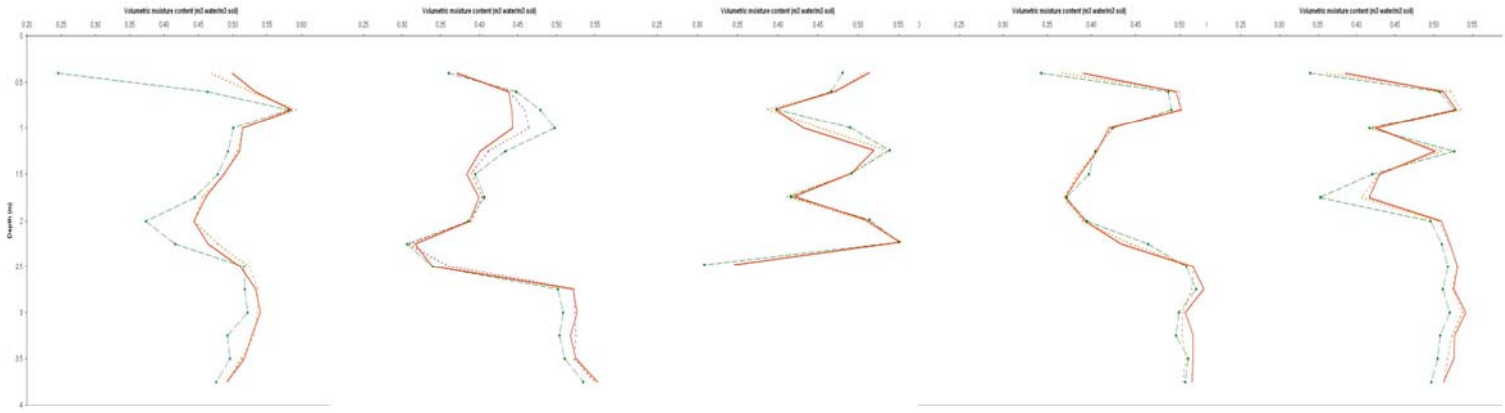
Below we see continued downward movement at the site of the Willow, greater (5mm) at the periphery of the root zone.



The levelling stations are at 2mtr ctrs, and the total distance between extreme stations (No's 1 and 19) is 38mtrs taking account of the gap between centres at the position of the trunk.

Neutron Probe Data

October 2006.



NP1 NP2 NP3 NP4 NP5

Undisturbed Samples

Part of the project is to see what effect sample disturbance has on oedometer testing. Traditional engineering truth finds the idea simply absurd.

MatLab have been using the test on disturbed samples and comparing the outcome with the filter paper method for many years, and found a good correlation.

The trick appears to be sample preparation and the method of consolidation and this stage of the research is aimed at resolving this issue if possible.

September Update

4th August 2006
31st August 2006
28th September 2006

The latest readings are reproduced above. The red line is the September plot, orange is late August and the green broken line is the plot for early August. NP1 is closest to the tree, NP3 is the probe where we encountered gravel and NP5 is further away.

NP1 – some apparent rehydration at 2mtrs but as the last two readings are broadly in agreement, more likely that the initial readings might be an anomaly related to the installation.

NP2 – fairly consistent throughout the last two months, with some drying between 0.5 and 1mtr bGL over the monitoring term.

NP3 – As NP2, with some drying at around 1.25m bGL.

NP4 - little change. TDR sensors installed near to NP4.

NP5 – some rehydration at around 1.75m, and at depth – possibly associated with water seepage down the side of the tube.

Hopefully a pattern will start to emerge through the winter months that will enable us to profile root activity.