

Rehydration Channel Feasibility Check Sheet

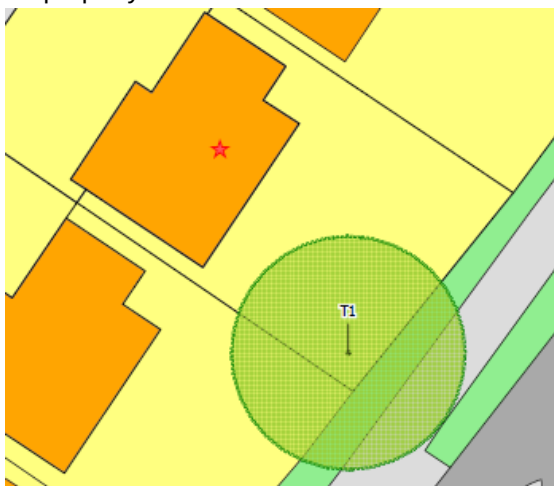
Address: 22 Oakmont Drive, Waterlooville, Hampshire, PO8 8TH



A brief history of the Claim

In August 2011 InFront-Innovation were instructed by Direct Line Group to take over the running of any existing claim which had been managed from inception by previous engineers who on this occasion were Riley Larkin Ltd Consulting Engineers and Surveyors. Various investigations have been undertaken and the cause identified as tree root induced clay shrinkage from the Oak Tree (T1) to the rear of the property currently protected by a tree preservation order.

An application (APP/12/00460 November 2012) and appeal (APP/TPO/X1735/3008) to remove the oak tree have been refused. The tree continues to cause differential movement to the foundations of the property.



The remaining trees believed to be the cause of the problem are:

Tree species	Height	Distance to Building	Owner
T1 Oak	22	10	T.P with TPO

Do any of the trees have TPO's or conservation restrictions: **YES T1 Oak.**

Category of damage Cat 1-5 **2**
(in accordance with table 1 BRE digest 251)

Area of Damage	Main House	Extension	Garage	Outbuilding
	Yes	Yes	No	No

Cracking around windows and wall junctions internally to the kitchen and left hand dining room area. Cracking and separation external of ground floor bay window and surrounding brickwork

Monitoring	Crack	Maximum Variation	Minimum Variation	Level Monitoring	Maximum Downward Variation	Minimum Upward Variation
	No	0	0	Yes	23mm	18mm

CLAY SOILS

Borehole No & Location	CLAY	PI	MC	LL	% passing 425µm sieve	Suction Kpa	Oedometer Strain
BH1. Rear.	Yes	53 – 1.3m 48 – 2.25m	24 26	75 70	98 98	400 KPA maximum at 1.75m	None

Granular Soils

Borehole No. & Location	Have drains been repaired?	McIntosh Probe readings	BGS CHECKS Superficial & Underlying Bedrock
	NO		Completed: Head Clay & Silt / London Clay formation
			Issue found: possible gravel / silt layers.

Has the property been underpinned previously ?
If yes, please state the type, depth and location
Of previous stabilisation works.....
Append a drawing of the property is needed.
Additional drawing **No**

No

Is the property in a conservation area?
Is the property listed?

No

No

Why have we recommended an intervention technique?

Damage at the property has been investigated, and the affected parts of the building are believed to be suffering from clay shrinkage subsidence. The cause of the problem is the Oak tree located to the rear of the property and protected by TPO's

The location of the identified tree provides the opportunity to implement the intervention techniques detailed below, in order to mitigate against their influence and reduce the foundational movement in order to restore relative stability.

How Rehydration Channels work?

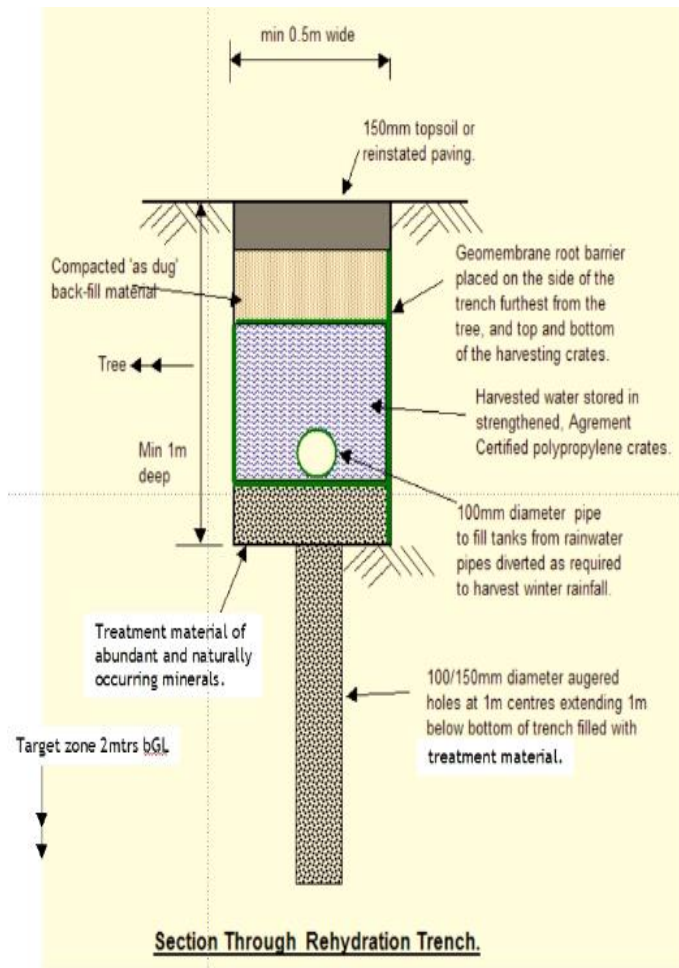
In the UK the shrinkage and swelling of clay soils, particularly when influenced by trees, is the single most common cause of foundation movements that damage domestic buildings. Trees are known to cause clay soils to shrink by drawing water through their roots, predominantly during spring and summer.

This shrinkage results in both vertical and horizontal ground movements that, when transmitted to a building's foundations, cause damage to the building structure. The amount of shrinkage depends on the type of clay soil, the type and size of tree, and on climate. Trees growing under grass cover are forced to compete for their water and to extract water from greater depths than they might otherwise do, as is the case in this instance. The water content of a shrinkable clay soil will vary with depth remote from and near to a large tree.

Near the ground surface there can be relatively large changes in soil water content between summer and winter as a result of evaporation from the ground surface and transpiration by the grass. Such variations are normally confined to the top 1-1.5m of the ground, possibly less adjacent to buildings. Where mature trees grow at the same location, then the water-content profiles will vary and the seasonal fluctuations in soil water content are both larger and extend to a greater depth. Soil volume changes and hence ground movements will be greater.

In order to mitigate the adverse effects of vegetation the planting and management of trees close to buildings therefore needs to be planned and undertaken from a sound science base. In a similar way, where tree root action results in damage to existing dwellings any intervention technique needs to take account of the potential for conflict to occur and employ innovative design and careful construction. All this will help to avoid such conflict occurring and ensure that trees are managed in a sustainable manner and the potential for damage is controlled. The solution adopted in this case seeks to decrease water uptake by the identified trees thereby lessening subsidence risk by conserving soil moisture and reducing clay subsoil shrinkage.





The focused introduction of harvested roof water is supplemented by controlling moisture uptake through adding a naturally occurring mineral to the sand layer within the rehydration channels which serves to buffer the water in order to raise the pH within the xylem.

This in turn boosts the effectiveness of ABA. Thus beneficially providing water across half the root zone, prompting the dry half to produce ABA whilst the wetter area ensures there is sufficient water to pump up the xylem to reach the leaves.

This is in effect the Partial Root Drying mechanism as used by crop growers in all of the dry climates in the world. The ABA tells the stoma to reduce transpiration and the harvested roof water provides a sufficient source to reduce ground movement. The suitability of available harvested roof water volumes is determined by the ratio of water supply to water demand (HWV)

If the water demand is higher than water supply then there is a water deficit while the opposite is a situation of water surplus. Under a surplus situation, it can be theoretically assumed that HWV is satisfied (i.e. a ratio >1). This surfeit can either be dealt with through an overflow return to the piped main or by construction of a suitable soak away. The surfeit that arises here is dealt with through the return to the existing piped main

Feasibility Workings for Rehydration Channel.

Trees and water demands for Channel to accommodate

			Land cover between tree and property		Annual water use			TPO
Trees	height	Crown spread	Hard	Porous	High	Moderate	Low	Root Severance required
Oak T1	22	7	30 %	70 %	4385			YES

Trees	Water Demand		Season				Yearly Demand	
			Spring	Summer	Autumn	Winter	Litres	Gallons
			62 Days	93	61	149		
Oak T1	High	Per Day	44	144	44	0		
		Season	2728	13392	2684	0	18804	4136
Total							18804	4136

Rainwater harvesting

Roof Area to be utilised	length	Width	Type	Total M2
Main house and extension roofs pitched	9.7	5	Pitched rear elevation	48.5
Total				48.5

Annual Rainfall

Water Co Region	Everton
Annual Rainfall (mm)	763.70
Annual Harvested rainfall (Gallons)	8139.72

Site Plan. (Not to scale) REHYDRATION OPTION

Rear Access via Main rd

Front.

Rehydration channel to be installed below turf area of rear garden approx. 9 meters in length. Minimum 5 meters from the Tree T1 no more than 4m from House. Rainwater to be harvested via the existing rainwater gulley from main roof only and taken back into existing system with an overflow.

Access for machinery through rear fence via main road.

All surfaces to be reinstated

